Holm-Bonferroni Method Post Hoc Analysis

Purpose: adjust multiple pairwise p-values while controlling family-wise error.
Workflow: one-way ANOVA context + pooled pairwise t-tests + Holm step-down correction.

Interpretation summary:

analysis	anova_p_value	anova_decision_alpha_0_05	pairwise_comparisons	holm_significant_comparisons	smallest_adjusted_p_comparison	smallest_holm_adjusted_p	note
Holm-Bonferroni Method	5.705728e-10	Reject equal means	6	4	1 vs 3	5.371758e-09	Holm-Bonferroni controls family-wise error by testing the smallest p-value first and then using progressively less strict thresholds.

ANOVA table:

source	sum_of_squares	df	mean_square	f_value	p_value
Between groups	465.077825	3	155.025942	15.876268	5.705728e-10
Within groups	6298.188739	645	9.764634	NaN	NaN
Total	6763.266564	648	NaN	NaN	NaN

Group summary:

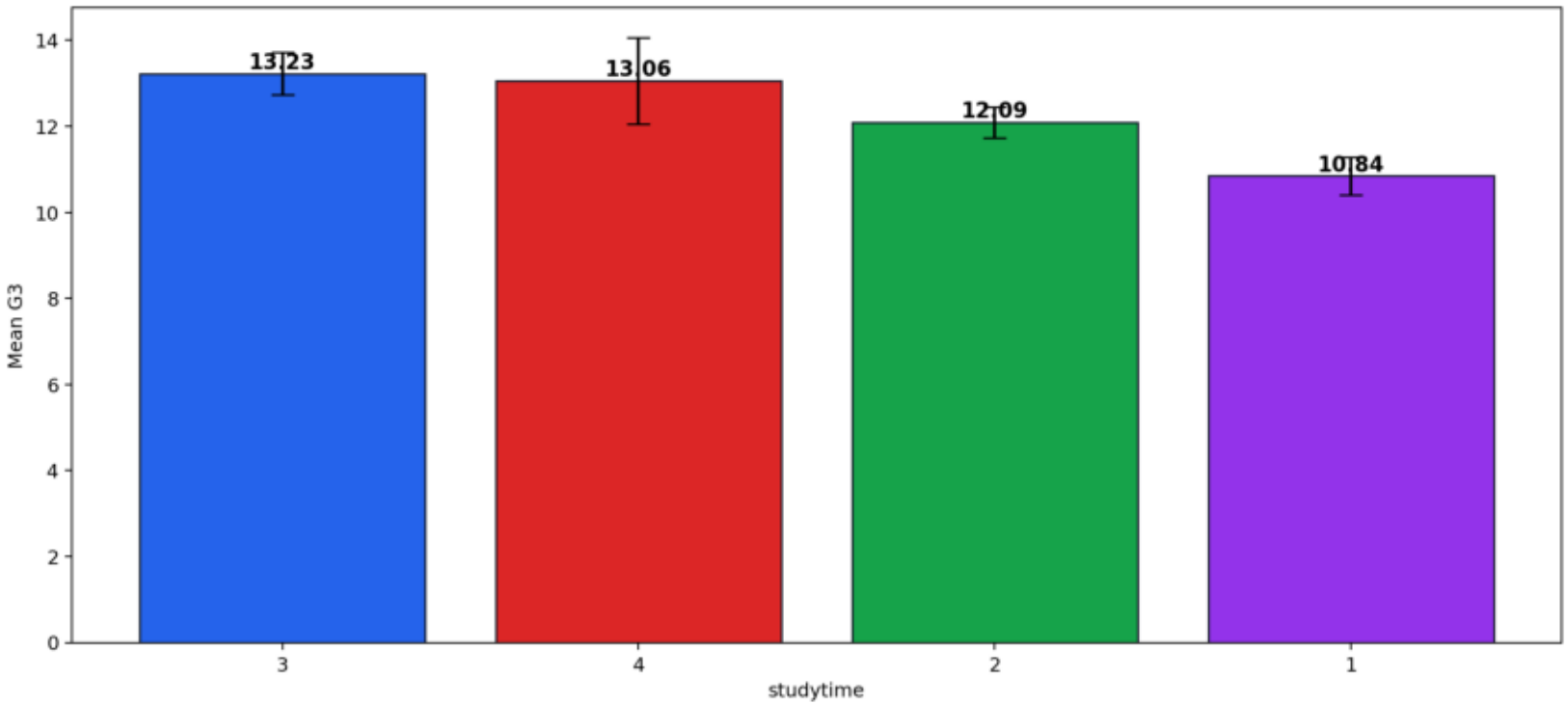
group	n	mean	standard_deviation	variance	standard_error	minimum	maximum	mean_ci95_lower	mean_ci95_upper
1	212	10.844340	3.218624	10.359541	0.221056	0	18	10.411070	11.277609
2	305	12.091803	3.243125	10.517860	0.185701	0	19	11.727830	12.455777
3	97	13.226804	2.502104	6.260524	0.254050	8	18	12.728866	13.724742
4	35	13.057143	3.038410	9.231933	0.513585	6	19	12.050516	14.063769

Holm-Bonferroni pairwise results:

comparison	mean_difference_group_1_minus_group_2	p_unadjusted	p_holm_adjusted	significant_holm_alpha_0_05	decision
1 vs 3	-2.382465	8.952930e-10	5.371758e-09	Yes	Reject equal means
1 vs 2	-1.247464	9.473280e-06	4.736640e-05	Yes	Reject equal means
1 vs 4	-2.212803	1.146236e-04	4.584943e-04	Yes	Reject equal means
2 vs 3	-1.135001	1.914916e-03	5.744748e-03	Yes	Reject equal means
2 vs 4	-0.965340	8.393031e-02	1.678606e-01	No	Fail to reject equal means
3 vs 4	0.169661	7.831343e-01	7.831343e-01	No	Fail to reject equal means

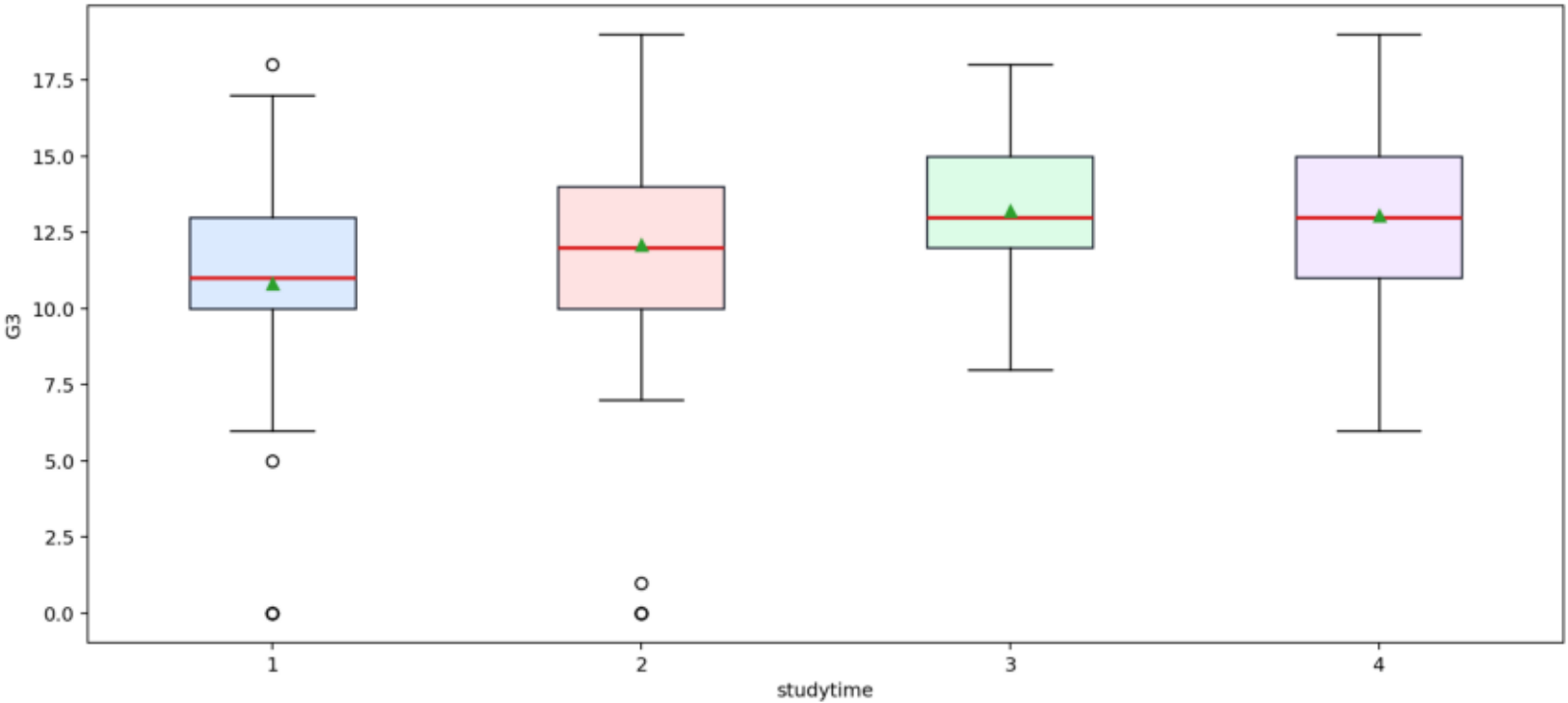
Holm-Bonferroni: Group Means with 95% CI

Colorful mean chart for the dependent variable before adjusted pairwise decisions.



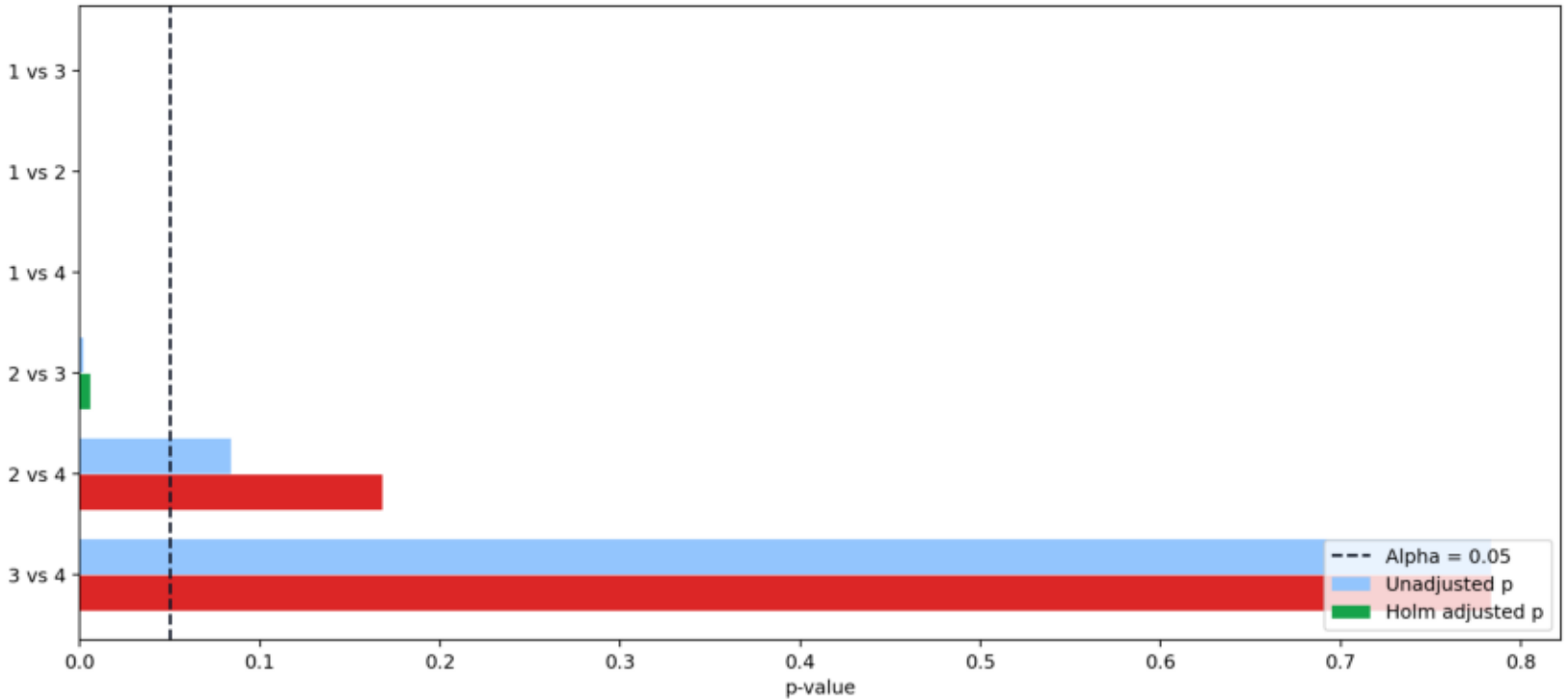
Holm-Bonferroni: Group Distribution Boxplots

Colorful boxplots show spread, medians, and possible outliers by factor group.



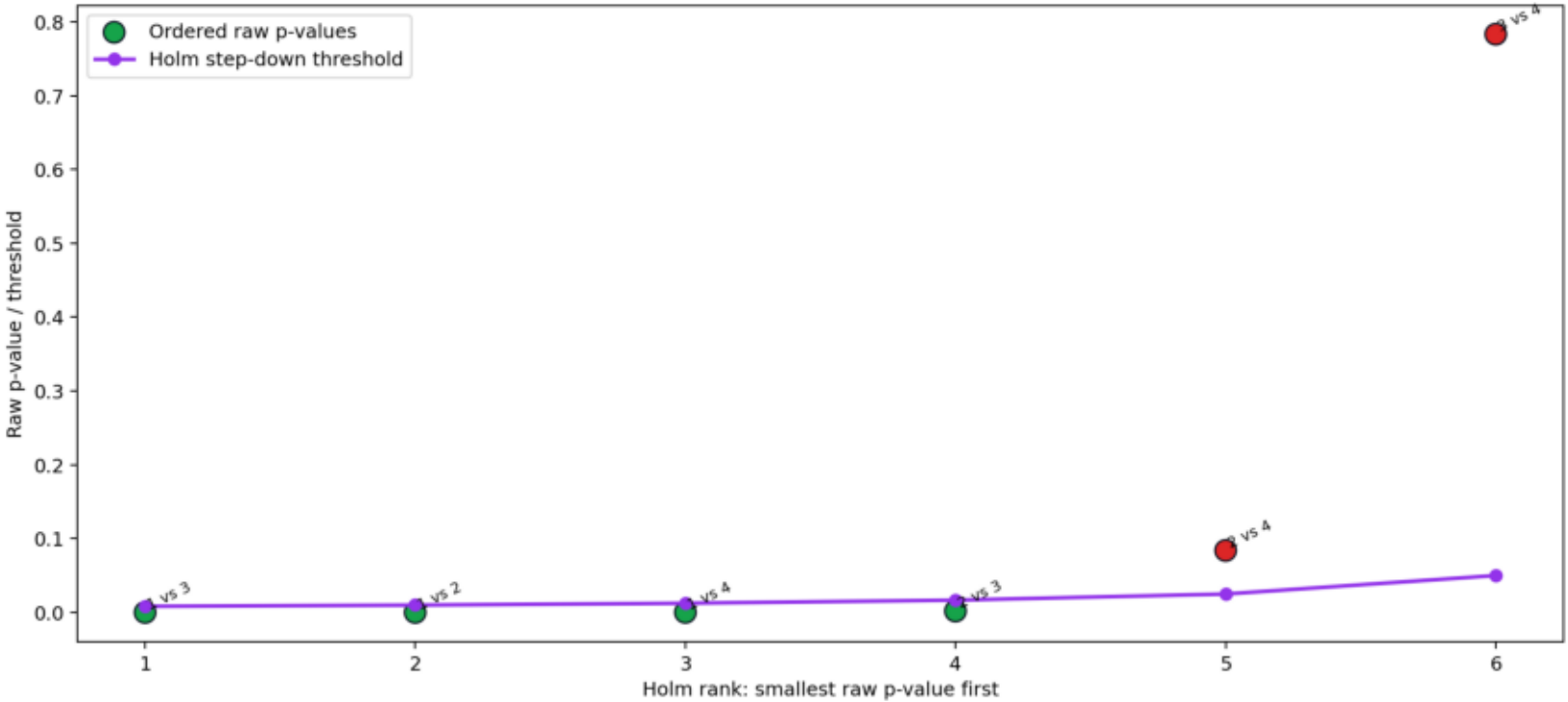
Holm-Bonferroni: Unadjusted vs Adjusted p-values

Green adjusted bars are significant after Holm-Bonferroni correction; red bars are not.



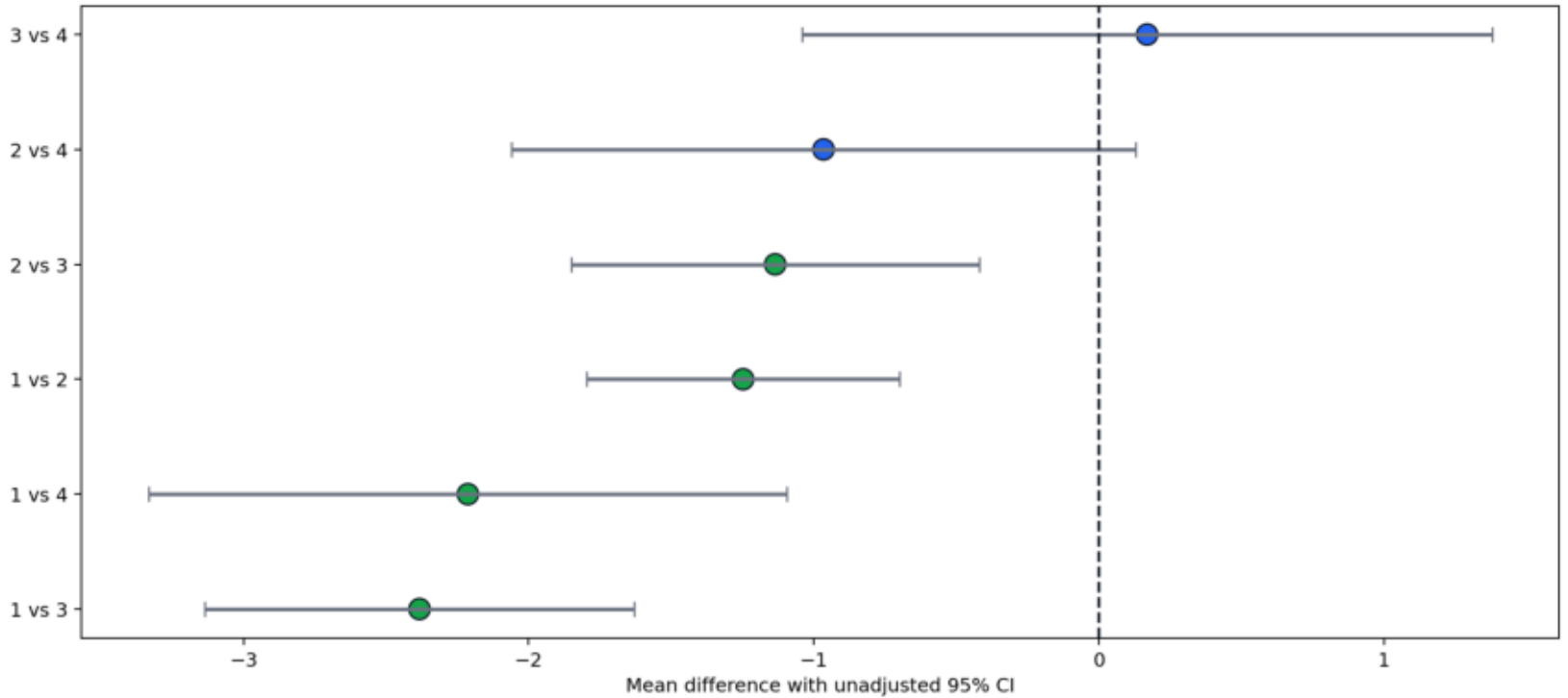
Holm-Bonferroni: Step-Down Decision Path

Each raw p-value is compared with alpha divided by its remaining-comparison multiplier.



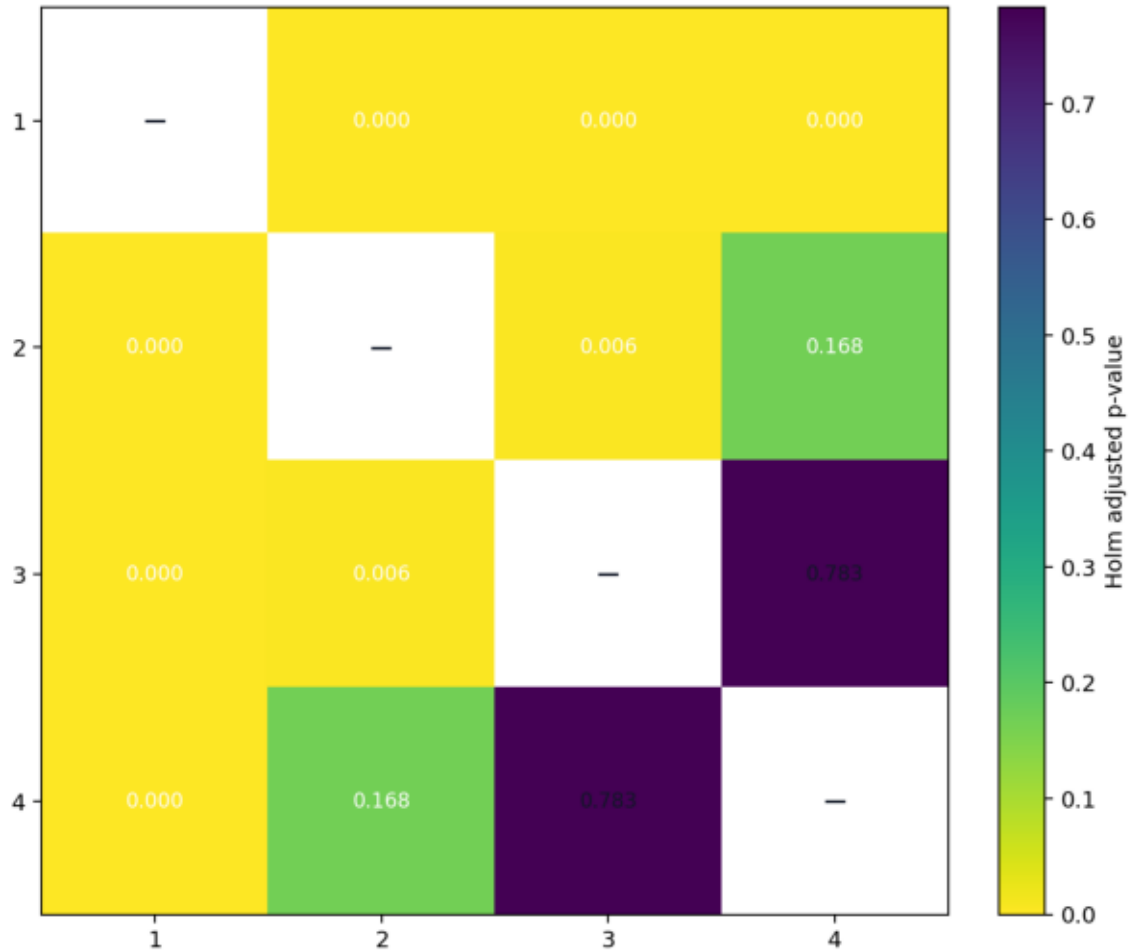
Holm-Bonferroni: Pairwise Mean Differences

Point estimates show direction and size; green points passed Holm correction.



Holm-Bonferroni: Adjusted p-value Heatmap

Darker cells indicate smaller adjusted p-values between group pairs.



Holm-Bonferroni: Group Spread Context

The adjustment controls multiple tests, but spread and sample size still affect each pairwise test.