Bonferroni Correction Post Hoc Analysis

Purpose: compare all pairs of group means while controlling familywise error.
H0 for each pair: the two group means are equal.
H1 for each pair: the two group means are different.

Analysis summary:

analysis	target_variable	group_variable	number_of_groups	number_of_pairwise_comparisons	familywise_alpha	per_comparison_alpha_bonferroni	anova_p_value	anova_decision_alpha_0_05	significant_bonferroni_pairs	not
Bonferroni correction post hoc analysis	G3	studytime	4	6	0.05	0.008333	5.705728e-10	Reject equal group means	4	Bonferroni controls familywise error by multiplying each pairwise p-value by the number of comparisons

One-way ANOVA:

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:

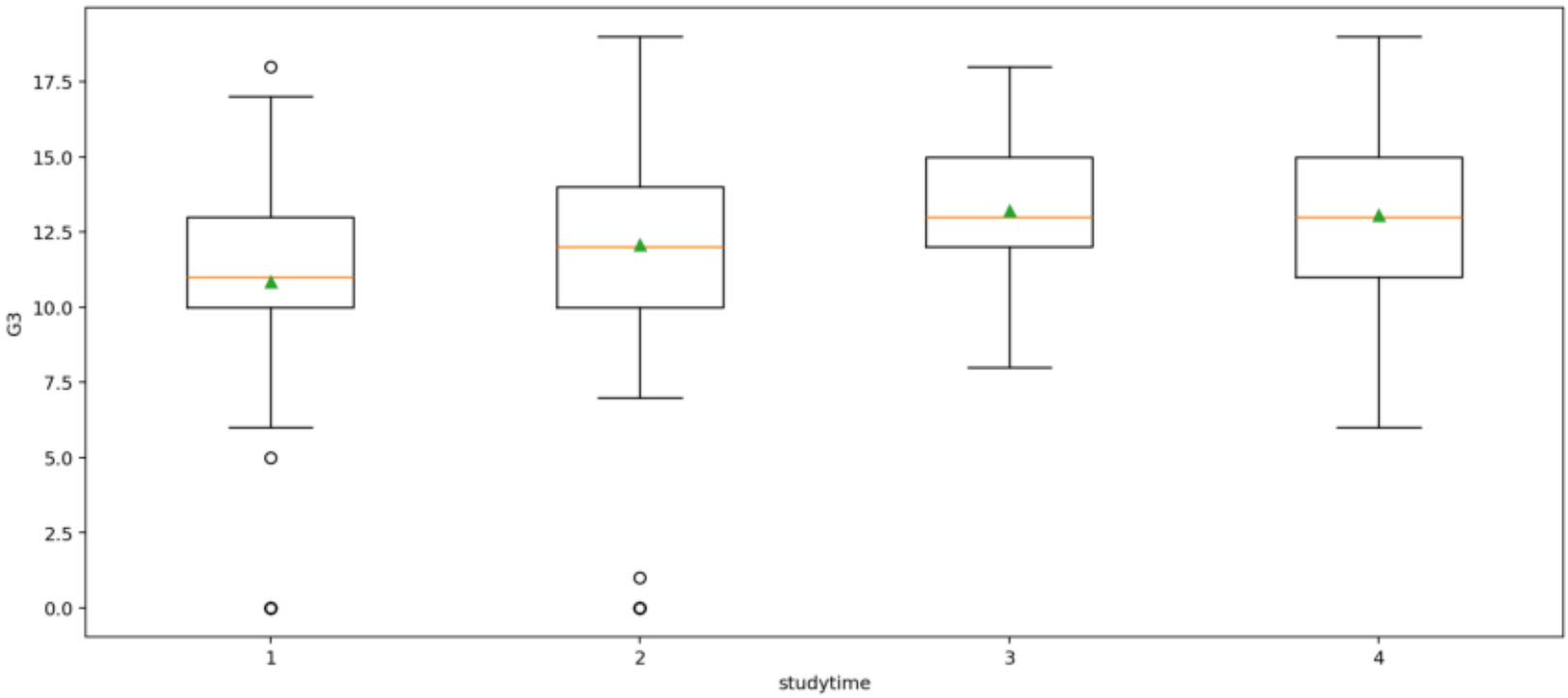
group	n	mean	standard_deviation	variance	standard_error	minimum	maximum	mean_ci95_lower	mean_ci95_upper
1	212	10.844340	3.218624	10.359541	0.221056	0	18	10.411070	11.277609
2	305	12.091803	3.243125	10.517860	0.185701	0	19	11.727830	12.455777
3	97	13.226804	2.502104	6.260524	0.254050	8	18	12.728866	13.724742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

Bonferroni pairwise comparisons:

group_1	group_2	mean_group_1	mean_group_2	mean_difference_group_1_minus_group_2	standard_error	t_value	df_error	raw_p_value	bonferroni_adjusted_p_value	bonferroni_ci95_lower	bonferroni_ci95_upper	alpha	decision_alpha_0_05
1	3	10.844340	13.226804	-2.382465	0.383048	-6.219751	645	8.952929e-10	5.371757e-09	-3.396171	-1.368758	0.05	Significant after Bonferroni correction
1	2	10.844340	12.091803	-1.247464	0.279419	-4.464497	645	9.473280e-06	5.683968e-05	-1.986923	-0.508004	0.05	Significant after Bonferroni correction
1	4	10.844340	13.057143	-2.212803	0.570131	-3.881220	645	1.146236e-04	6.877414e-04	-3.721609	-0.703997	0.05	Significant after Bonferroni correction
2	3	12.091803	13.226804	-1.135001	0.364255	-3.115953	645	1.914916e-03	1.148950e-02	-2.098972	-0.171029	0.05	Significant after Bonferroni correction
2	4	12.091803	13.057143	-0.965340	0.557678	-1.730998	645	8.393031e-02	5.035818e-01	-2.441190	0.510511	0.05	Not significant after Bonferroni correction
3	4	13.226804	13.057143	0.169661	0.616162	0.275352	645	7.831343e-01	1.000000e+00	-1.460963	1.800286	0.05	Not significant after Bonferroni correction

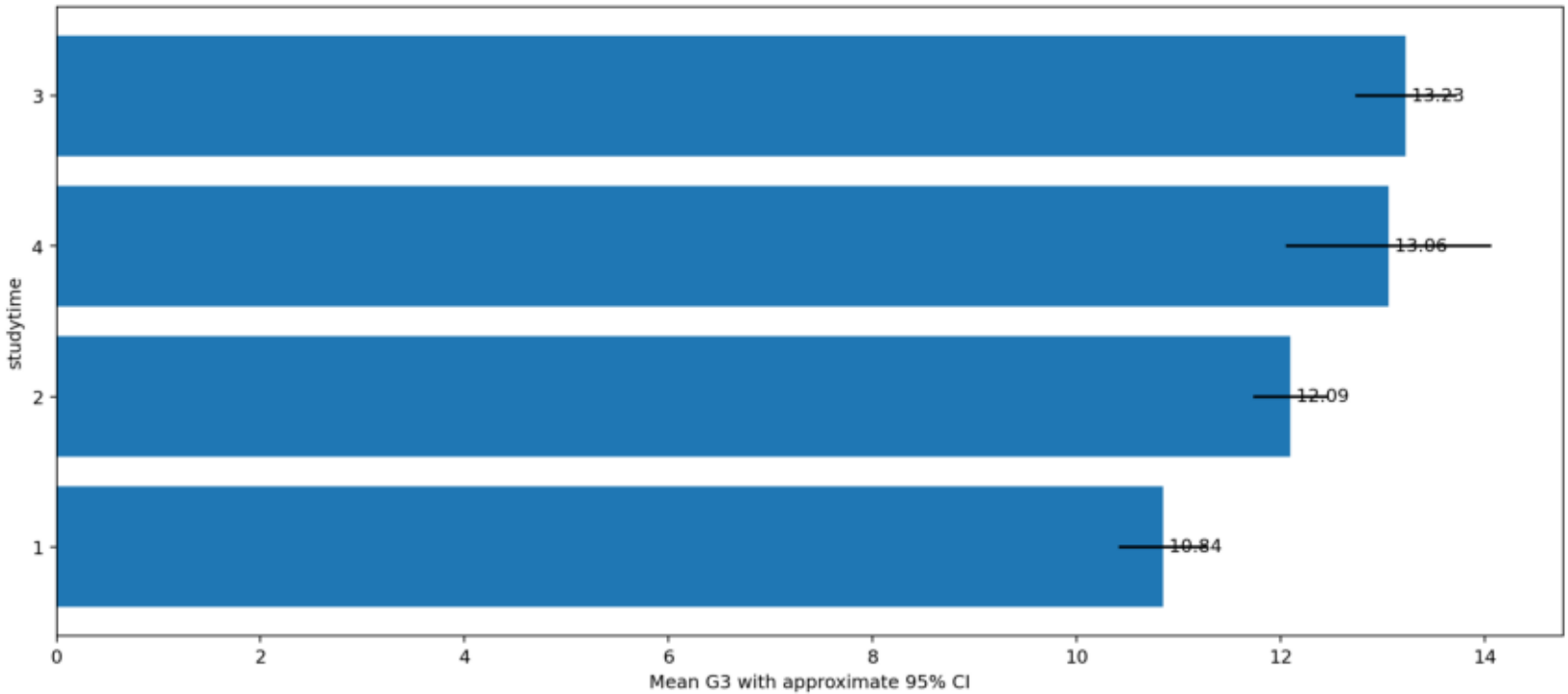
Bonferroni Post Hoc: Group Distributions

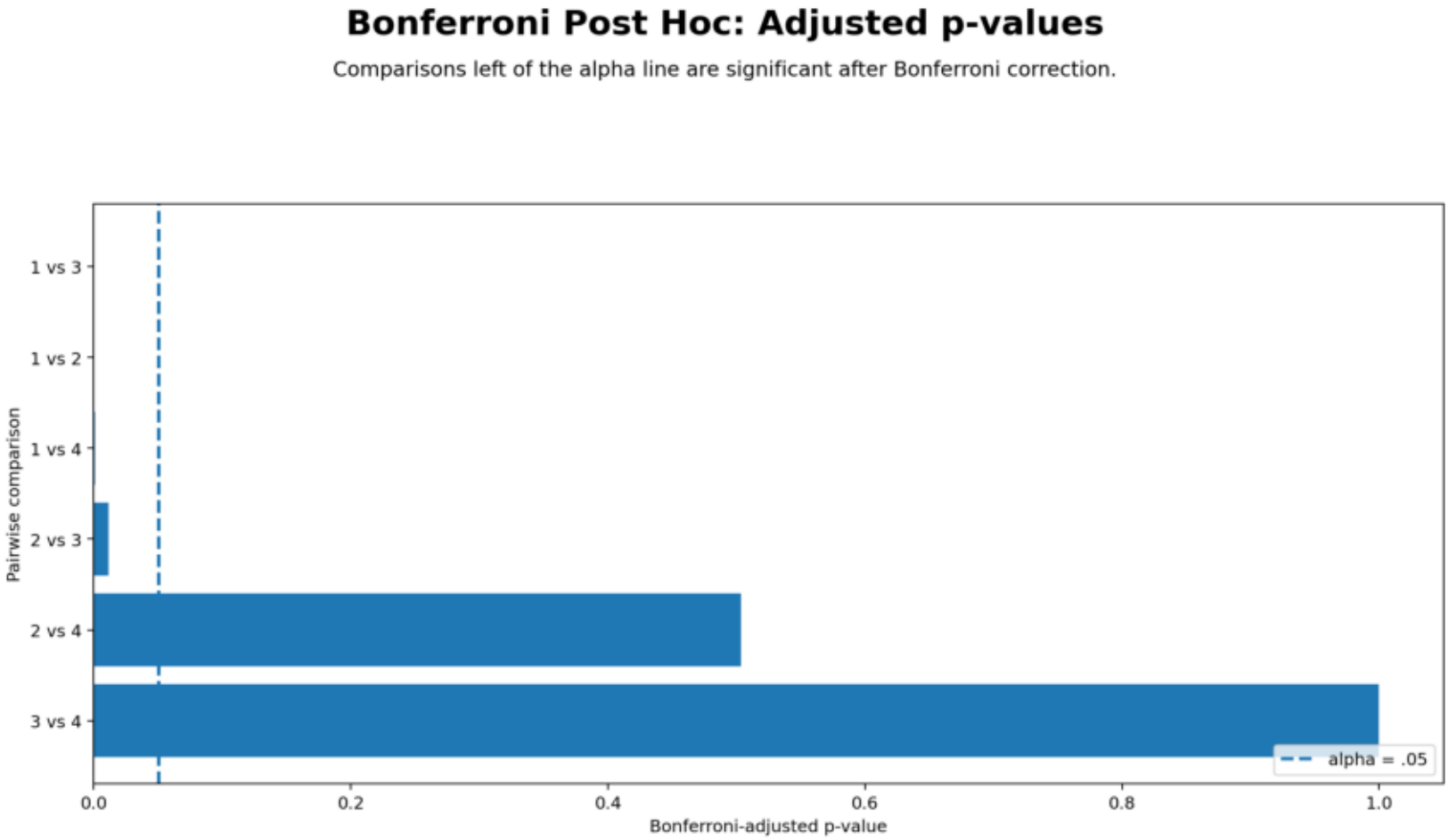
Boxplots show the score distribution before pairwise mean comparisons.

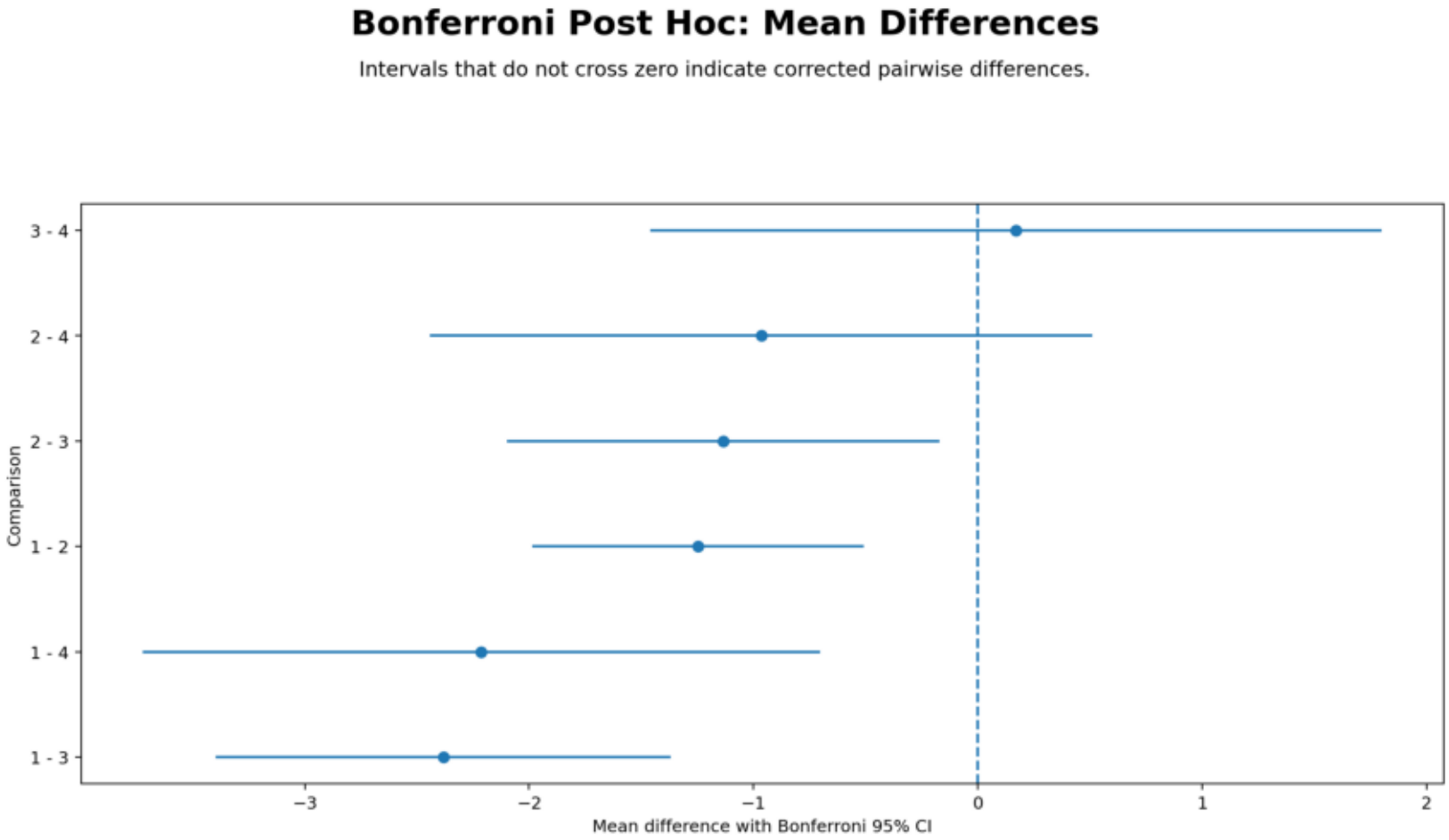


Bonferroni Post Hoc: Group Means

Bonferroni comparisons test which group means differ after correction.




Bonferroni Post Hoc: Adjusted p-values
Comparisons left of the alpha line are significant after Bonferroni correction.
Pairwise comparison
1 vs 3
1 vs 2
1 vs 4
2 vs 3
2 vs 4
3 vs 4
0.0
0.2
0.4
0.6
0.8
1.0
Bonferroni-adjusted p-value
alpha = .05


Bonferroni Post Hoc: Mean Differences
Intervals that do not cross zero indicate corrected pairwise differences.
3 - 4
2 - 4
2 - 3
1 - 2
1 - 4
1 - 3
Comparison
−3
−2
−1
0
1
2
Mean difference with Bonferroni 95% CI

Bonferroni Post Hoc: Group Sample Sizes

Unequal sample sizes affect the standard errors of pairwise comparisons.