Gabriel's Test Post Hoc Analysis − R Report

```
                                    analysis target_variable group_variable number_of_groups
1 Gabriel's post hoc pairwise comparison test              G3      studytime                4
  number_of_pairwise_comparisons significant_pairwise_comparisons_alpha_0_05 omnibus_anova_p_value alpha
1                              6                                          4          5.705728e−10  0.05

1 R uses the Gabriel standard error formula with an approximate Studentized maximum modulus critical value. Use SPSS output for the official
                                                                                                                                  when_to_use_no
1 Gabriel's test is commonly used after one−way ANOVA when equal variances are assumed and group sizes are unequal but not extremely differen
```

ANOVA and Assumption Context

ANOVA table:

	source	sum_of_squares	df	mean_square	f_value	p_value
1	Between groups	465.0778	3	155.025942	15.87627	5.705728e−10
2	Within groups	6298.1887	645	9.764634	NA	NA
3	Total	6763.2666	648	NA	NA	NA

Assumption context:

	check	statistic	p_value	note
1	Brown−Forsythe / median Levene	1.026312	0.38035752	Requires package car; robust equal−variance context.
2	Bartlett variance test	9.462687	0.02373164	Sensitive to non−normality; use as context only.

Group Summary

	group	n	mean	standard_deviation	variance	standard_error	minimum	maximum	mean_ci95_lower	mean_ci95_upper
1	1	212	10.84434	3.218624	10.359541	0.2210560	0	18	10.41107	11.27761
2	2	305	12.09180	3.243125	10.517860	0.1857008	0	19	11.72783	12.45578
3	3	97	13.22680	2.502104	6.260524	0.2540502	8	18	12.72887	13.72474
4	4	35	13.05714	3.038410	9.231933	0.5135850	6	19	12.05052	14.06377

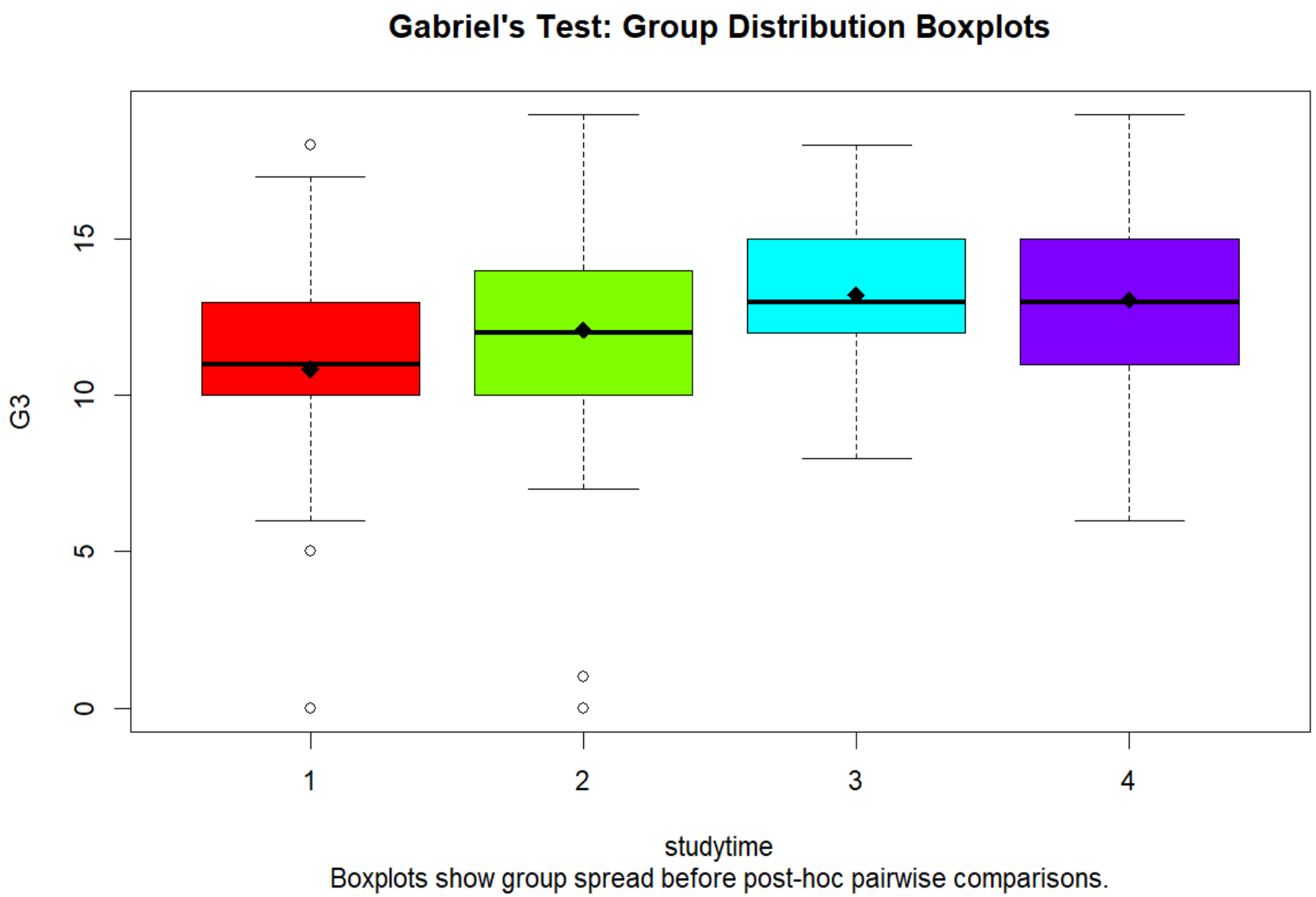
Gabriel Pairwise Comparisons

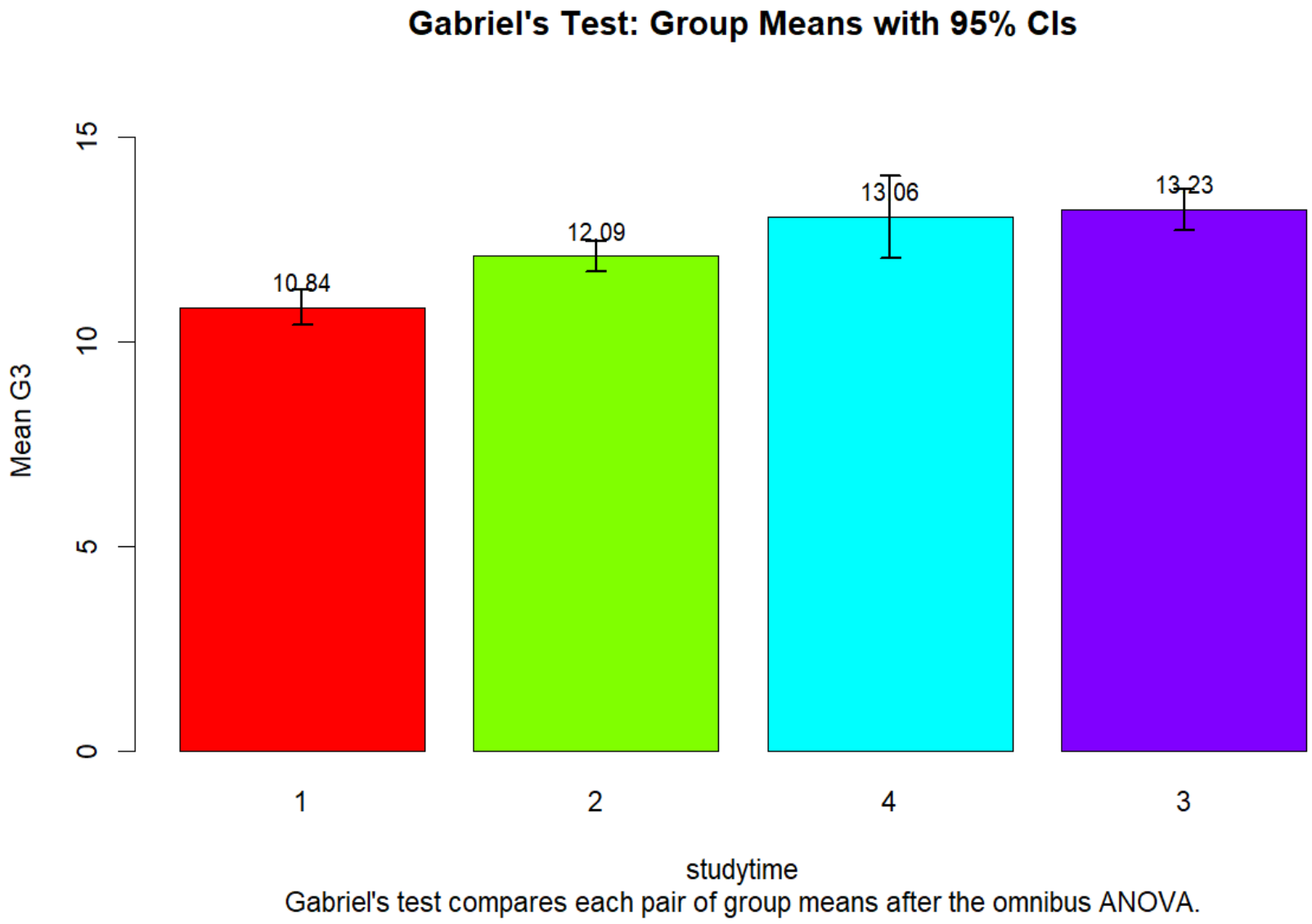
	group_1	group_2	mean_group_1	mean_group_2	mean_difference_group_1_minus_group_2	absolute_mean_difference
2	1	3	10.84434	13.22680	−2.3824645	2.3824645
1	1	2	10.84434	12.09180	−1.2474637	1.2474637
3	1	4	10.84434	13.05714	−2.2128032	2.2128032
4	2	3	12.09180	13.22680	−1.1350008	1.1350008
5	2	4	12.09180	13.05714	−0.9653396	0.9653396
6	3	4	13.22680	13.05714	0.1696613	0.1696613

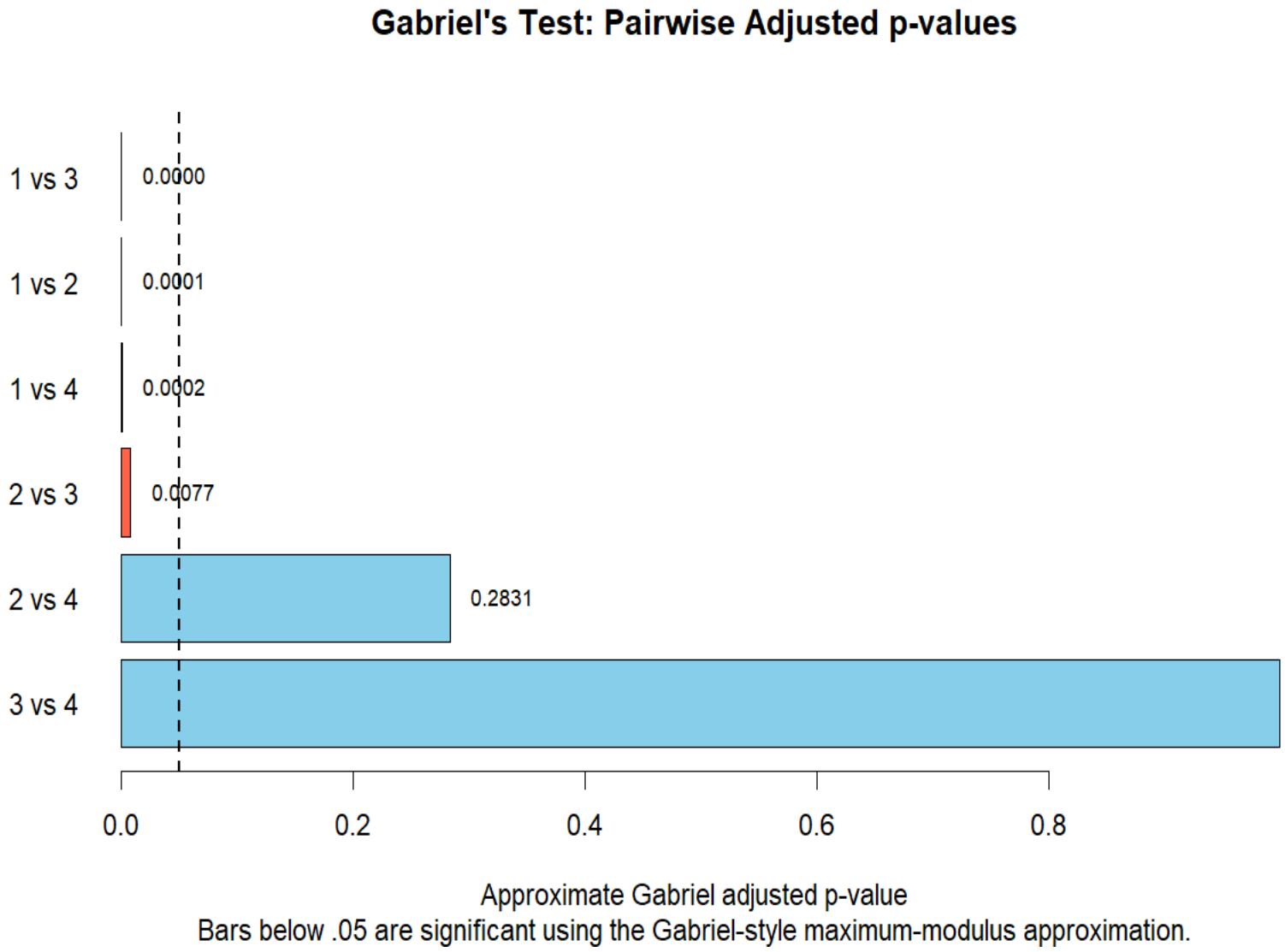
	n_group_1	n_group_2	mse_within	s_pp_root_mse	gabriel_standard_error	gabriel_max_modulus_statistic	df_error
2	212	97	9.764634	3.124841	0.3761063	6.3345517	645
1	212	305	9.764634	3.124841	0.2782768	4.4828152	645
3	212	35	9.764634	3.124841	0.5252457	4.2128917	645
4	305	97	9.764634	3.124841	0.3508717	3.2348034	645
5	305	35	9.764634	3.124841	0.5000111	1.9306362	645
6	97	35	9.764634	3.124841	0.5978405	0.2837902	645

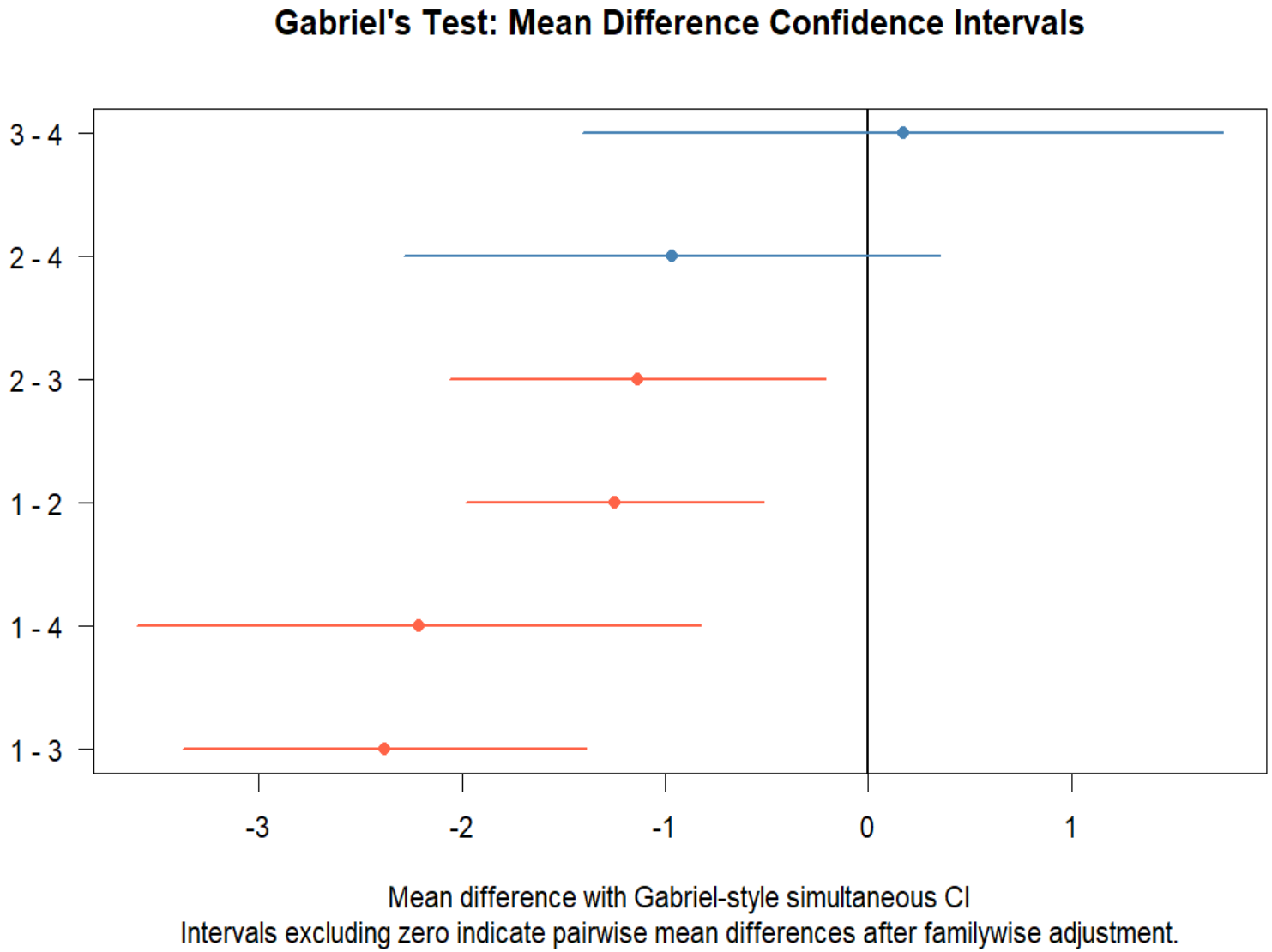
	k_groups	k_star_pairwise_count	max_modulus_critical_alpha_0_05_approx	gabriel_adjusted_p_value_approx
2	4	6	2.639141	2.679462e−09
1	4	6	2.639141	5.230486e−05
3	4	6	2.639141	1.728155e−04
4	4	6	2.639141	7.652156e−03
5	4	6	2.639141	2.831301e−01
6	4	6	2.639141	9.998759e−01

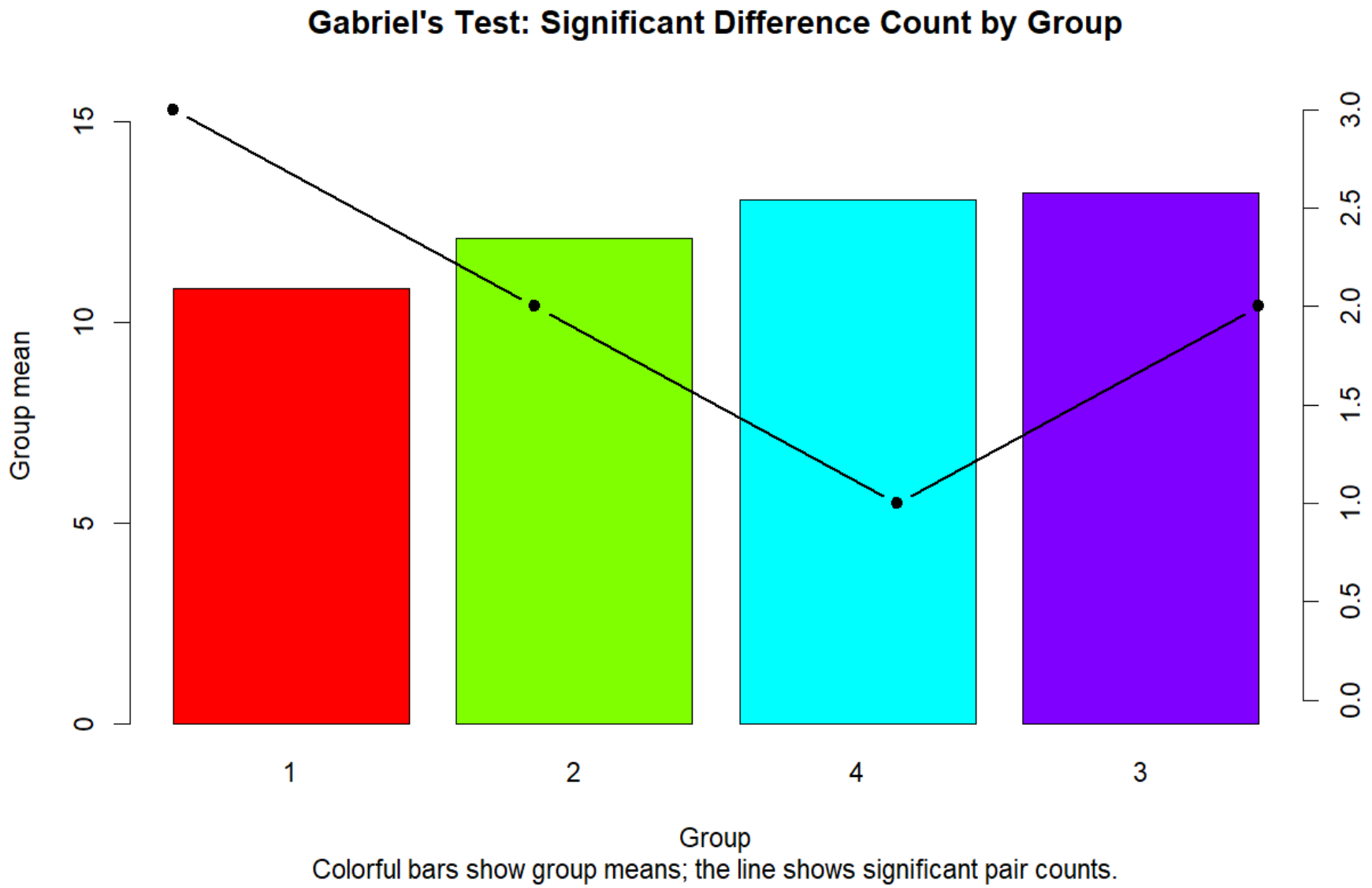
	gabriel_critical_difference	gabriel_ci95_lower	gabriel_ci95_upper	alpha	decision_alpha_0_05
2	0.9925973	−3.375062	−1.3898672	0.05	Significant by Gabriel approx
1	0.7344117	−1.981875	−0.5130519	0.05	Significant by Gabriel approx
3	1.3861973	−3.599001	−0.8266059	0.05	Significant by Gabriel approx
4	0.9259997	−2.061001	−0.2090011	0.05	Significant by Gabriel approx
5	1.3195997	−2.284939	0.3542601	0.05	Not significant by Gabriel approx
6	1.5777852	−1.408124	1.7474465	0.05	Not significant by Gabriel approx


Gabriel's Test: Group Distribution Boxplots
G3
0
5
10
15
1
2
3
4
studytime
Boxplots show group spread before post-hoc pairwise comparisons.


Gabriel's Test: Group Means with 95% CIs
Mean G3
0
5
10
15
10.84
12.09
13.06
13.23
1
2
4
3
studytime
Gabriel's test compares each pair of group means after the omnibus ANOVA.


Gabriel's Test: Pairwise Adjusted p-values
1 vs 3
1 vs 2
1 vs 4
2 vs 3
2 vs 4
3 vs 4
0.0000
0.0001
0.0002
0.0077
0.2831
0.0
0.2
0.4
0.6
0.8
Approximate Gabriel adjusted p-value
Bars below .05 are significant using the Gabriel-style maximum-modulus approximation.


Gabriel's Test: Mean Difference Confidence Intervals
3 - 4
2 - 4
2 - 3
1 - 2
1 - 4
1 - 3
-3
-2
-1
0
1
Mean difference with Gabriel-style simultaneous CI
Intervals excluding zero indicate pairwise mean differences after familywise adjustment.


Gabriel's Test: Significant Difference Count by Group
Group mean
0
5
10
15
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1
2
4
3
Group
Colorful bars show group means; the line shows significant pair counts.