Introduction

This report presents two statistical analysis techniques in ANOVA (Analysis of Variance) and ANCOVA (Analysis of Covariance) with each applied into two biomedical datasets to evaluate treatment effects. The goal of the statistical analysis was to have an understanding of how different factors affect outcomes and whether those effects are significant.

The first dataset, Animal Survival Time, examines the effects of poison type and treatment on survival time, while the second dataset, Blood Pressure Treatment explores how various medicines/treatments affect post-treatment blood pressure (diastolic and systolic). These datasets were a fit to the statistical methods as they are widely used in health and biological studies. ANOVA aids in comparing group means to check if at least one is different, while ANCOVA on the other hand goes a step further by controlling another variable. Ultimately, these tools help in seeing if treatments really work or if differences are just by chance.

Methodology

This statistical analysis was completely conducted in Microsoft Excel. The program provides users the ability to perform statistical analysis tasks with the help of add-ins. The data pre-processing includes importing the data using the *Get Data* function and transforming inside the *Power Query Editor*. Tasks such as removing errors and duplicates, specifying column data types and so on were handled in the Power Query Editor.

After that, the statistical analysis process was performed, the *Analysis Toolpak* add-in was utilized all throughout. The descriptive statistics were generated automatically using the add-in and manually using *PivotTables*, tables generated from these processes include mean, standard deviation, sample variance and so on. To further understand the data, several graphs and plots were visualized. After having all those things in place, the null and alternative hypotheses were formulated to prepare for the analysis phase.

In the Animal Survival Time dataset, the One-Way ANOVA test was performed to test if the poison type affects survival time or the mean time. The Two-Way ANOVA was consecutively performed to check the effects of both poison and treatment and see if both variables interact with each other.

For the Blood Pressure Treatment dataset, ANCOVA was used to see how post-treatment blood pressure changes after considering pre-treatment levels. Additionally, a simple linear regression was performed to model that relationship between pre- and post-treatment blood pressures, alongside computing the correlation between pre- and post-treatment variables.

Results and Interpretation

The findings from the two analyses provided important insights into the effects of treatments/medication on blood pressure and poisons.

Animal Survival Time (ANOVA)

The dataset was made up of 48 observations composed of three poison, four treatment and four replicates per group. The One-Way ANOVA showed that poison type significantly affected mean survival time.

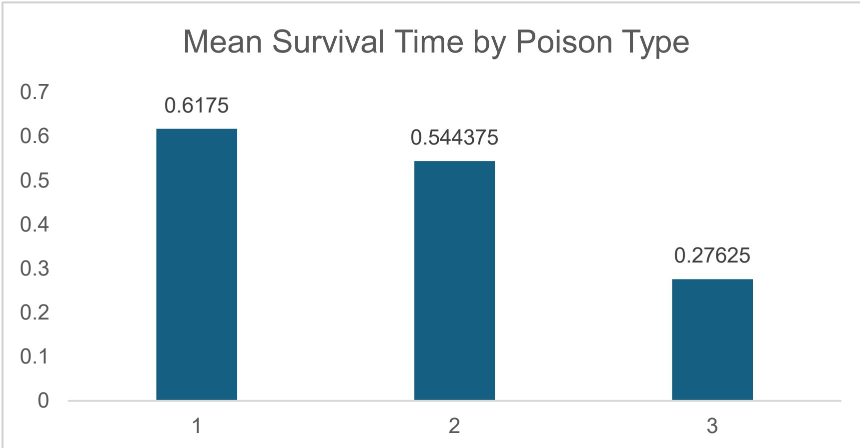
$$F = 11.79$$
$$P - value = 7.65564e - 05$$
$$a = 0.05$$
$$0.0000766 \ \leq 0.05$$

Post-hoc comparisons revealed that poison 3 was significantly different from poisons 1 and 2.

POST-HOC TEST

Groups (poison)	*P-value (T test)*	*Significant?*
1 v 2	0.419320742	No
2 v 3	**0.001062402**	**Yes**

3 v 1	**6.99734E-07**	**Yes**



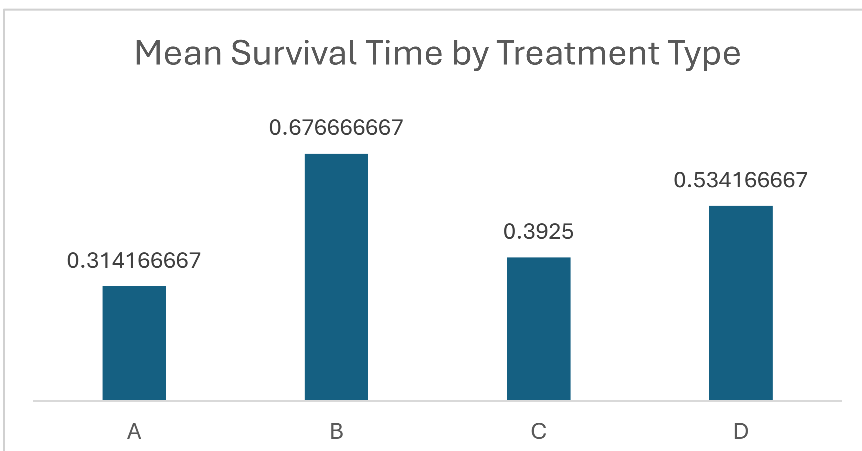
For the Two-Way ANOVA, both poison and treatment had significant effects, but their interaction was not significant.

Factor	F-value	p-value	Interpretation
Poison (main effect)	23.22	3.33e-07	Significant difference among poisons
Treatment (main effect)	13.81	3.77733e-06	Significant difference among treatments
Interaction (Poison×Treatment)	1.87	0.112	No significant interaction

Post-hoc comparisons uncovered that treatment A mean survival time is significantly different from mean survival times of treatment B and D. Treatment B mean survival time is significantly different from treatment C while it is not significantly different from treatment D. Treatment C is not significantly different from treatment A and D.

POST-HOC TEST

Groups (treat)	*P-value (T test)*	*Significant?*
A v B	**0.001165176**	**Yes**
A v C	0.179773695	No
A v D	**0.004672031**	**Yes**
B v C	**0.012460458**	**Yes**
B v D	0.217365628	No
C v D	0.088964569	No



While the findings from the One-Way ANOVA involving the poison type is consistent with the ones found in the Two-Way ANOVA. However, the interaction between the poison and treatment was found to be not significant, the effect of the treatment does not depend on poison type. This means that poison and treatment affect mean survival time independently.

$$F = 1.87$$

$$F\ crit = 2.36$$

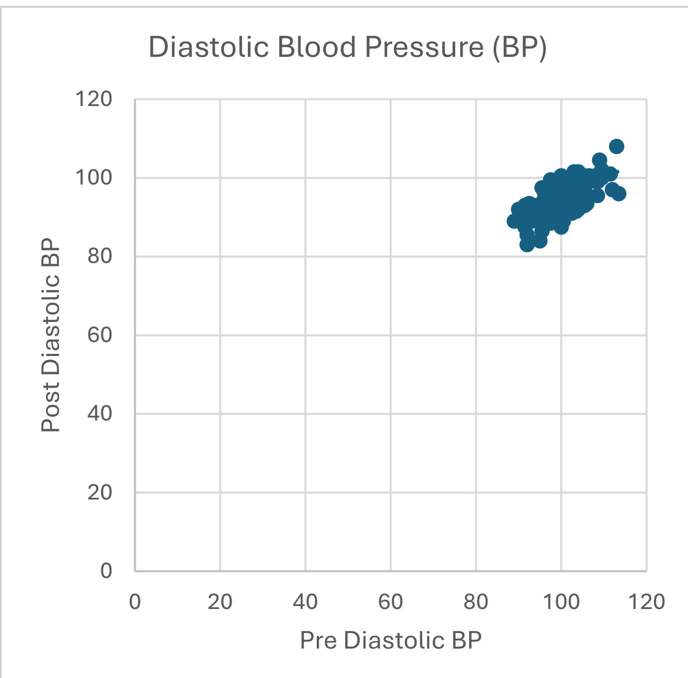
$$P - value = 0.1122$$

$$a\ = 0.05$$

$$0.1122\ > 0.05$$

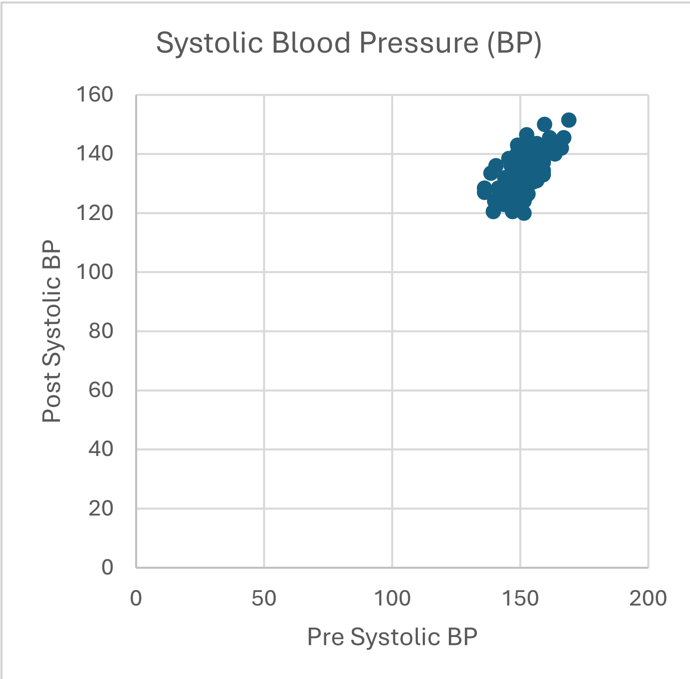
Blood Pressure Treatment (ANCOVA)

There were 120 participants divided into four treatment/medicine groups: New Medicine, Old Medicine, Placebo, and None. The simple linear regression and ANCOVA results showed that the pre-treatment blood pressure was a strong predictor of post-treatment values.



Correlation		
	predias	*postdias*
predias	1	
postdias	0.659230173	1

Regression Statistics	
Multiple R	0.659230173
R Square	0.434584421
Adjusted R Square	0.429792763



Correlation

	presys	*postsys*
presys	1	
postsys	0.64503915	1

Regression Statistics

Multiple R	0.64503915
R Square	0.416075505
Adjusted R Square	0.411126992

In terms of pre- and post-diastolic blood pressure, the None treatment group showed a significant difference compared to the Placebo group. The New and Old Medicine groups did not show any significant difference compared to Placebo. In conclusion, treatment or at least one treatment affected post-diastolic blood pressure.

diastolic ($a = 0.05$)

Factor	**p-value**	**Interpretation**
Treatment (overall)	2.66e-18	Treatment affects post diastolic BP
None vs Placebo	0.0056	Significantly different post diastolic BP
New vs Placebo	0.78	No significant difference
Old vs Placebo	0.23	No significant difference

On the other hand, pre- and post-systolic blood pressure, uncovered the same findings as its diastolic counterpart. The None treatment group also showed a significant difference compared to the Placebo Group while the New and Old Medicine groups did not show any significant differences compared to Placebo. With this in mind, treatment or at least one treatment affect post-systolic blood pressure.

systolic ($a = 0.05$)

Factor	p-value	Interpretation
Treatment (overall)	4.55e-16	Treatment affects post systolic BP
None vs Placebo	0.0066	Significantly different post systolic BP
New vs Placebo	0.70	No significant difference
Old vs Placebo	0.97	No significant difference

Discussion and Conclusion

The results showed insightful stories regarding the statistical analysis of the two datasets. For the Animal Survival Time, both poison type and treatment significantly affected mean survival time. However, there was no significant interaction between the two variables, meaning the effect of treatment was consistent across poisons.

The Blood Pressure Treatment revealed that, neither the New nor old medicine significantly affected diastolic and systolic blood pressure compared to placebo. Those who received no medicine/treatment at all had higher diastolic and systolic blood pressures. These findings suggest that the medicines may not be more effective than a placebo in reducing blood pressure.

diastolic

Factor	Coefficient	Interpretation
None vs Placebo	2.22	Elevated diastolic BP by 2.22
New vs Placebo	-0.27	Lowered diastolic BP by 0.27
Old vs Placebo	-1.16	Lowered diastolic BP by 1.16

systolic

Factor	Coefficient	Interpretation
None vs Placebo	3.27	Elevated systolic BP by 3.27
New vs Placebo	-0.56	Lowered systolic BP by 0.56
Old vs Placebo	0.05	Elevated systolic BP by 0.05

Overall, both analyses show how important it is to use the right statistical tools to correctly understand data. ANOVA can identify which factors matter the most, and ANCOVA can adjust for pre-existing differences.

Appendix

All data were processed in Microsoft Excel using the Data *Analysis Toolpak* add-in. Descriptive statistics, ANOVA, and ANCOVA were computed directly Excel using the add-in. Included below are screenshots and tables that summarized how the analysis was performed.

Appendix A: ANOVA

id	time	poison	treat
1	0.31	1	A
2	0.45	1	A
3	0.46	1	A
4	0.43	1	A
5	0.36	2	A
6	0.29	2	A
7	0.4	2	A
8	0.23	2	A
9	0.22	3	A
10	0.21	3	A
11	0.18	3	A
12	0.23	3	A
13	0.82	1	B
14	1.1	1	B
15	0.88	1	B
16	0.72	1	B
17	0.92	2	B
18	0.61	2	B
19	0.49	2	B
20	1.24	2	B
21	0.3	3	B
22	0.37	3	B
23	0.38	3	B
24	0.29	3	B
25	0.43	1	C
26	0.45	1	C
27	0.63	1	C
28	0.76	1	C
29	0.44	2	C
30	0.35	2	C
31	0.31	2	C
32	0.4	2	C
33	0.23	3	C
34	0.25	3	C
35	0.24	3	C
36	0.22	3	C
37	0.45	1	D
38	0.71	1	D
39	0.66	1	D
40	0.62	1	D
41	0.56	2	D
42	1.02	2	D
43	0.71	2	D
44	0.38	2	D
45	0.3	3	D
46	0.36	3	D
47	0.31	3	D
48	0.33	3	D

time	
Mean	0.479375
Standard Error	0.036497117
Median	0.4
Mode	0.31
Standard Deviation	0.252859445
Sample Variance	0.063937899
Kurtosis	1.007095408
Skewness	1.229127741
Range	1.06
Minimum	0.18
Maximum	1.24
Sum	23.01
Count	48
Confidence Level(95.0%)	0.073422729

treat (time)

treat	Mean	Standard Deviation	Sample Variance	Minimum	Maximum	Sum	Count
A	0.314166667	0.102288214	0.010462879	0.18	0.46	3.77	12
B	0.676666667	0.320832251	0.102933333	0.29	1.24	8.12	12
C	0.3925	0.16701252	0.027893182	0.22	0.76	4.71	12
D	0.534166667	0.219439714	0.048153788	0.3	1.02	6.41	12
Grand Total	**0.479375**	**0.252859445**	**0.063937899**	**0.18**	**1.24**	**23.01**	**48**

poison (time)

poison	Mean	Standard Deviation	Sample Variance	Minimum	Maximum	Sum	Count
1	0.6175	0.209427792	0.04386	0.31	1.1	9.88	16
2	0.544375	0.289366406	0.083732917	0.23	1.24	8.71	16
3	0.27625	0.062276266	0.003878333	0.18	0.38	4.42	16
Grand Total	**0.479375**	**0.252859445**	**0.063937899**	**0.18**	**1.24**	**23.01**	**48**

Average of Time	**Poison**			
Treatment	**1**	**2**	**3**	**Grand Total**
A	0.4125	0.32	0.21	0.314166667
B	0.88	0.815	0.335	0.676666667
C	0.5675	0.375	0.235	0.3925
D	0.61	0.6675	0.325	0.534166667
Grand Total	**0.6175**	**0.544375**	**0.27625**	**0.479375**

poison	Mean Time
1	0.6175
2	0.544375
3	0.27625
Grand Total	**0.479375**

treat	Mean Time
A	0.314166667
B	0.676666667
C	0.3925
D	0.534166667
Grand Total	**0.479375**

One-Way ANOVA

H0: The mean time is the same for all types of poison.
H1: There is at least one poison that has a mean time that differs from the other types of poison.

Poison 1	Poison 2	Poison 3
0.31	0.36	0.22
0.45	0.29	0.21
0.46	0.4	0.18
0.43	0.23	0.23
0.82	0.92	0.3
1.1	0.61	0.37
0.88	0.49	0.38
0.72	1.24	0.29
0.43	0.44	0.23
0.45	0.35	0.25
0.63	0.31	0.24
0.76	0.4	0.22
0.45	0.56	0.3
0.71	1.02	0.36
0.66	0.71	0.31
0.62	0.38	0.33

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Poison 1	16	9.88	0.6175	0.04386
Poison 2	16	8.71	0.544375	0.083732917
Poison 3	16	4.42	0.27625	0.003878333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.0330125	2	0.51650625	11.78598933	7.65564E-05	3.204317292
Within Groups	1.97206875	45	0.04382375			
Total	3.00508125	47				

F = 11.7859893322684
F crit = 3.20431729211419
P-value = 0.0000765563518517592
alpha = 0.05

$$0.0000766 \leq 0.05$$

This means we have sufficient evidence to say that there is at least one poison that has a mean time that differs from other types of poison.

POST-HOC TEST

Groups (poison)	*P-value (T test)*	*Significant?*
1 v 2	0.419320742	No
2 v 3	0.001062402	Yes
3 v 1	6.99734E-07	Yes

Poison 3 has a significantly different mean time compared to poison 1 and poison 2. Poison 1 and poison 2 are not significantly different from each other.

ALPHA

Test	*Alpha*
ANOVA	0.05
POST-HOC TEST (Bonferroni Corrected)	0.016666667

Two-Way ANOVA

Poison

H0: The mean time is the same for all types of poison.

H1: There is at least one poison that has a mean time different from other types of poison.

Treat/Treament

H0: The mean time is the same for all types of treament.

H1: There is at least one treatment that has a mean time different from other types of treatment.

Interaction

H0: The effect of treatment does not depend on the poison.

H1: The effect of treatment does depend on the poison.

Treat		Poison 1	Poison 2	Poison 3
	A	0.31	0.36	0.22
		0.45	0.29	0.21
		0.46	0.4	0.18
		0.43	0.23	0.23
	B	0.82	0.92	0.3
		1.1	0.61	0.37
		0.88	0.49	0.38
		0.72	1.24	0.29
	C	0.43	0.44	0.23
		0.45	0.35	0.25
		0.63	0.31	0.24
		0.76	0.4	0.22
	D	0.45	0.56	0.3
		0.71	1.02	0.36
		0.66	0.71	0.31
		0.62	0.38	0.33

Anova: Two-Factor With Replication

SUMMARY	1	2	3	Total
A				
Count	4	4	4	12
Sum	1.65	1.28	0.84	3.77
Average	0.4125	0.32	0.21	0.314166667
Variance	0.004825	0.005666667	0.000466667	0.010462879
B				
Count	4	4	4	12
Sum	3.52	3.26	1.34	8.12
Average	0.88	0.815	0.335	0.676666667
Variance	0.025866667	0.1131	0.002166667	0.102933333
C				
Count	4	4	4	12
Sum	2.27	1.5	0.94	4.71
Average	0.5675	0.375	0.235	0.3925
Variance	0.024558333	0.003233333	0.000166667	0.027893182
D				
Count	4	4	4	12
Sum	2.44	2.67	1.3	6.41
Average	0.61	0.6675	0.325	0.534166667
Variance	0.012733333	0.073425	0.0007	0.048153788
Total				
Count	16	16	16	
Sum	9.88	8.71	4.42	
Average	0.6175	0.544375	0.27625	
Variance	0.04386	0.083732917	0.003878333	

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample	0.92120625	3	0.30706875	13.80558244	3.77733E-06	2.866265551
Columns	1.0330125	2	0.51650625	23.22173655	3.33E-07	3.259446306
Interaction	0.2501375	6	0.041689583	1.874332636	0.112250608	2.363750958
Within	0.800725	36	0.022242361			
Total	3.00508125	47				

Treat

F = 13.8055824409129

F crit = 2.86626555094018

P-value = 0.0000037773305759207

alpha = 0.05

$$0.00000378 \leq 0.05$$

This means we have sufficient evidence to say that there is at least one treatment that has a mean time different from other types of treatment.

POST-HOC TEST

Groups (treat)	*P-value (T test)*	*Significant?*
A v B	0.001165176	Yes
A v C	0.179773695	No
A v D	0.004672031	Yes
B v C	0.012460458	Yes
B v D	0.217365628	No
C v D	0.088964569	No

Treatment A mean time is significantly different from mean times of treatment B and D. Treatment B mean time is significantly different from treatment C while it is not significantly different from treatment D. Treatment C is not significantly different from

ALPHA

Test	*Alpha*
ANOVA	0.05
POST-HOC TEST (Bonferroni Corrected)	0.0125

Poison

F = 23.2217365512504

F crit = 3.25944630614411

P-value = 0.000000333143996157054

alpha = 0.05

$$0.000000333 \leq 0.05$$

This means we have sufficient evidence to say that there is at least one poison that has a mean time different from other types of poison.

POST-HOC TEST

Groups (poison)	*P-value (T test)*	*Significant?*
1 v 2	0.419320742	No
2 v 3	0.001062402	Yes
3 v 1	6.99734E-07	Yes

Poison 3 has a significantly different mean time compared to poison 1 and poison 2. Poison 1 and poison 2 are not significantly different from each other.

ALPHA

Test	*Alpha*
ANOVA	0.05
POST-HOC TEST (Bonferroni Corrected)	0.016666667

Interaction

F = 1.87433263604859

F crit = 2.36375095836615

P-value = 0.112250608311411

alpha = 0.05

$$0.1122 > 0.05$$

This means we have sufficient evidence to say that the effect of treatment does not depend on the poison.

Appendix B: ANCOVA

predias		*presys*	
Mean	100.4041667	Mean	150.8875
Standard Error	0.467886654	Standard Error	0.584087023
Median	101	Median	150.5
Mode	101	Mode	149
Standard Deviation	5.125441499	Standard Deviation	6.398352762
Sample Variance	26.27015056	Sample Variance	40.93891807
Kurtosis	-0.166299024	Kurtosis	0.134532454
Skewness	0.093092347	Skewness	0.2485032
Range	24.5	Range	33
Minimum	89	Minimum	136
Maximum	113.5	Maximum	169
Sum	12048.5	Sum	18106.5
Count	120	Count	120
Confidence Level(95.0%)	0.926462307	Confidence Level(95.0%)	1.156550642

postdias		*postsys*	
Mean	94.3875	Mean	133.5041667
Standard Error	0.397359214	Standard Error	0.571605675
Median	94	Median	133
Mode	92	Mode	133.5
Standard Deviation	4.352852103	Standard Deviation	6.261626441
Sample Variance	18.94732143	Sample Variance	39.20796569
Kurtosis	0.15261202	Kurtosis	0.002345691
Skewness	0.137501439	Skewness	0.256143444
Range	25	Range	31.5
Minimum	83	Minimum	120
Maximum	108	Maximum	151.5
Sum	11326.5	Sum	16020.5
Count	120	Count	120
Confidence Level(95.0%)	0.786810931	Confidence Level(95.0%)	1.131836326

			treatment (predias)				
predias	**Mean**	**Standard Deviation**	**Sample Variance**	**Minimum**	**Maximum**	**Sum**	**Count**
New Medicine	102.125	4.706867882	22.15460526	91.5	109.5	2042.5	20
None	99.43333333	5.647458305	31.89378531	89	113	5966	60
Old Medicine	101.175	5.003354138	25.03355263	92	113.5	2023.5	20
Placebo	100.825	3.376680868	11.40197368	94.5	106	2016.5	20
Grand Total	**100.4041667**	**5.125441499**	**26.27015056**	**89**	**113.5**	**12048.5**	**120**

predias	**Mean**
New Medicine	102.13
None	99.43
Old Medicine	101.18
Placebo	100.83

			treatment (presys)				
presys	**Mean**	**Standard Deviation**	**Sample Variance**	**Minimum**	**Maximum**	**Sum**	**Count**
New Medicine	152.75	7.938082759	63.01315789	141	166	3055	20
None	149.5916667	6.135815713	37.64823446	136	169	8975.5	60
Old Medicine	152.225	6.653995634	44.27565789	136	167	3044.5	20
Placebo	151.575	4.568988717	20.87565789	144	159	3031.5	20
Grand Total	**150.8875**	**6.398352762**	**40.93891807**	**136**	**169**	**18106.5**	**120**

presys	**Mean**
New Medicine	152.75
None	149.59
Old Medicine	152.23
Placebo	151.58

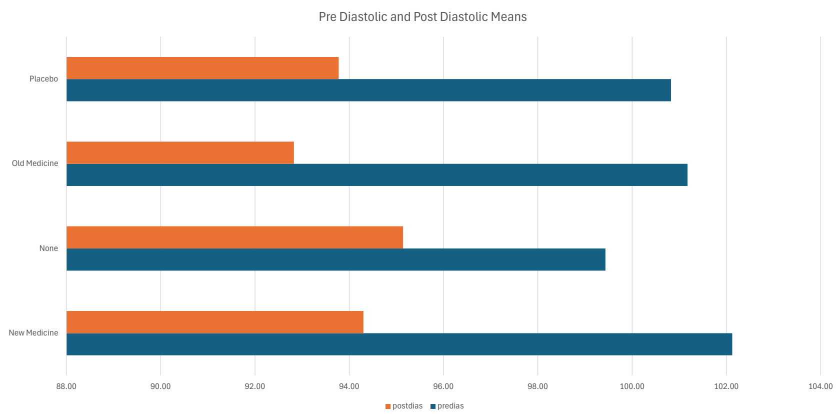
			treatment (postdias)				
postdias	**Mean**	**Standard Deviation**	**Sample Variance**	**Minimum**	**Maximum**	**Sum**	**Count**
New Medicine	94.3	4.228350431	17.87894737	86.5	104.5	1886	20
None	95.14166667	4.483578008	20.10247175	85.5	108	5708.5	60
Old Medicine	92.825	4.609129956	21.24407895	83	100	1856.5	20
Placebo	93.775	3.514911843	12.35460526	88.5	100.5	1875.5	20
Grand Total	**94.3875**	**4.352852103**	**18.94732143**	**83**	**108**	**11326.5**	**120**

postdias	**Mean**
New Medicine	94.30
None	95.14
Old Medicine	92.83
Placebo	93.78

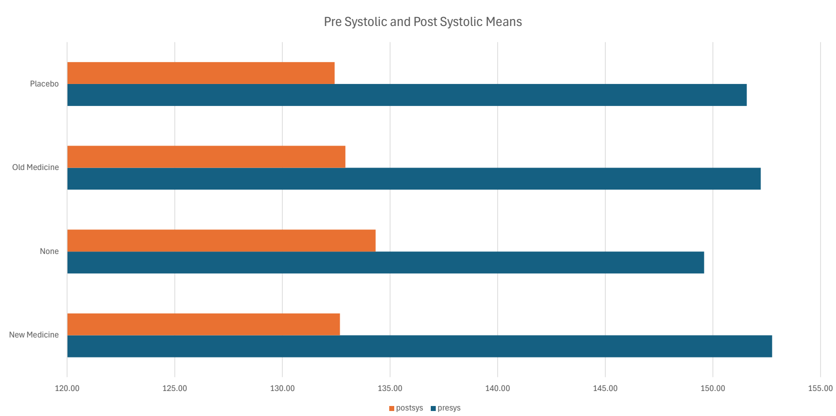
			treatment (postsys)				
postsys	**Mean**	**Standard Deviation**	**Sample Variance**	**Minimum**	**Maximum**	**Sum**	**Count**
New Medicine	132.675	7.559022145	57.13881579	120.5	150	2653.5	20
None	134.3333333	5.986330946	35.83615819	120.5	151.5	8060	60
Old Medicine	132.925	7.702144267	59.32302632	120	146.5	2658.5	20
Placebo	132.425	3.65367515	13.34934211	123	141.5	2648.5	20
Grand Total	**133.5041667**	**6.261626441**	**39.20796569**	**120**	**151.5**	**16020.5**	**120**

postsys	**Mean**
New Medicine	132.68
None	134.33
Old Medicine	132.93
Placebo	132.43

	New Medicine	None	Old Medicine	Placebo
predias	102.13	99.43	101.18	100.83
postdias	94.30	95.14	92.83	93.78



	New Medicine	None	Old Medicine	Placebo
presys	152.75	149.59	152.23	151.58
postsys	132.68	134.33	132.93	132.43



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.659230173
R Square	0.434584421
Adjusted R Square	0.429792763
Standard Error	3.286928626
Observations	120

H0: There is no linear relationship between the pre diastolic and post diastolic blood pressures.
H1: There is a linear relationship between the pre diastolic and post diastolic blood pressures.

F = 90.6960535533705
Significance F = 0.000000000000000269867628895804
P-value = 0.000000000000000269867628895804
alpha = 0.05

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	979.8710743	979.8710743	90.69605355	2.70E-16
Residual	118	1274.860176	10.80389979		
Total	119	2254.73125			

$$0.00000000000000027 \leq 0.05$$

This means we have sufficient evidence to say that there is a l
relationship between the pre diastolic and post diastolic blc
pressures.

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	38.17518865	5.910138719	6.459271172	2.45112E-09	26.47150495	49.87887234	26.47150495	49.87887234
predias	0.559860345	0.05878757	9.523447567	2.70E-16	0.44344495	0.676275739	0.44344495	0.676275739

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.64503915
R Square	0.416075505
Adjusted R Square	0.411126992
Standard Error	4.805050748
Observations	120

H0: There is no linear relationship between the pre systolic and post systolic blood pressures.
H1: There is a linear relationship between the pre systolic and post systolic blood pressures.

F = 84.0809213054708
Significance F = 0.00000000000000184330324023234
P-value = 0.00000000000000184330324023234
alpha = 0.05

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1941.303419	1941.303419	84.08092131	1.84E-15
Residual	118	2724.444498	23.08851269		
Total	119	4665.747917			

$$0.0000000000000018 \leq 0.05$$

This means we have sufficient evidence to say that there is a linea
relationship between the pre systolic and post systolic blood
pressures.

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	38.25563016	10.39672241	3.679585608	0.000353425	17.66728929	58.84397104	17.66728929	58.84397104
presys	0.631255316	0.06884245	9.169564946	1.8433E-15	0.494928523	0.767582109	0.494928523	0.767582109

Baseline Treatment: Placebo

New Medicine
H0: The new medicine has the same effect or equal effect on post diastolic blood pressure as the placebo.
H1: The new medicine has a different effect on post diastolic blood pressure than the placebo.

Old Medicine
H0: The old medicine has the same effect or equal effect on post diastolic blood pressure as the placebo.
H1: The old medicine has a different effect on post diastolic blood pressure than the placebo.

None
H0: No treatment has the same effect or equal effect on post diastolic blood pressure as the placebo.
H1: No treatment has a different effect on post diastolic blood pressure than the placebo.

Overall
H0: All treatments has the same effect or equal effect on post diastolic blood pressure.
H1: At least one treatment has a different effect on post diastolic blood pressure.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.730863036
R Square	0.534160777
Adjusted R Square	0.517957674
Standard Error	3.022153353
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1204.388998	301.0972494	32.96657218	2.66E-18
Residual	115	1050.342252	9.133410891		
Total	119	2254.73125			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	32.28943397	5.608744236	5.756980995	7.23981E-08	21.17959109	43.39927685	21.17959109	43.39927685
predias	0.609824607	0.055223256	11.04289475	9.10523E-20	0.500437965	0.71921125	0.500437965	0.71921125
none	2.215339245	0.784092052	2.82535608	0.005569783	0.662203796	3.768474694	0.662203796	3.768474694
new	-0.267771989	0.95838141	-0.279400233	0.780439568	-2.166141113	1.630597134	-2.166141113	1.630597134
old	-1.163438613	0.955884233	-1.217133386	0.226045292	-3.056861309	0.729984084	-3.056861309	0.729984084

New Medicine
P-value = 0.780439567899722
alpha = 0.05
Coefficient = -0.267771989476716

$$0.780439567899722 > 0.05$$

This means we have sufficient evidence to say that the new medicine has the same effect or equal effect on post diastolic blood pressure as the placebo.

The predicted 0.27 mmHg lower blood pressure is not statistically significant.

Old Medicine
P-value = 0.226045291776685
alpha = 0.05
Coefficient = -1.16343861255142

$$0.226045291776685 > 0.05$$

This means we have sufficient evidence to say that the old medicine has the same effect or equal effect on post diastolic blood pressure as the placebo.

The predicted 1.16 mmHg lower blood pressure is not statistically significant.

None
P-value = 0.00556978307171071
alpha = 0.05
Coefficient = 2.21533924514495

$$0.00556978307171071 \leq 0.05$$

This means we have sufficient evidence to say that no/none treatment has a different effect on post diastolic blood pressure than the placebo.

The predicted 2.22 mmHg higher blood pressure is statistically significant.

Overall
P-value = 0.0000000000000000026596676893021
alpha = 0.05

$$0.0000000000000000027 \leq 0.05$$

This means we have sufficient evidence to say that at least one treatment has a different effect on post diastolic blood pressure.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.699890743
R Square	0.489847052
Adjusted R Square	0.472102602
Standard Error	4.549481627
Observations	120

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2285.502863	571.3757158	27.60564809	4.55E-16
Residual	115	2380.245053	20.69778307		
Total	119	4665.747917			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	28.22575788	10.15675822	2.779012484	0.006370506	8.107174608	48.34434115	8.107174608	48.34434115
none	3.271762858	1.18209022	2.767777622	0.006579806	0.930269636	5.61325608	0.930269636	5.61325608
new	-0.557746063	1.440803682	-0.387107605	0.699391995	-3.411700861	2.296208735	-3.411700861	2.296208735
old	0.053161752	1.43932496	0.036935198	0.970600713	-2.797863982	2.904187486	-2.797863982	2.904187486
presys	0.687443458	0.066671179	10.31095397	4.76257E-18	0.555380684	0.819506232	0.555380684	0.819506232

Baseline

New Medicine
H0: The new medicine has the same effect or equal effect on post systolic blood pressure as the placebo.
H1: The new medicine has a different effect on post systolic blood pressure than the placebo.

Old Medicine
H0: The old medicine has the same effect or equal effect on post systolic blood pressure as the placebo.
H1: The old medicine has a different effect on post systolic blood pressure than the placebo.

None
H0: No treatment has the same effect or equal effect on post systolic blood pressure as the placebo.
H1: No treatment has a different effect on post systolic blood pressure than the placebo.

Overall
H0: All treatments has the same effect or equal effect on post systolic blood pressure.
H1: At least one treatment has a different effect on post systolic blood pressure.

New Medicine
P-value = 0.69939199521329
alpha = 0.05
Coefficient = -0.557746062965703

$$0.69939199521329 > 0.05$$

This means we have sufficient evidence to say that the new medicine has the same effect or equal effect on post systolic blood pressure as the placebo.

The predicted 0.56 mmHg lower blood pressure is not statistically significant.

Old Medicine
P-value = 0.970600713343952
alpha = 0.05
Coefficient = 0.053161752

$$0.970600713343952 > 0.05$$

This means we have sufficient evidence to say that the old medicine has the same effect or equal effect on post systolic blood pressure as the placebo.

The predicted 0.05 mmHg higher blood pressure is not statistically significant

None
P-value = 0.006579806
alpha = 0.05
Coefficient = 3.27176285805559

$$0.006579806 \leq 0.05$$

This means we have sufficient evidence to say that no treatment has a differen effect on post systolic blood pressure than the placebo.

The predicted 3.27 mmHg higher blood pressure is statistically significant.

Overall
P-value = 0.000000000000000454624628491472
alpha = 0.05

$$0.00000000000000045 \leq 0.05$$

This means we have sufficient evidence to say that at least one treatment has different effect on post diastolic blood pressure.