RADPAD Data Analysis

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Resident 1

Observed Difference in Median Dose

Table 1: Median Dose (microSV) Statistics for Resident 1

Procedure	Median NOPAD	Median RADPAD	Difference	Percent Change
BPV	15.44	6.12	-9.32	-60.36
PDA	5.77	2.83	-2.94	-50.91
PMI	18.33	8.75	-9.58	-52.26
PV Stent	92.00	14.81	-77.19	-83.90

ANCOVA Model Analysis of Variance

Table 2: Resident 1 Analysis of Variance

	Sum Sq	Df	F value	Pr(>F)
(Intercept)	57.784	1	47.610	0.000
RADPAD	38.247	1	31.513	0.000
Procedure_Type	17.982	3	4.939	0.002
Weight	22.093	1	18.204	0.000
Time	22.866	1	18.840	0.000
RADPAD:Procedure_Type	7.661	3	2.104	0.101
Residuals	239.096	197	NA	NA

Contrasts

Table 3: Resident 1 RADPAD by Procedure Type Contrast on Log Scale

contrast	Procedure_Type	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	BPV	-1.438	0.256	197	-1.943	-0.933	-5.614	0.000
Y - N	PDA	-0.592	0.343	197	-1.269	0.085	-1.724	0.086
Y - N	PMI	-1.056	0.421	197	-1.886	-0.226	-2.508	0.013
Y - N	PV Stent	-2.006	0.537	197	-3.065	-0.947	-3.735	0.000

Table 4: Resident 1 RADPAD by Procedure Type Contrast, Ratio of Geometric Means

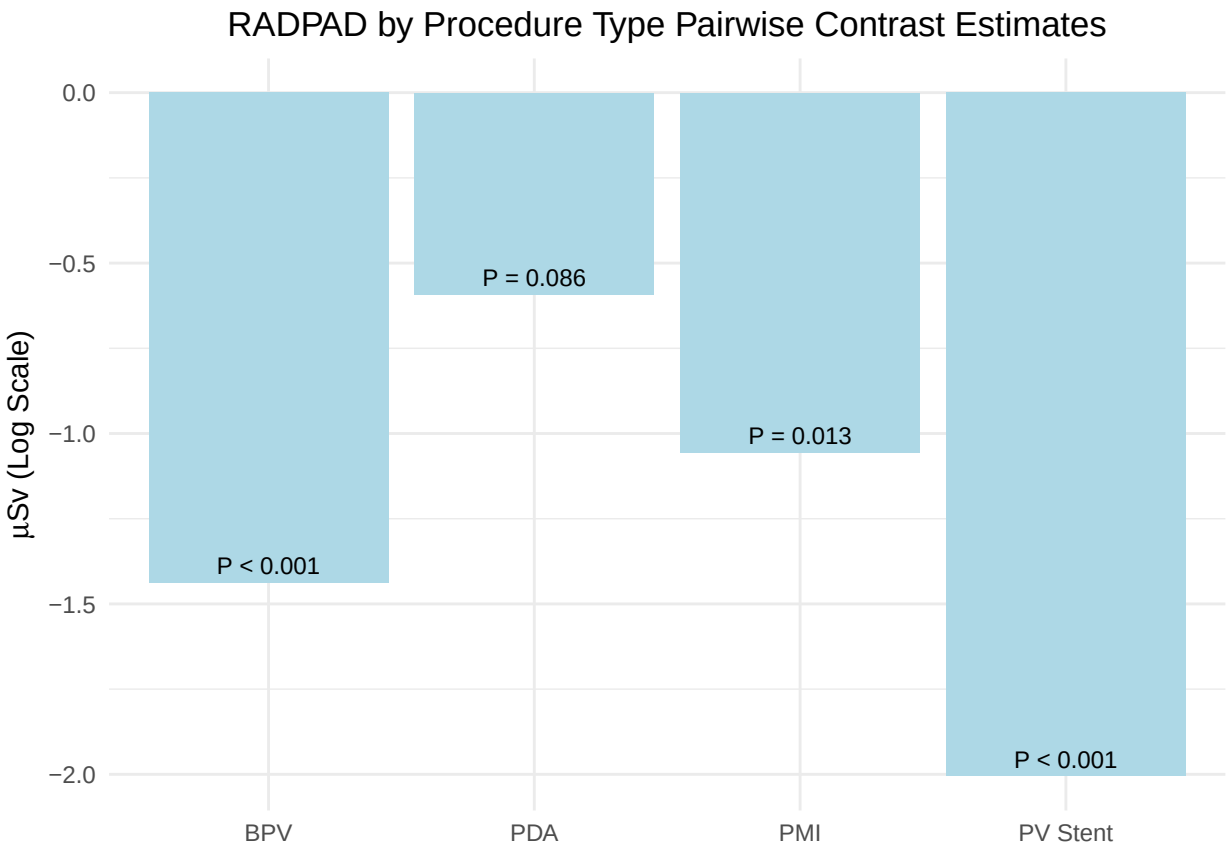
contrast	Procedure_Type	ratio	SE	lower.CL	upper.CL	null	t.ratio	p.value
Y / N	BPV	0.237	0.061	0.143	0.394	1	-5.614	0.000
Y / N	PDA	0.553	0.190	0.281	1.089	1	-1.724	0.086
Y / N	PMI	0.348	0.146	0.152	0.798	1	-2.508	0.013
Y / N	PV Stent	0.135	0.072	0.047	0.388	1	-3.735	0.000

Table 5: Resident 1 RADPAD Contrast on Log Scale

contrast	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	-1.273	0.201	197	-1.669	-0.876	-6.333	0

Table 6: Resident 1 RADPAD Contrast, Ratio of Geometric Means

contrast	ratio	SE	lower.CL	upper.CL	null	t.ratio	p.value
Y / N	0.28	0.056	0.188	0.416	1	-6.333	0



Resident 2

Observed Difference in Median Dose

Table 7: Median Dose (microSV) Statistics for Resident 2

Procedure	Median NOPAD	Median RADPAD	Difference	Percent Change
BPV	1.84	0.52	-1.31	-71.47
PDA	0.88	0.34	-0.53	-60.80
PMI	1.63	0.31	-1.32	-80.98
PV Stent	3.48	3.86	0.38	10.78

ANCOVA Model Analysis of Variance

Table 8: Resident 2 Analysis of Variance

	Sum Sq	Df	F value	Pr(>F)
(Intercept)	6.138	1	3.028	0.084
RADPAD	14.518	1	7.162	0.008
Procedure_Type	7.996	3	1.315	0.271
Weight	65.270	1	32.199	0.000
Time	2.192	1	1.081	0.300
RADPAD:Procedure_Type	11.750	3	1.932	0.126
Residuals	344.609	170	NA	NA

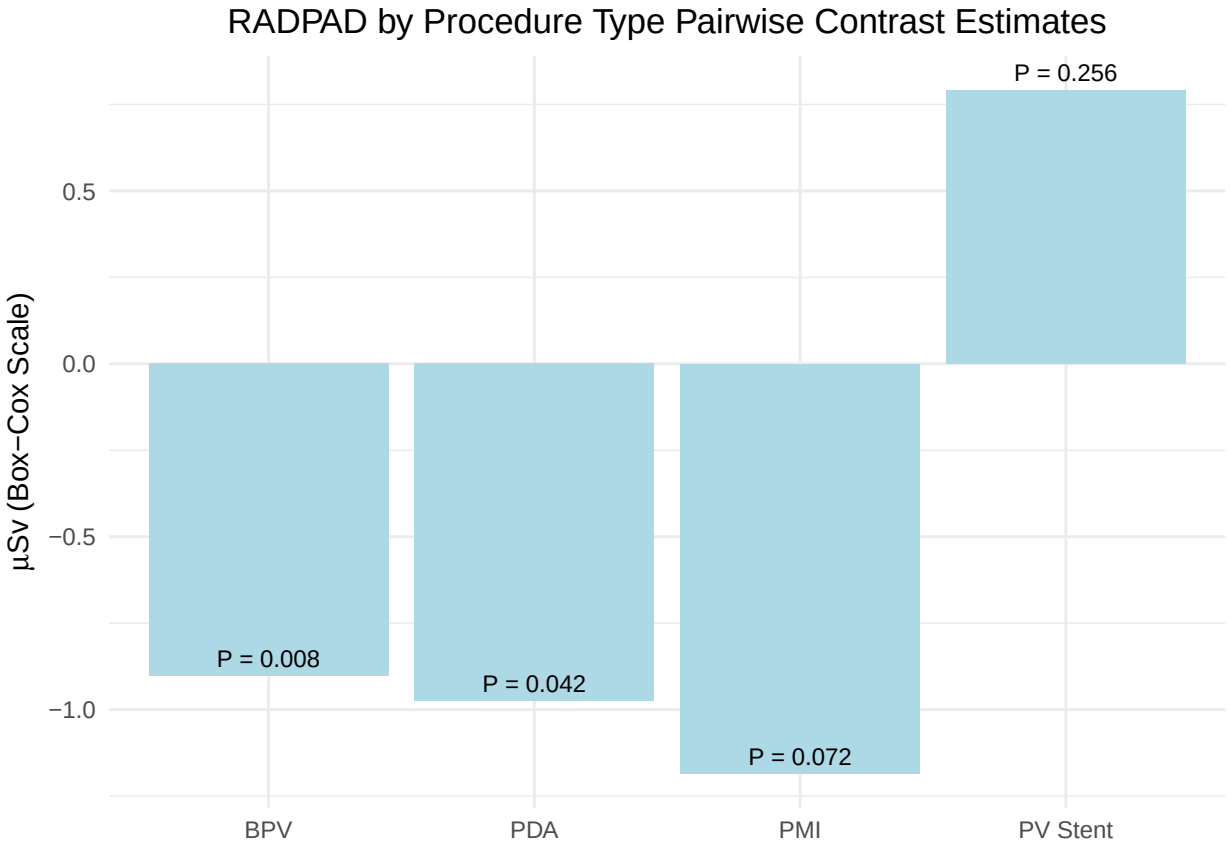
Contrasts

Table 9: Resident 2 RADPAD by Procedure Type Contrast on Box-Cox Scale

contrast	Procedure_Type	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	BPV	-0.903	0.337	170	-1.568	-0.237	-2.676	0.008
Y - N	PDA	-0.975	0.477	170	-1.916	-0.034	-2.046	0.042
Y - N	PMI	-1.185	0.656	170	-2.479	0.109	-1.808	0.072
Y - N	PV Stent	0.792	0.694	170	-0.579	2.163	1.141	0.256

Table 10: Resident 2 RADPAD Contrast on Box-Cox Scale

contrast	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	-0.568	0.279	170	-1.119	-0.016	-2.032	0.044


RADPAD by Procedure Type Pairwise Contrast Estimates
µSv (Box−Cox Scale)
0.5
0.0
−0.5
−1.0
P = 0.256
P = 0.008
P = 0.042
P = 0.072
BPV
PDA
PMI
PV Stent

Faculty

Observed Difference in Median Dose

Table 11: Median Dose (microSV) Statistics for Faculty

Procedure	Median NOPAD	Median RADPAD	Difference	Percent Change
BPV	1.28	0.54	-0.74	-57.81
PDA	0.58	0.11	-0.47	-81.03
PMI	3.62	0.54	-3.08	-85.08
PV Stent	4.64	2.30	-2.34	-50.32

GLS Model Analysis of Variance

Table 12: Faculty Analysis of Variance

	Df	Chisq	Pr(>Chisq)
(Intercept)	1	20.302	0.000
RADPAD	1	6.102	0.014
Procedure_Type	3	8.925	0.030
Weight	1	12.582	0.000
Time	1	22.694	0.000
RADPAD:Procedure_Type	3	0.544	0.909

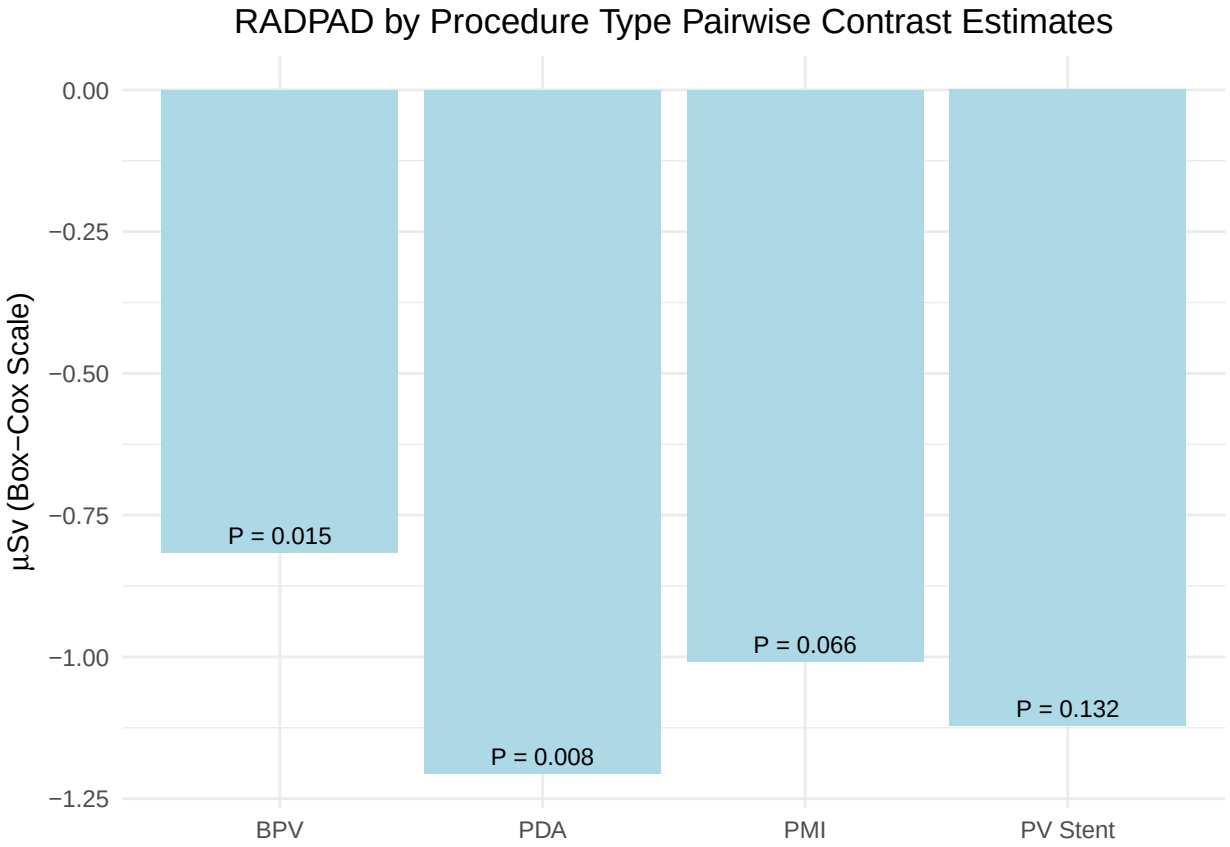
Contrasts

Table 13: Faculty RADPAD by Procedure Type Contrast on Box-Cox Scale

contrast	Procedure_Type	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	BPV	-0.816	0.330	116.811	-1.469	-0.162	-2.470	0.015
Y - N	PDA	-1.206	0.443	118.361	-2.084	-0.328	-2.719	0.008
Y - N	PMI	-1.009	0.543	112.769	-2.084	0.066	-1.859	0.066
Y - N	PV Stent	-1.122	0.742	182.164	-2.586	0.342	-1.512	0.132

Table 14: Faculty RADPAD Contrast on Box-Cox Scale

contrast	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	-1.038	0.268	148.013	-1.567	-0.509	-3.879	0


RADPAD by Procedure Type Pairwise Contrast Estimates
µSv (Box–Cox Scale)
0.00
−0.25
−0.50
−0.75
−1.00
−1.25
P = 0.015
P = 0.008
P = 0.066
P = 0.132
BPV
PDA
PMI
PV Stent

TEE

Observed Difference in Median Dose

Table 15: Median Dose (microSV) Statistics for TEE

Procedure	Median NOPAD	Median RADPAD	Difference	Percent Change
BPV	1.66	3.48	1.82	109.64
PDA	2.28	2.05	-0.23	-10.09
PMI	3.92	0.33	-3.59	-91.58
PV Stent	2.36	3.59	1.24	52.65

GLS Model Analysis of Variance

Table 16: TEE Analysis of Variance

	Df	Chisq	Pr(>Chisq)
(Intercept)	1	2.205	0.138
RADPAD	1	1.333	0.248
Procedure_Type	3	3.595	0.309
Weight	1	8.520	0.004
Time	1	0.544	0.461
RADPAD:Procedure_Type	3	4.322	0.229

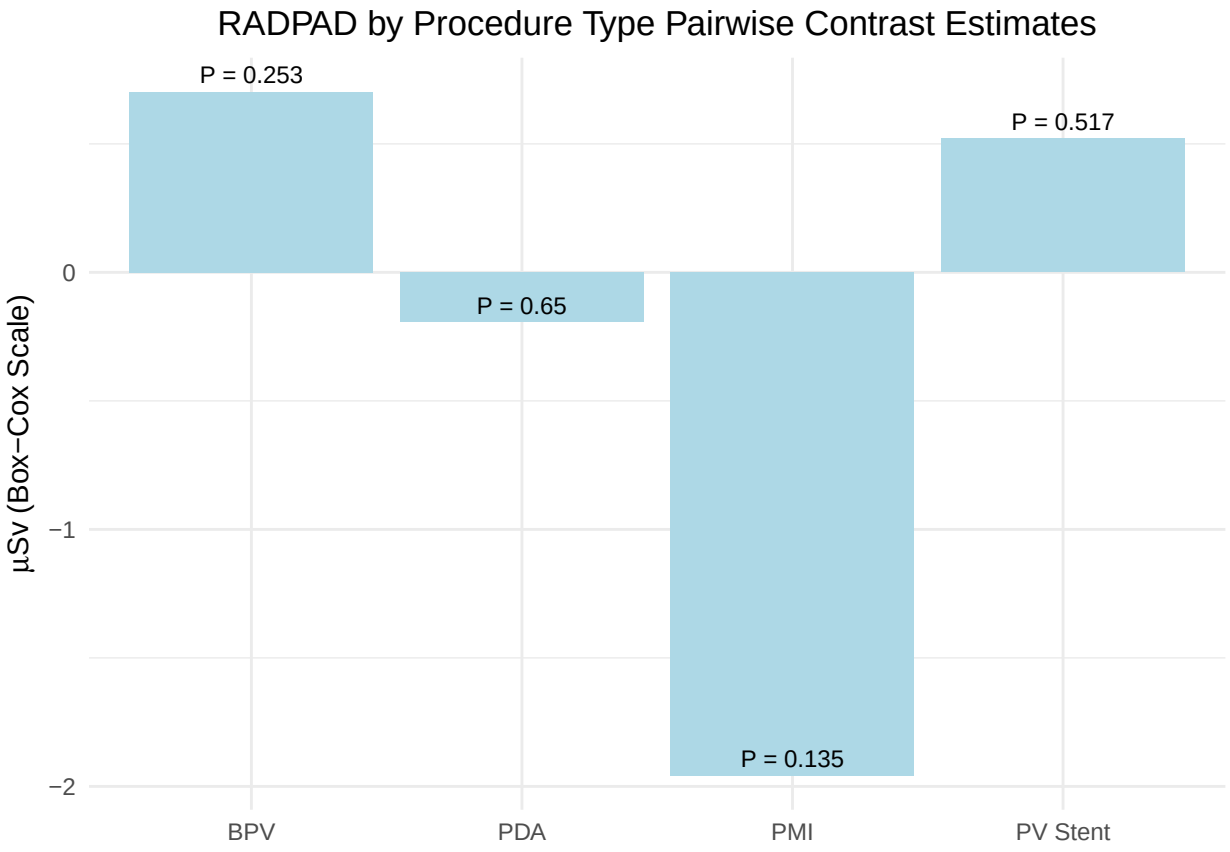
Contrasts

Table 17: TEE RADPAD by Procedure Type Contrast on Box-Cox Scale

contrast	Procedure_Type	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	BPV	0.702	0.608	55.221	-0.517	1.921	1.154	0.253
Y - N	PDA	-0.194	0.425	41.827	-1.051	0.663	-0.456	0.650
Y - N	PMI	-1.958	1.268	25.237	-4.569	0.653	-1.544	0.135
Y - N	PV Stent	0.521	0.798	53.043	-1.079	2.121	0.653	0.517

Table 18: TEE RADPAD Contrast on Box-Cox Scale

contrast	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	-0.232	0.414	33.628	-1.075	0.61	-0.56	0.579


RADPAD by Procedure Type Pairwise Contrast Estimates
P = 0.253
P = 0.517
P = 0.65
P = 0.135
0
−1
−2
µSv (Box−Cox Scale)
BPV
PDA
PMI
PV Stent

Anesthesia

Observed Difference in Median Dose

Table 19: Median Dose (microSV) Statistics for Anesthesia

Procedure	Median NOPAD	Median RADPAD	Difference	Percent Change
BPV	4.69	0.05	-4.64	-98.93
PDA	1.77	0.06	-1.70	-96.32
PMI	2.36	0.10	-2.26	-95.75
PV Stent	23.27	0.21	-23.07	-99.12

Gamma GLM Analysis of Variance

Table 20: Anesthesia Analysis of Variance

	LR Chisq	Df	Pr(>Chisq)
RADPAD	84.036	1	0.000
Procedure_Type	9.789	3	0.020
Weight	8.235	1	0.004
Time	9.178	1	0.002
RADPAD:Procedure_Type	6.717	3	0.081

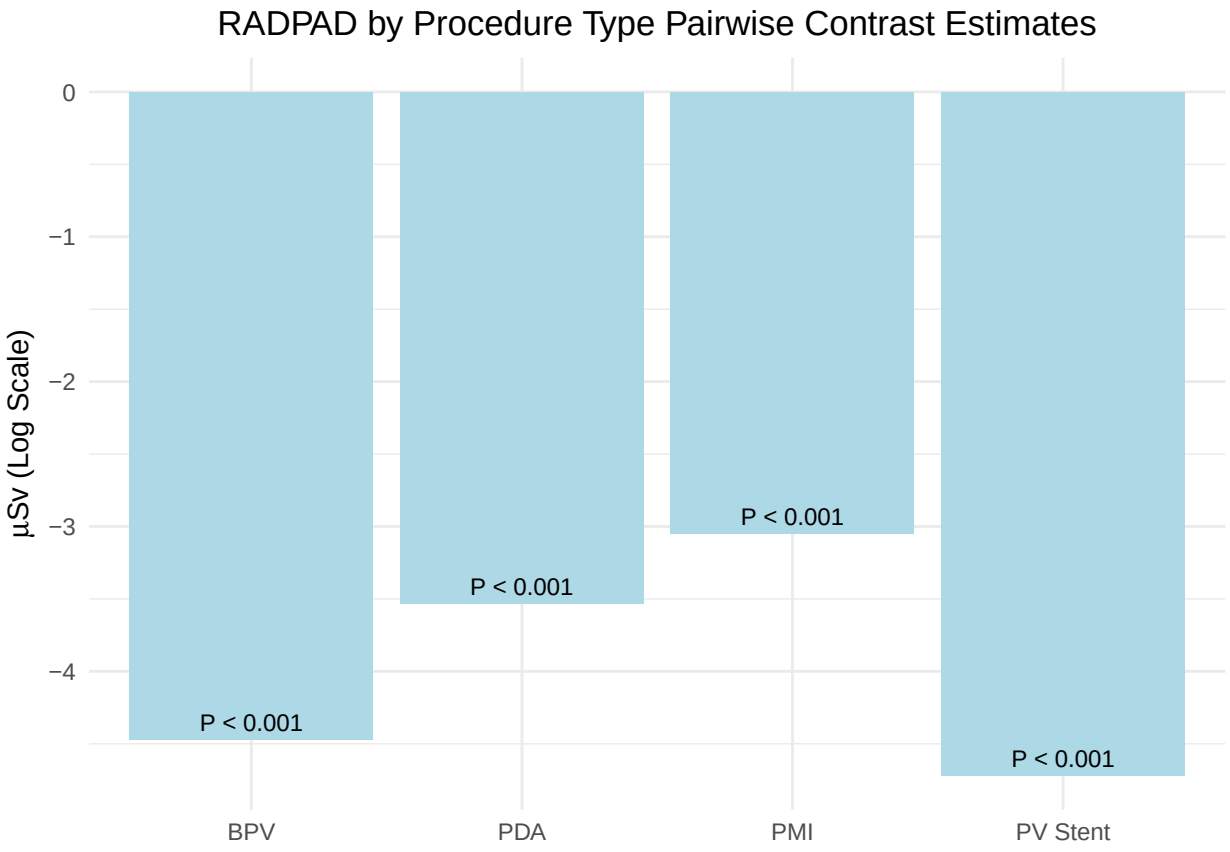
Contrasts

Table 21: Anesthesia RADPAD by Procedure Type Contrast on Log Scale

contrast	Procedure_Type	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	BPV	-4.472	0.325	186	-5.114	-3.829	-13.739	0
Y - N	PDA	-3.533	0.432	186	-4.386	-2.681	-8.177	0
Y - N	PMI	-3.048	0.678	186	-4.386	-1.711	-4.497	0
Y - N	PV Stent	-4.719	0.671	186	-6.044	-3.395	-7.030	0

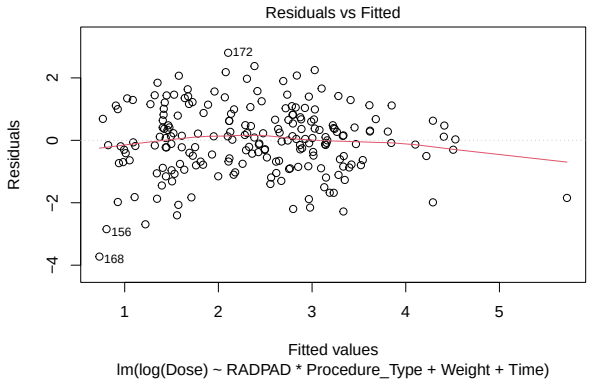
Table 22: Anesthesia RADPAD Contrast on Log Scale

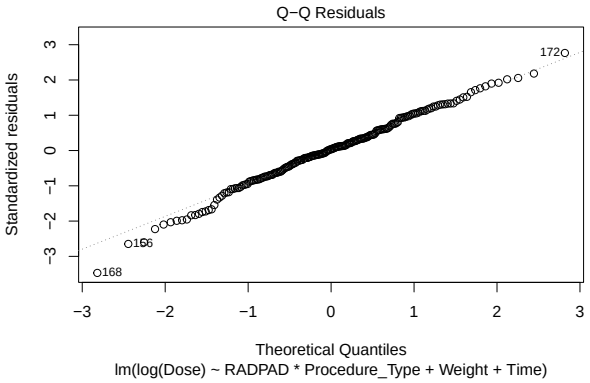
contrast	estimate	SE	df	lower.CL	upper.CL	t.ratio	p.value
Y - N	-3.943	0.274	186	-4.483	-3.403	-14.402	0


RADPAD by Procedure Type Pairwise Contrast Estimates
µSv (Log Scale)
0
−1
−2
−3
−4
P < 0.001
P < 0.001
P < 0.001
P < 0.001
BPV
PDA
PMI
PV Stent

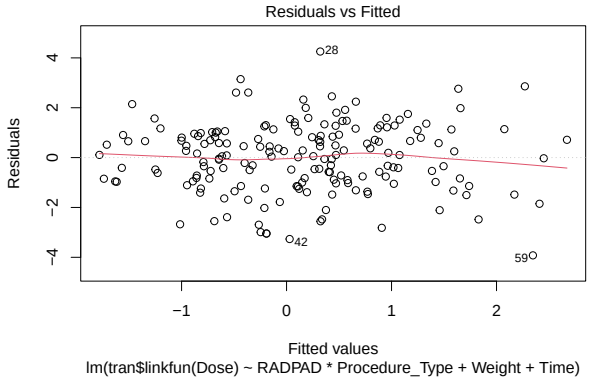
Resiudal Analysis

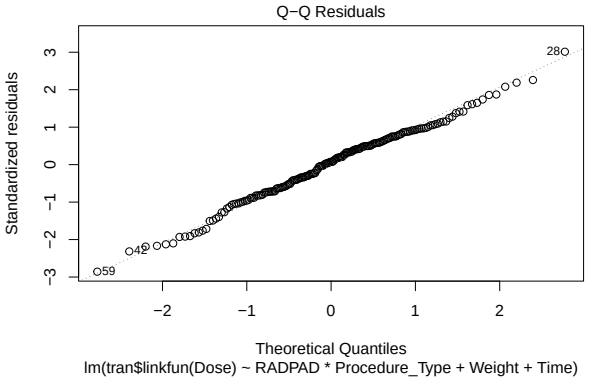
Resident 1



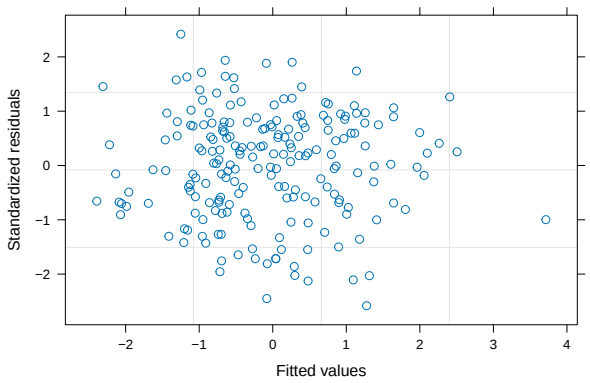


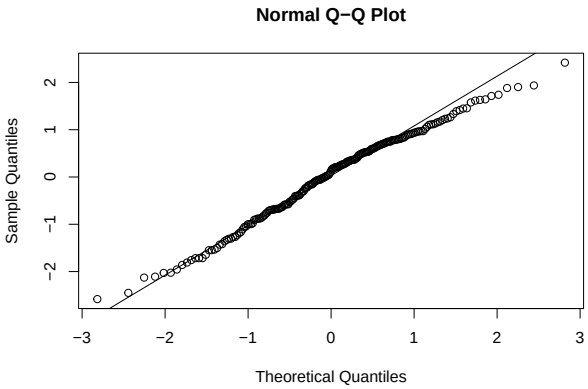
Resident 2



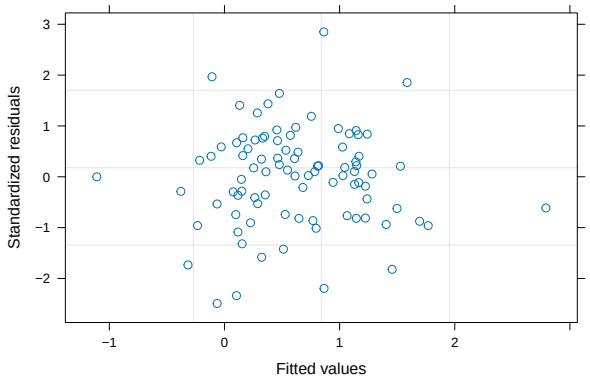


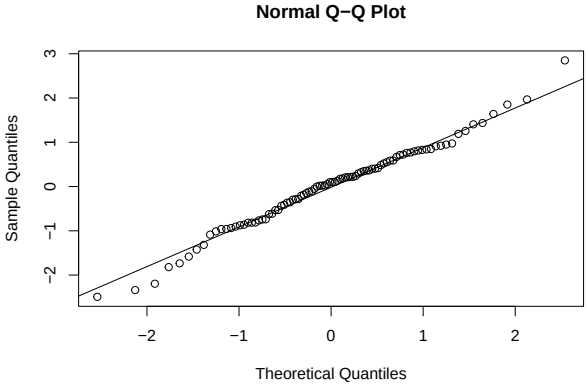
Faculty

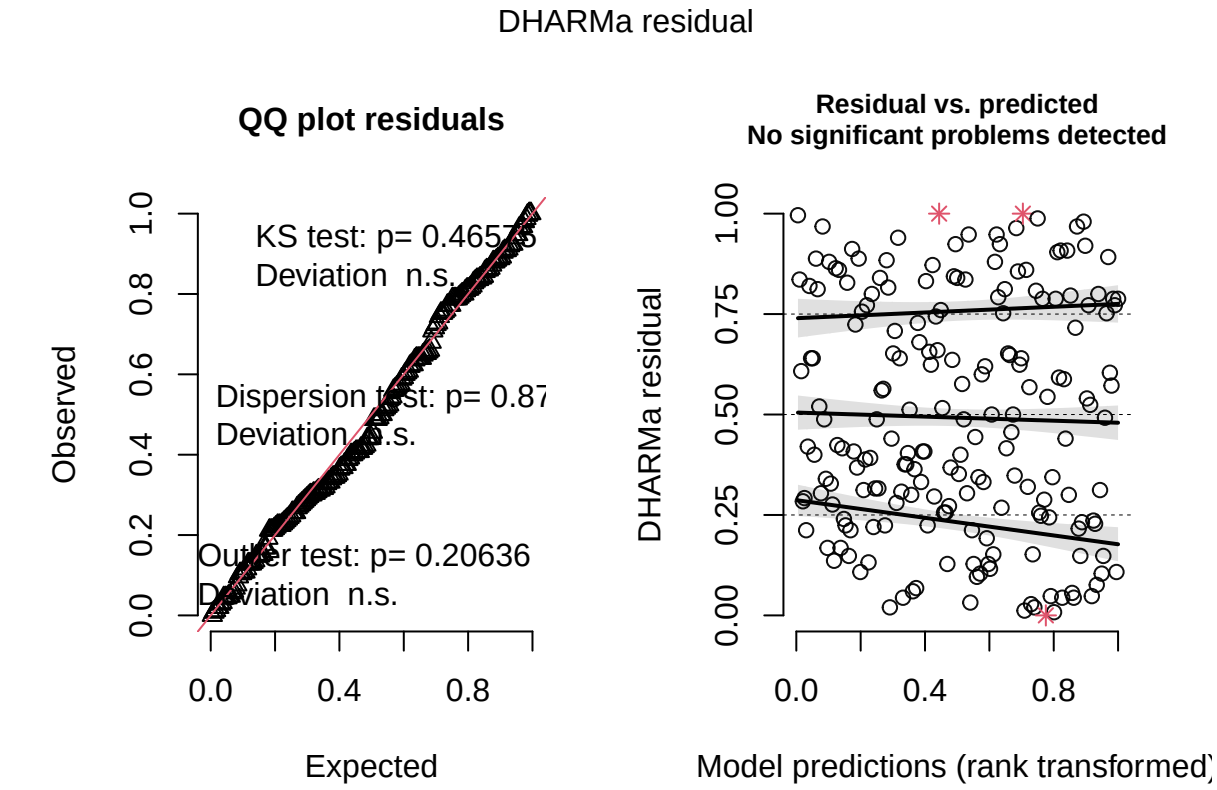

Standardized residuals
Fitted values

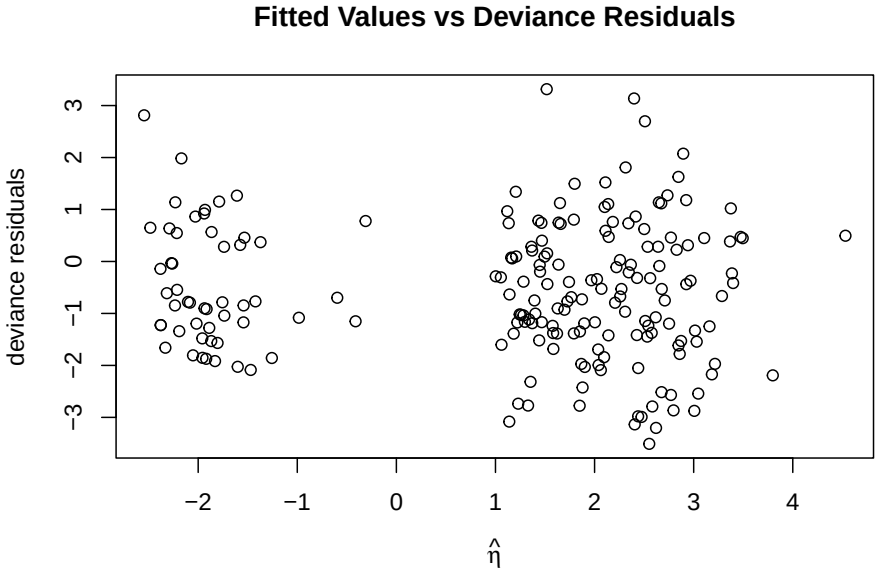

Normal Q−Q Plot
Sample Quantiles
Theoretical Quantiles

TEE


Standardized residuals
Fitted values


Normal Q−Q Plot
Sample Quantiles
Theoretical Quantiles


DHARMa residual
QQ plot residuals
KS test: p= 0.46575
Deviation n.s.
Dispersion test: p= 0.87
Deviation n.s.
Outlier test: p= 0.20636
Deviation n.s.
Observed
Expected
Residual vs. predicted
No significant problems detected
DHARMa residual
Model predictions (rank transformed)


Fitted Values vs Deviance Residuals
deviance residuals
η̂

Numeric Summaries

Dose (microSV)

Lab_Personnel	Procedure_Type	RADPAD	Count	Mean	Median	SD	Min	Max
Anesthesia	BPV	N	72	13.387	4.685	18.280	0.01	84.94
Anesthesia	BPV	Y	24	0.161	0.050	0.306	0.01	1.46
Anesthesia	PDA	N	38	5.997	1.765	14.327	0.01	88.04
Anesthesia	PDA	Y	14	0.139	0.065	0.161	0.01	0.51
Anesthesia	PMI	N	26	4.815	2.355	7.912	0.03	39.45
Anesthesia	PMI	Y	5	0.168	0.100	0.181	0.01	0.44
Anesthesia	PV Stent	N	9	40.408	23.270	46.803	1.39	146.79
Anesthesia	PV Stent	Y	8	0.226	0.205	0.170	0.05	0.57
Faculty	BPV	N	73	3.544	1.280	5.709	0.01	32.81
Faculty	BPV	Y	25	0.999	0.540	1.175	0.02	4.23
Faculty	PDA	N	40	1.857	0.580	3.300	0.01	13.54
Faculty	PDA	Y	14	0.588	0.110	1.424	0.02	5.45
Faculty	PMI	N	28	5.780	3.620	8.515	0.02	44.42
Faculty	PMI	Y	9	1.771	0.540	2.690	0.04	8.60
Faculty	PV Stent	N	9	6.920	4.640	6.291	0.71	20.12
Faculty	PV Stent	Y	8	3.411	2.305	3.765	0.38	11.70
Resident 1	BPV	N	73	30.965	15.440	36.953	2.28	196.00
Resident 1	BPV	Y	25	9.330	6.120	9.876	0.05	38.35
Resident 1	PDA	N	40	11.430	5.765	16.513	0.59	72.00
Resident 1	PDA	Y	14	5.540	2.830	7.739	1.23	31.38
Resident 1	PMI	N	29	25.794	18.330	20.463	1.82	98.66
Resident 1	PMI	Y	9	21.856	8.750	37.307	0.23	116.92
Resident 1	PV Stent	N	9	87.398	92.000	35.524	41.17	136.67
Resident 1	PV Stent	Y	8	30.610	14.810	45.049	0.89	135.56
Resident 2	BPV	N	71	4.131	1.840	6.333	0.02	43.29
Resident 2	BPV	Y	24	2.260	0.525	4.318	0.01	18.45
Resident 2	PDA	N	36	1.473	0.880	2.126	0.08	9.11
Resident 2	PDA	Y	12	0.489	0.345	0.466	0.05	1.36
Resident 2	PMI	N	12	2.221	1.630	1.672	0.52	6.40
Resident 2	PMI	Y	8	0.584	0.310	0.654	0.05	1.92
Resident 2	PV Stent	N	9	4.776	3.480	4.865	0.12	16.25
Resident 2	PV Stent	Y	8	15.078	3.855	23.021	0.51	62.83
TEE	BPV	N	13	4.218	1.660	5.919	0.02	18.74
TEE	BPV	Y	7	2.839	3.480	1.696	0.33	4.50
TEE	PDA	N	36	3.195	2.280	3.325	0.03	12.77
TEE	PDA	Y	12	2.814	2.050	2.870	0.26	8.98
TEE	PMI	N	9	25.231	3.920	63.015	0.08	193.00
TEE	PMI	Y	1	0.330	0.330	NA	0.33	0.33
TEE	PV Stent	N	8	4.803	2.355	6.728	0.54	20.28
TEE	PV Stent	Y	4	11.992	3.595	18.926	0.54	40.24
Tech 1	BPV	N	72	0.136	0.040	0.278	0.00	1.40
Tech 1	BPV	Y	25	0.028	0.000	0.061	0.00	0.26
Tech 1	PDA	N	38	0.093	0.025	0.145	0.00	0.56
Tech 1	PDA	Y	14	0.061	0.025	0.073	0.00	0.20

Tech 1	PMI	N	24	0.302	0.025	0.919	0.00	4.50
Tech 1	PMI	Y	9	0.119	0.000	0.282	0.00	0.85
Tech 1	PV Stent	N	8	0.360	0.060	0.680	0.01	2.00
Tech 1	PV Stent	Y	8	0.162	0.040	0.202	0.00	0.49

Fluoroscopic Time (minutes)

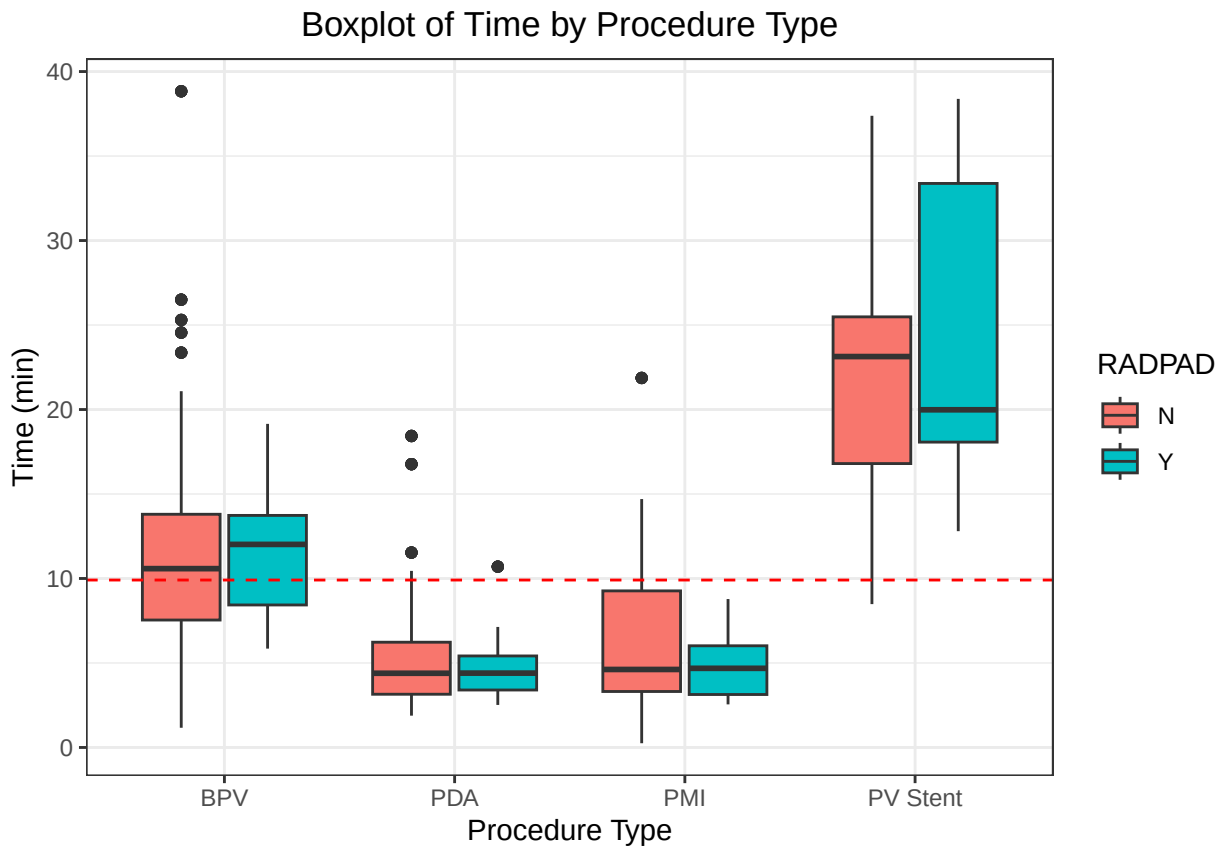
Procedure_Type	RADPAD	Mean	Median	SD	Min	Max
BPV	N	11.702	10.583	6.200	1.167	38.833
BPV	Y	11.635	12.017	3.737	5.850	19.150
PDA	N	5.312	4.392	3.621	1.883	18.433
PDA	Y	4.676	4.400	1.991	2.517	10.700
PMI	N	6.249	4.617	4.723	0.250	21.867
PMI	Y	4.648	4.683	1.701	2.550	8.783
PV Stent	N	21.871	23.133	7.739	8.483	37.383
PV Stent	Y	24.322	19.983	9.617	12.800	38.383

Weight (kilograms)

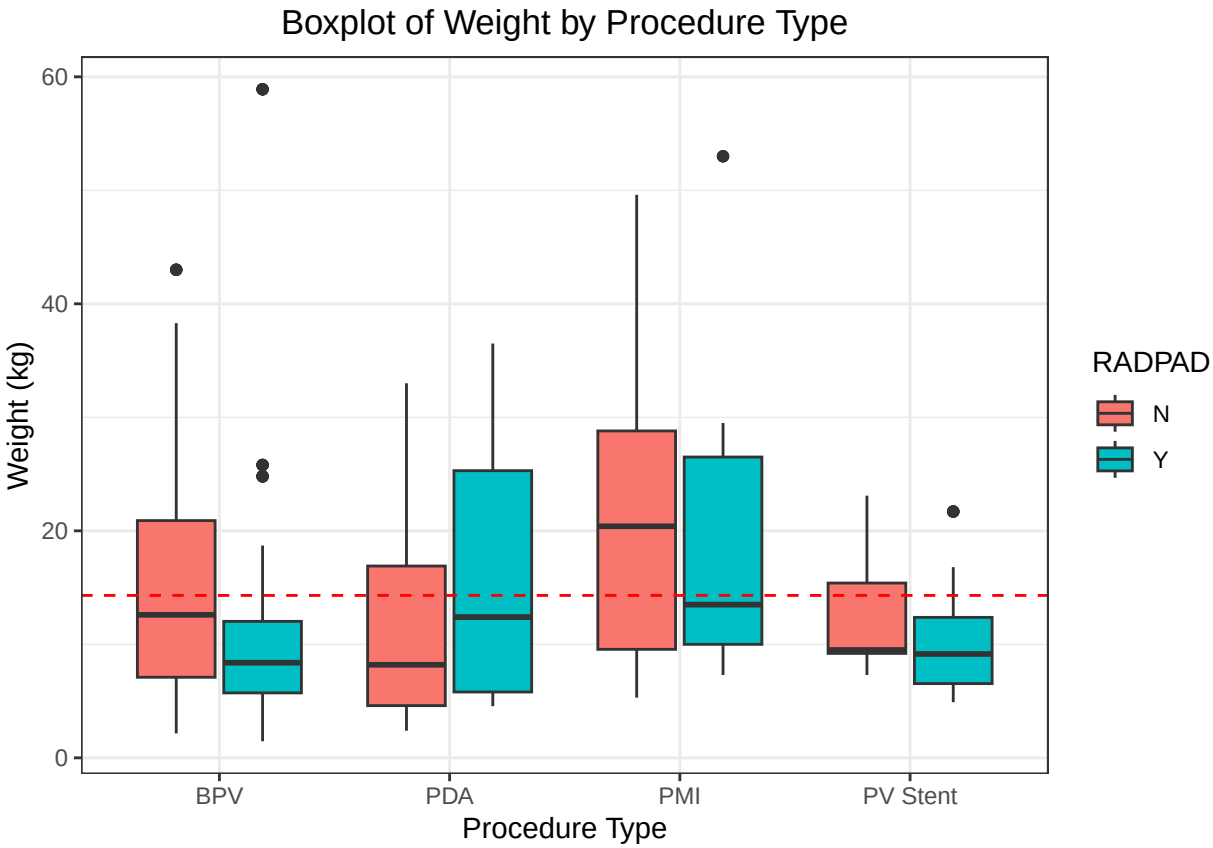
Procedure_Type	RADPAD	Mean	Median	SD	Min	Max
BPV	N	14.224	12.60	9.042	2.15	43.0
BPV	Y	11.790	8.38	11.339	1.46	58.9
PDA	N	11.642	8.20	8.369	2.39	33.0
PDA	Y	15.397	12.40	11.268	4.55	36.5
PMI	N	21.661	20.40	11.978	5.30	49.6
PMI	Y	17.904	13.50	12.585	7.30	53.0
PV Stent	N	13.262	9.50	5.995	7.30	23.1
PV Stent	Y	10.824	9.15	5.488	4.90	21.7

Graphical Summaries

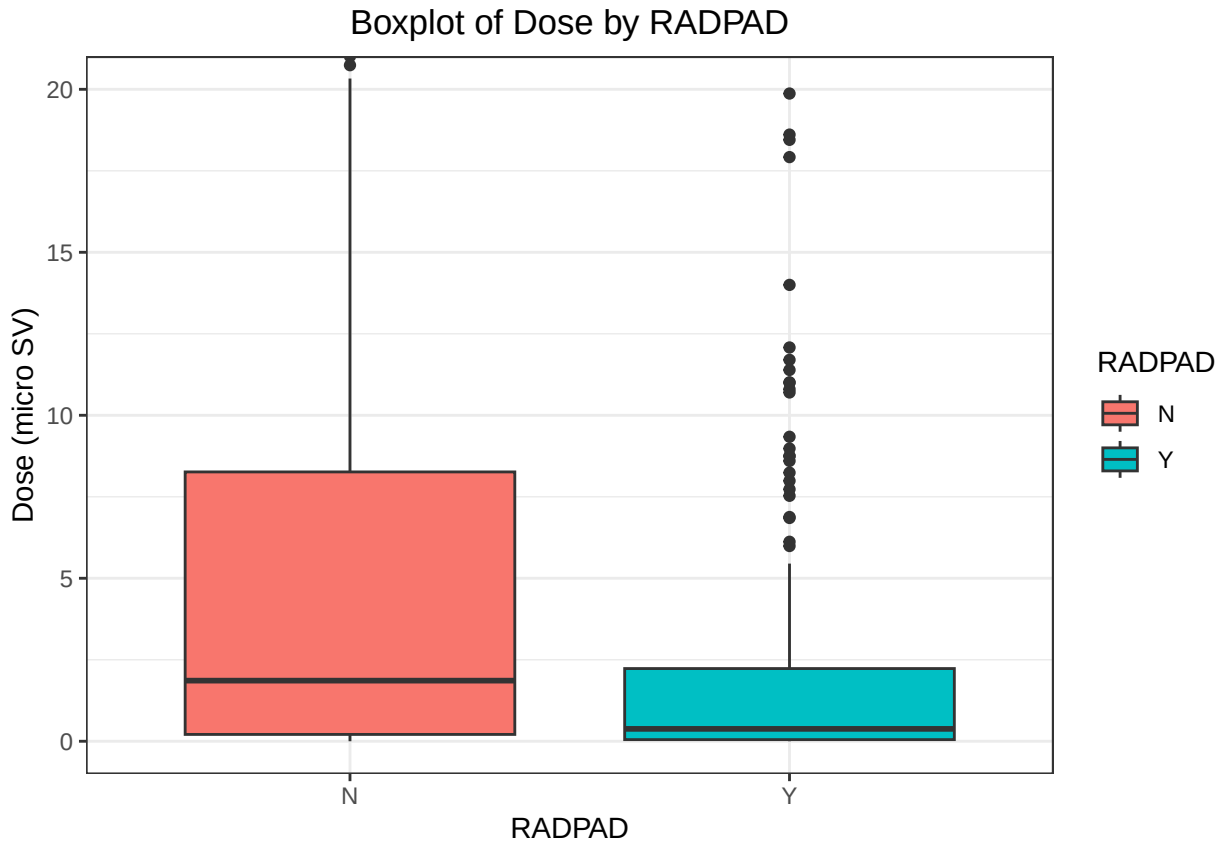
Fluoroscopic Time (minutes)



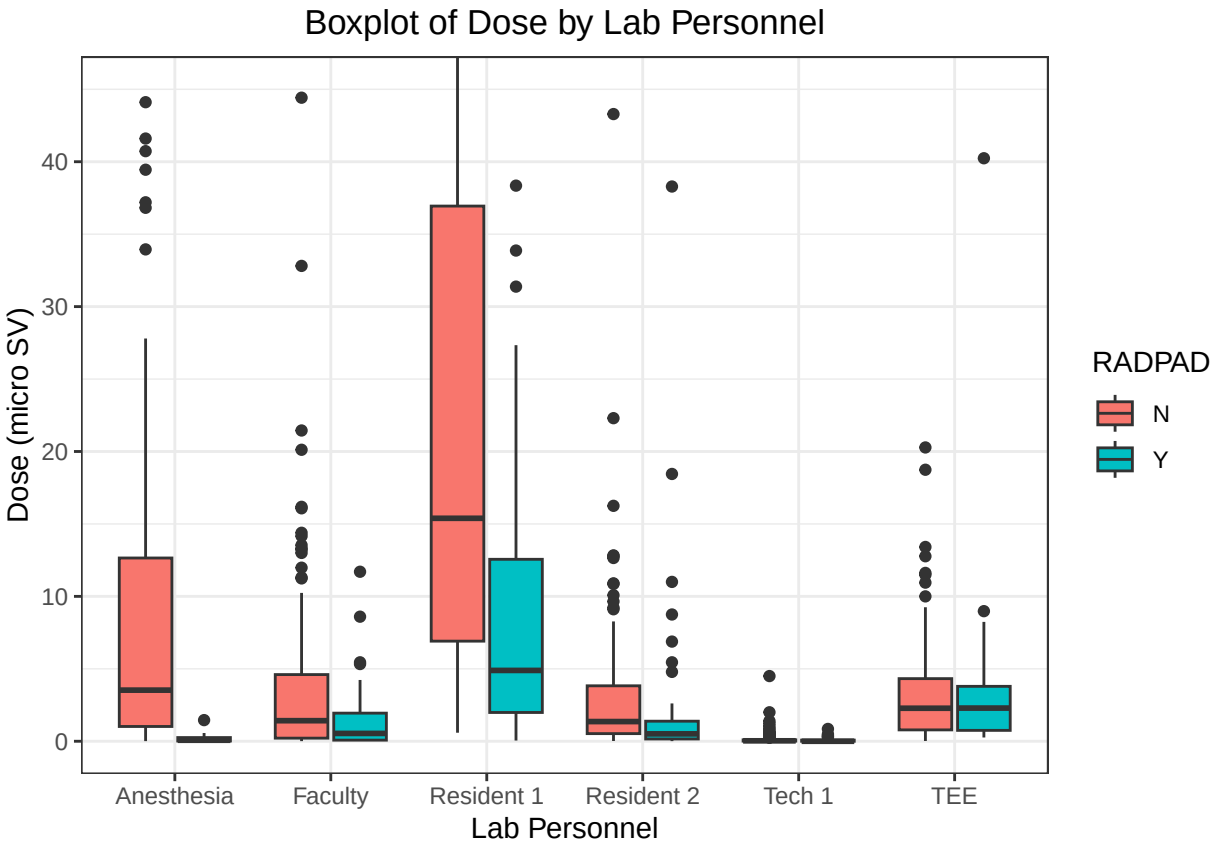
Weight (kilograms)



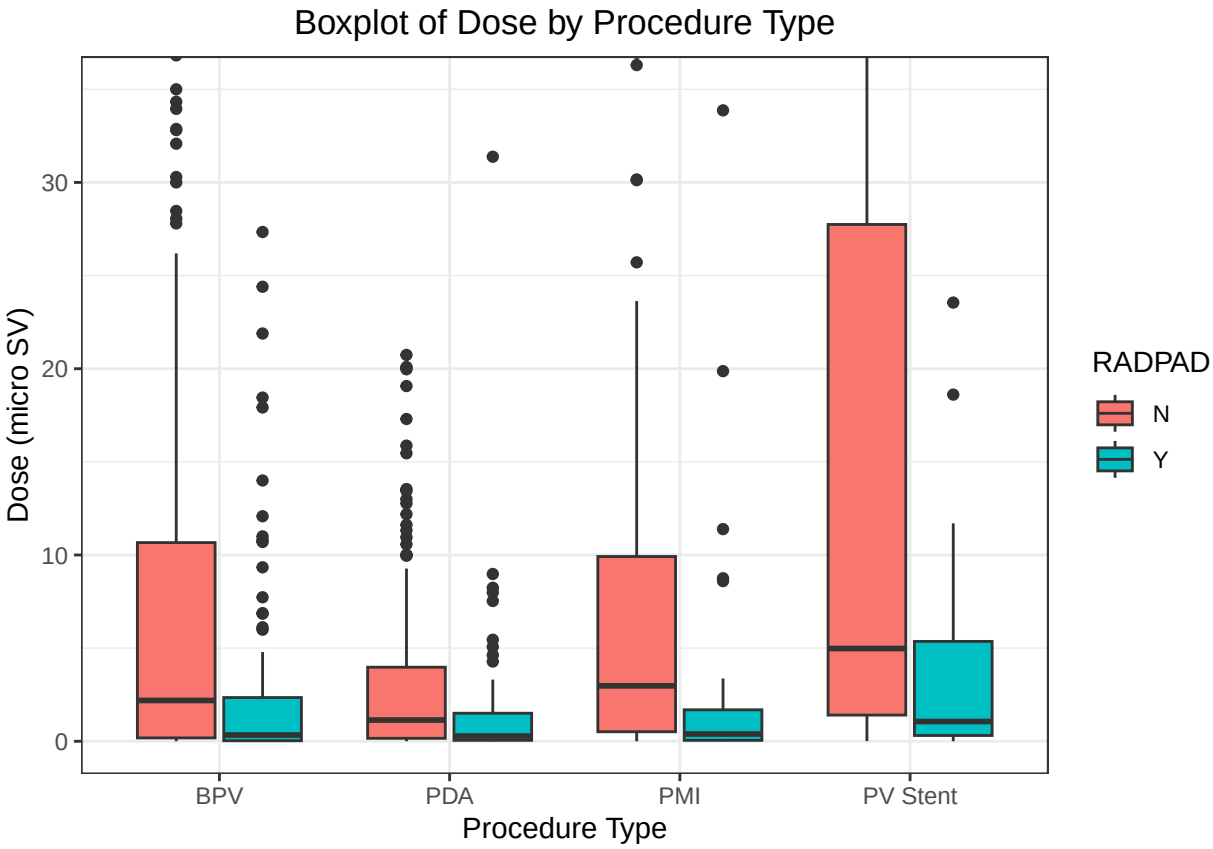
Dose (micro SV) by RADPAD



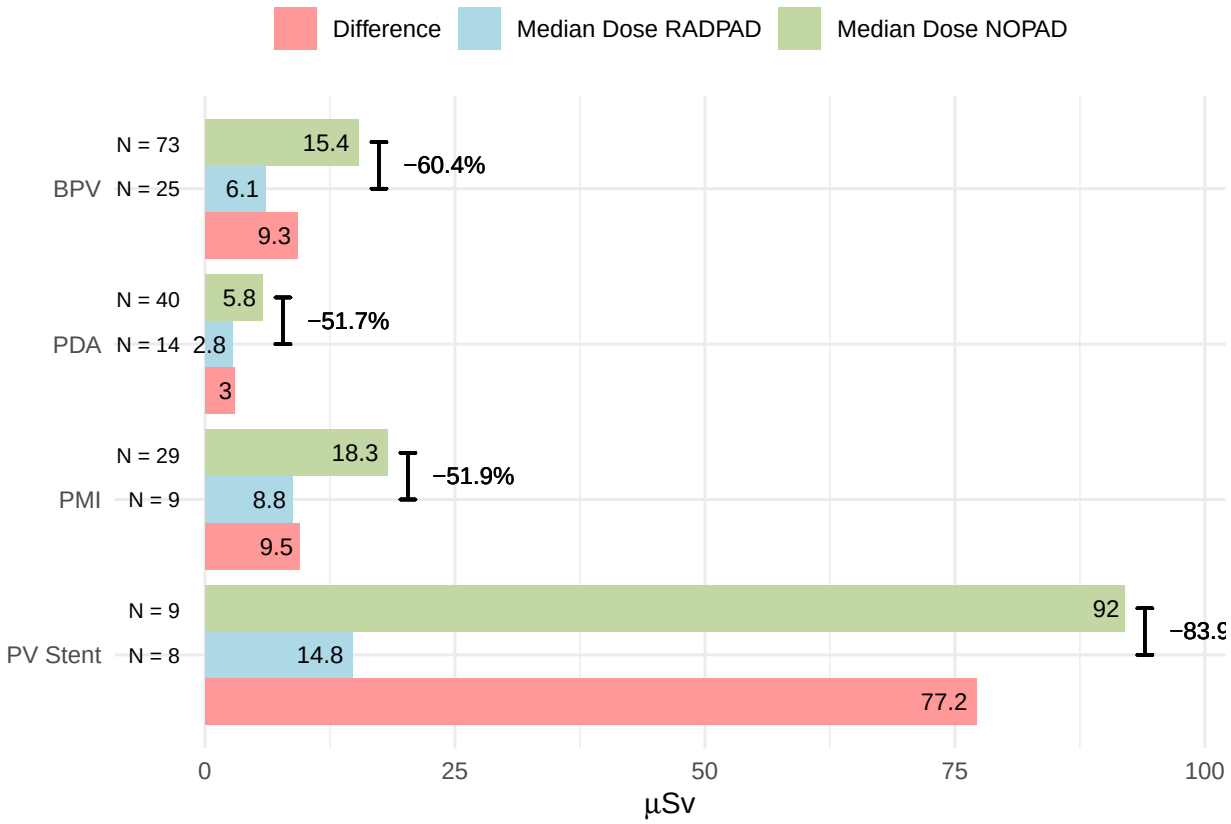
Dose (micro SV) by Personnel



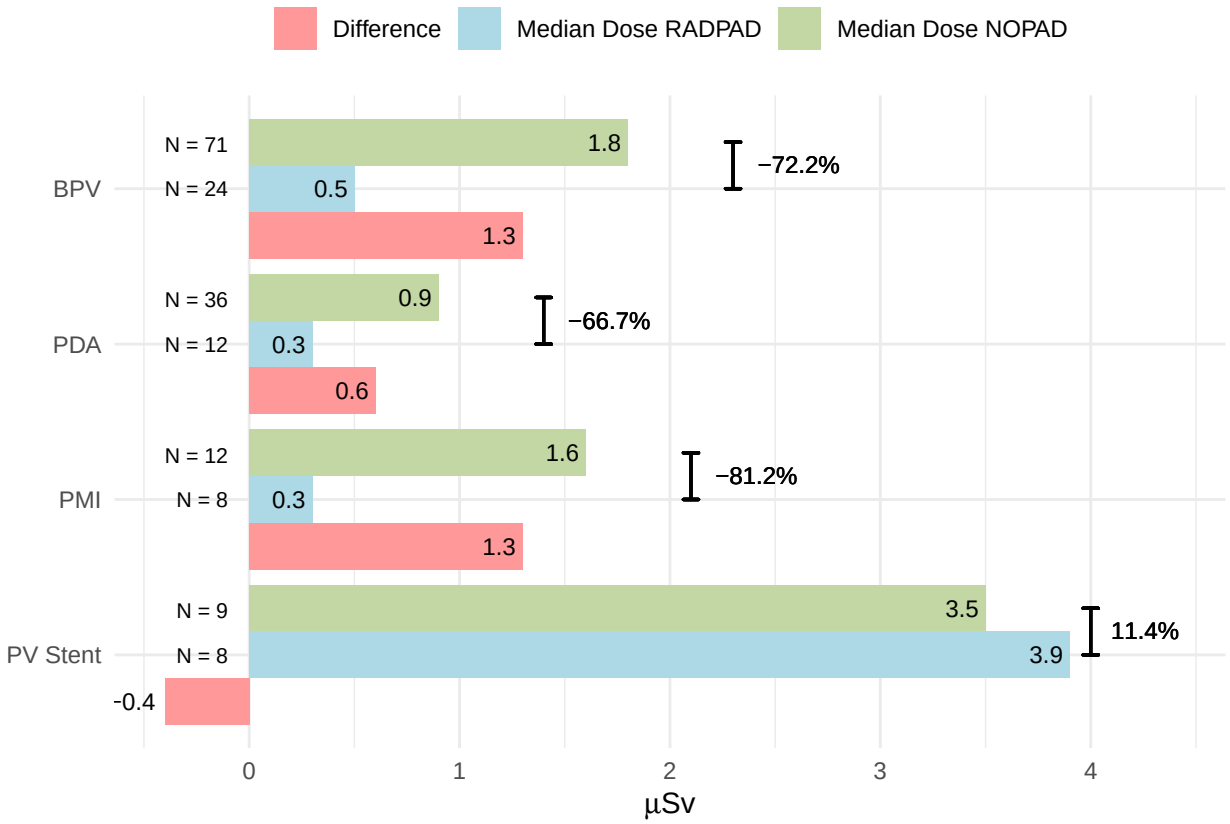
Dose (micro SV) by Procedure Type



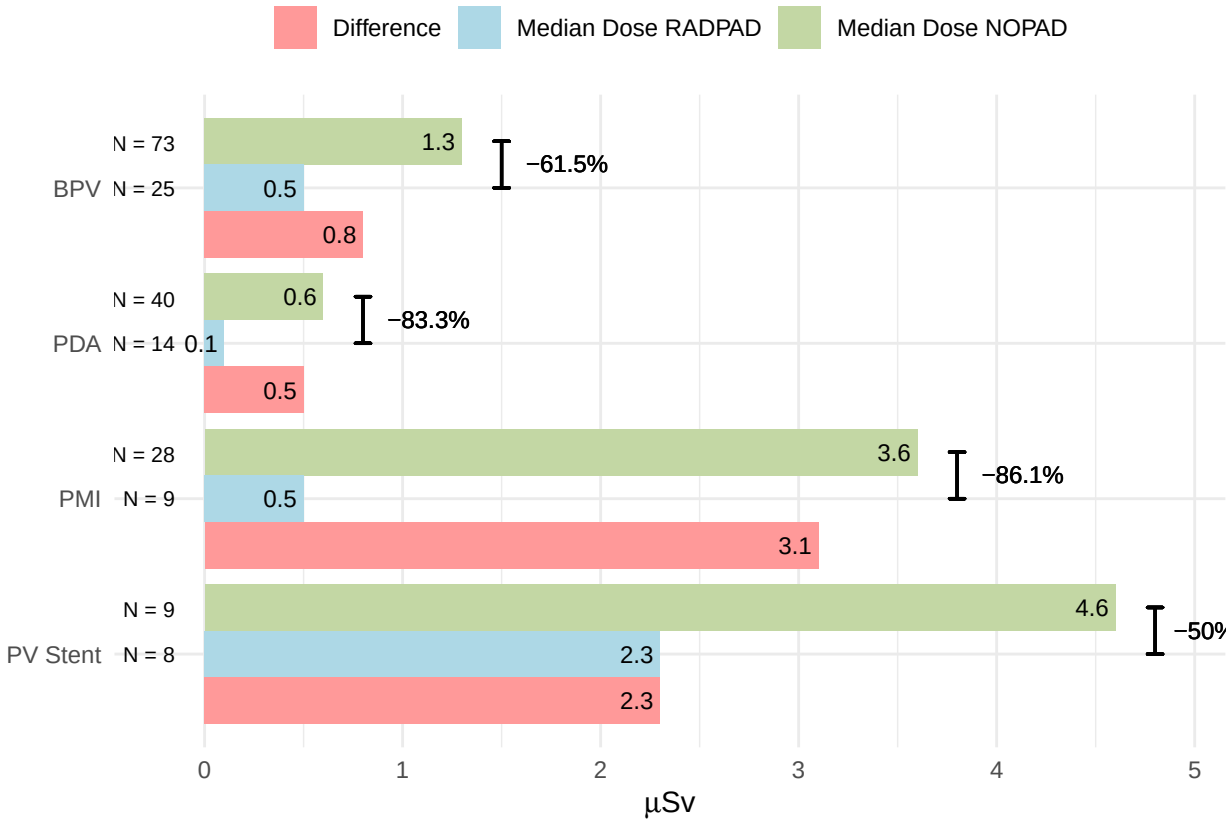
Resident 1 Median Plot



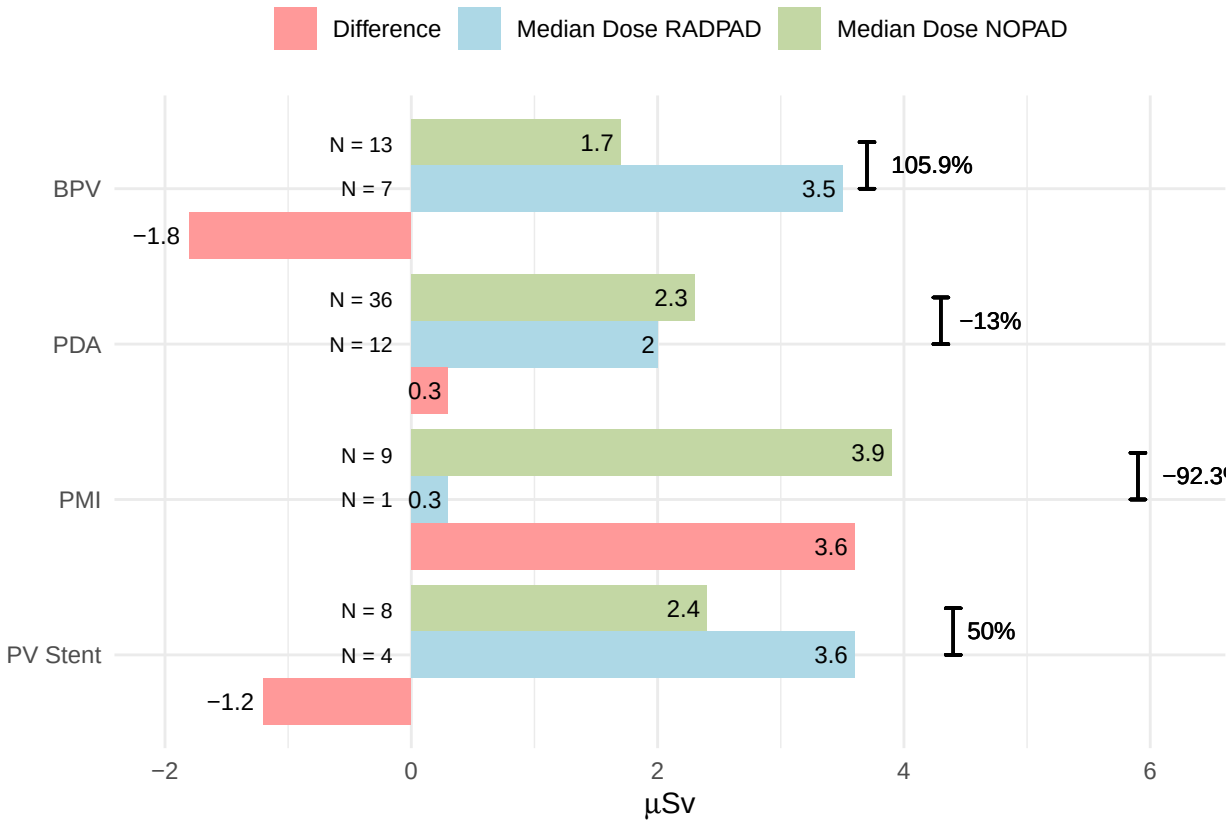
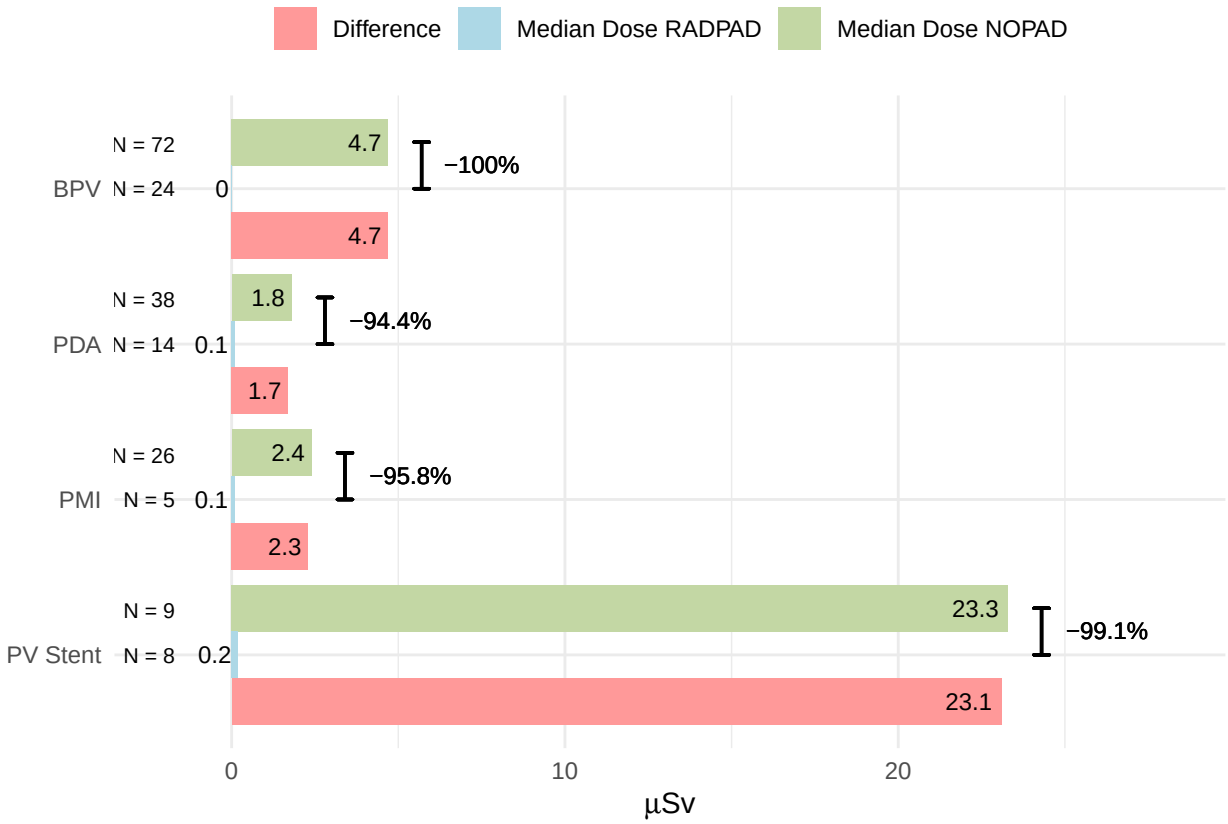
Resident 2 Median Plot



Faculty Median Plot



TEE Median Plot



Anesthesia Median Plot