

Supplementary Material

Temporal statistical relationship between regional cerebral oxygen saturation (rSO₂) and brain tissue oxygen tension (PbtO₂) in moderate to severe traumatic brain injury: A Canadian High Resolution-TBI (CAHR-TBI) Cohort Study

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1 Supplementary File S1: Evaluation of Stationarity of PbtO₂ Signals

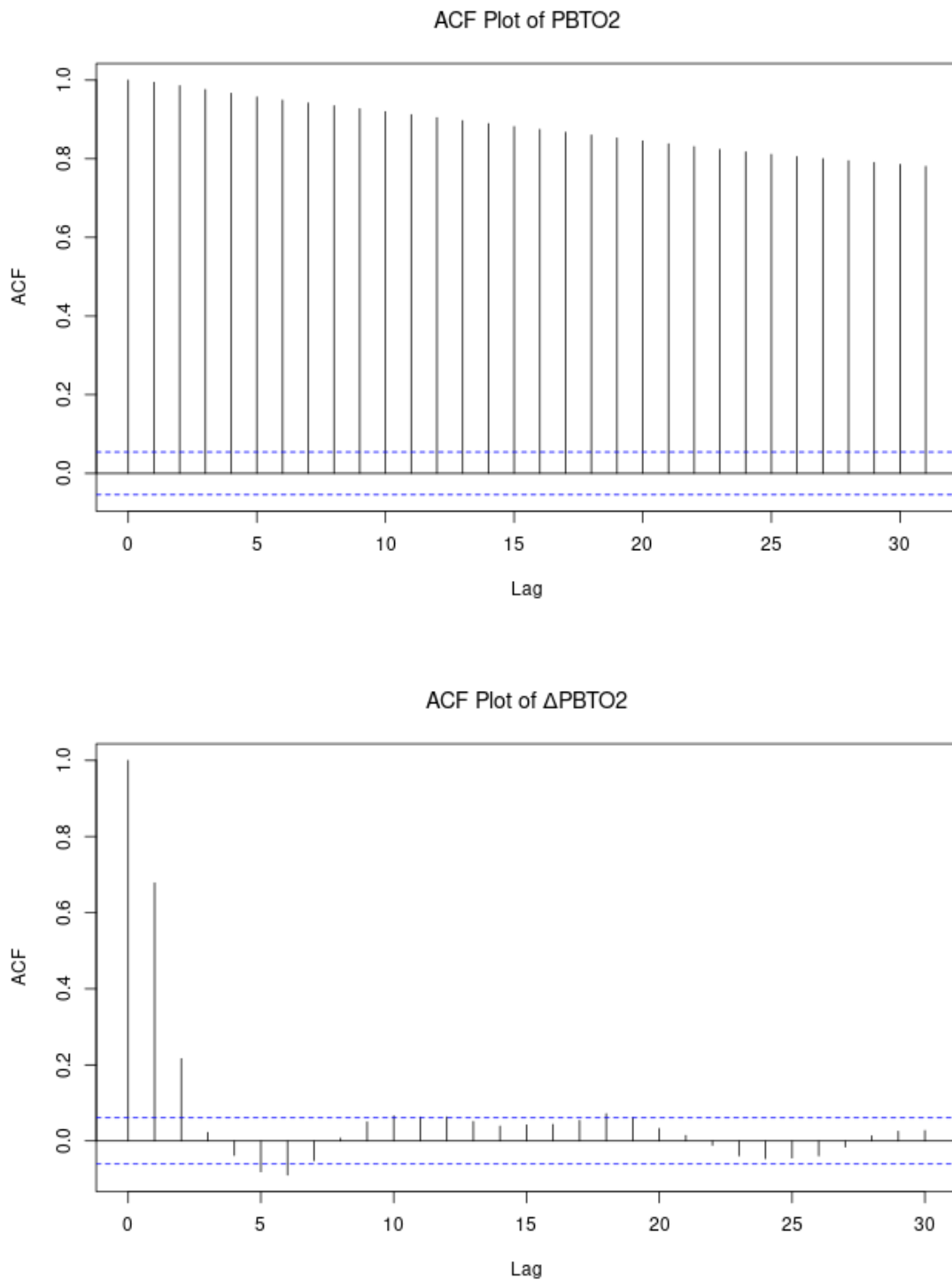
Supplementary File S1 Table 1: KPSS and ADF test results for each subject

Subject ID	PbtO ₂		Δ PbtO ₂	
	KPSS	ADF	KPSS	ADF
1				
2	<0.01	0.46	0.08	<0.01
3	<0.01	<0.01	>0.1	<0.01
4	<0.01	0.19	>0.1	<0.01
5	<0.01	<0.01	>0.1	<0.01
6	<0.01	<0.01	>0.1	<0.01
7	<0.01	<0.01	>0.1	<0.01
8	<0.01	0.02	>0.1	<0.01
9	<0.01	<0.01	>0.1	<0.01
10	<0.01	<0.01	>0.1	<0.01
11	<0.01	<0.01	>0.1	<0.01
12	<0.01	0.01	>0.1	<0.01
13	<0.01	<0.01	>0.1	<0.01
14	<0.01	<0.01	>0.1	<0.01
15	<0.01	<0.01	>0.1	<0.01
16	<0.01	<0.01	>0.1	<0.01
17	<0.01	<0.01	>0.1	<0.01
18	<0.01	<0.01	>0.1	<0.01
19	<0.01	0.07	>0.1	<0.01
20	<0.01	<0.01	>0.1	<0.01

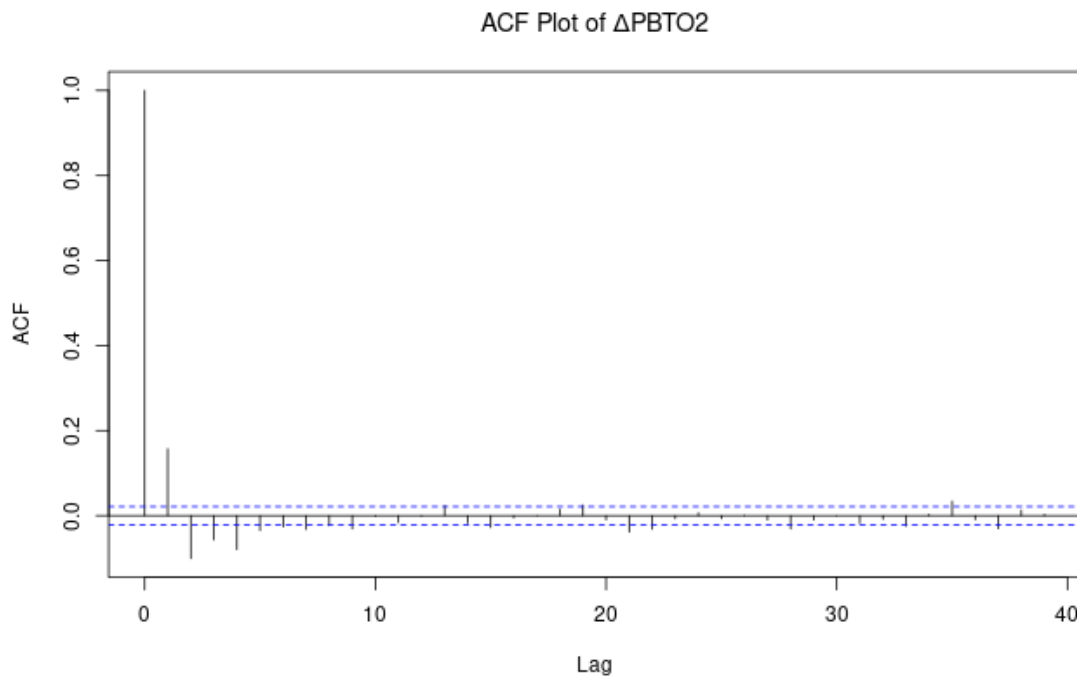
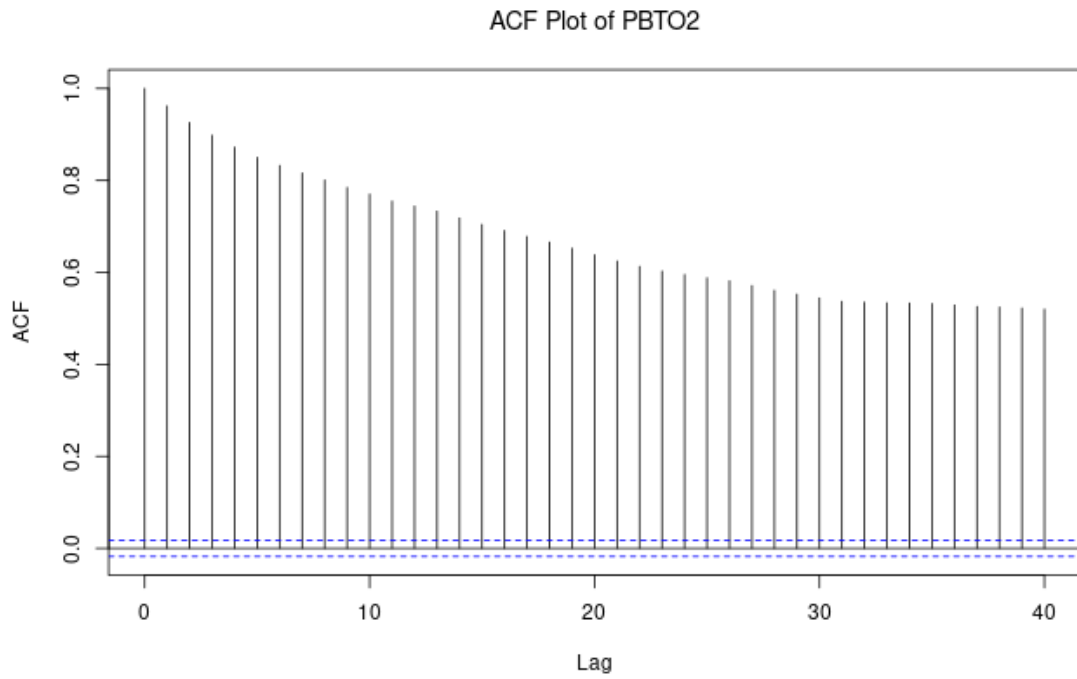
ADF = Augmented Dickie Fuller test, KPSS = Kwiatkowski-Phillips-Schmidt-Shin test, Δ PbtO₂ = change in brain tissue oxygen tension, PbtO₂ = Brain tissue oxygen tension.

Supplementary File S1 Figures 1-20:

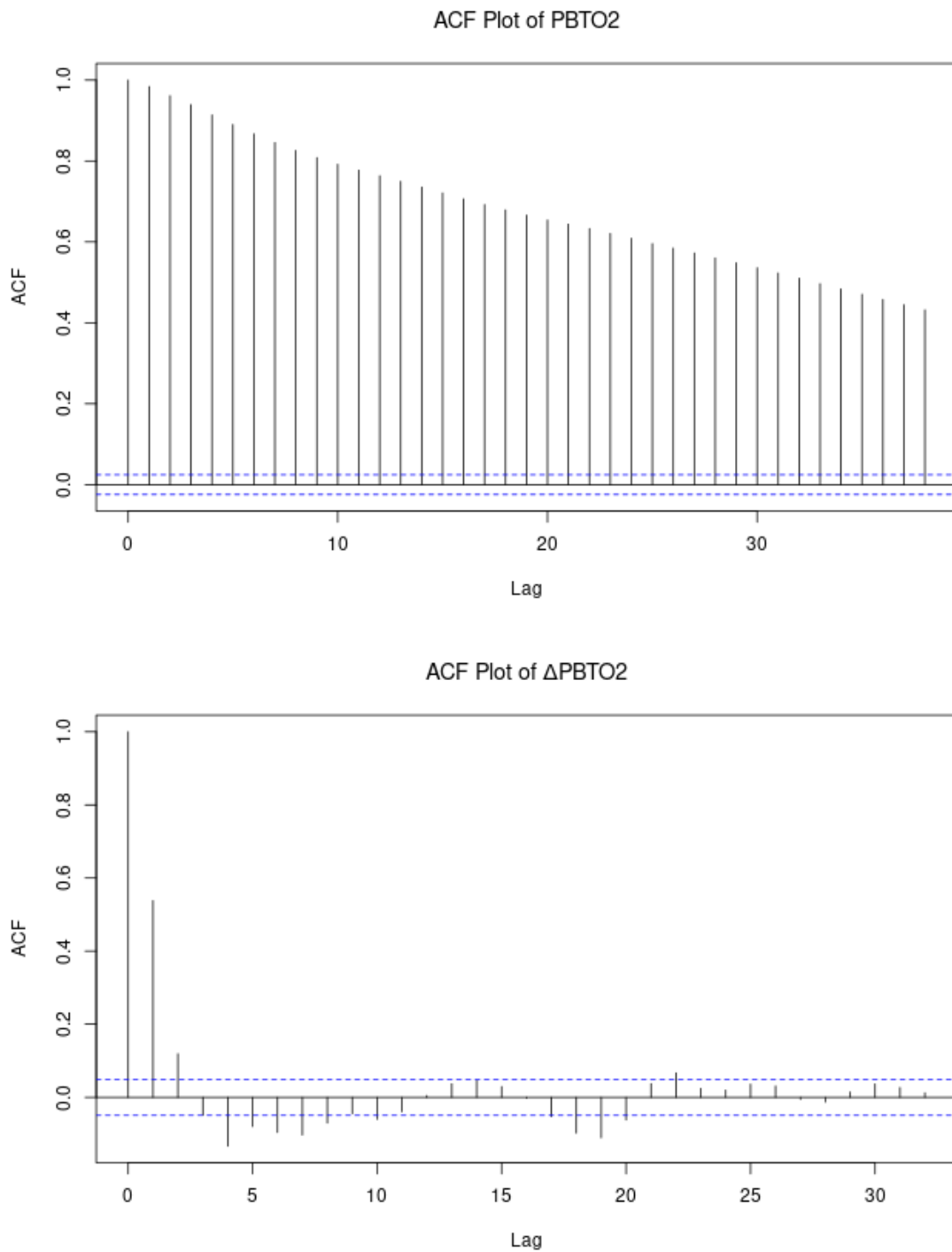
Plot Legend: *For the following plots the dashed blue line represents the significance levels which were set to a correlation level of $\pm(2/N^{1/2})$, where N is the number of samples. ACF = Autocorrelative function, $\Delta PbtO_2$ = change in brain tissue oxygen tension, $PbtO_2$ = Brain tissue oxygen tension*

Subject 1**Supplementary File S1 Figure 1: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 1.**

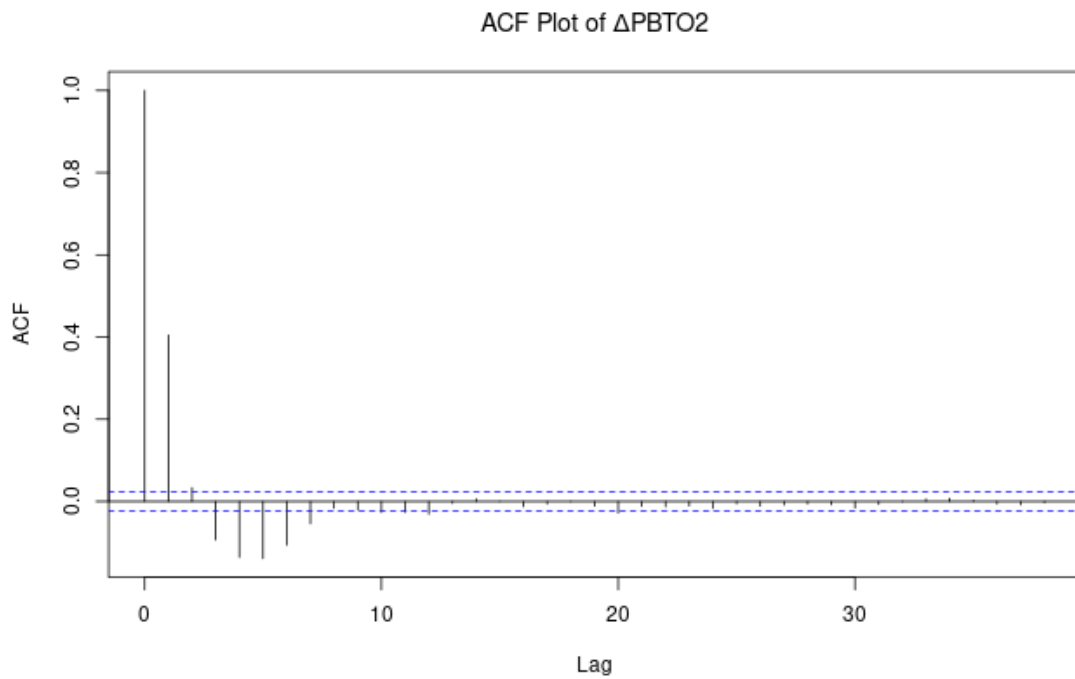
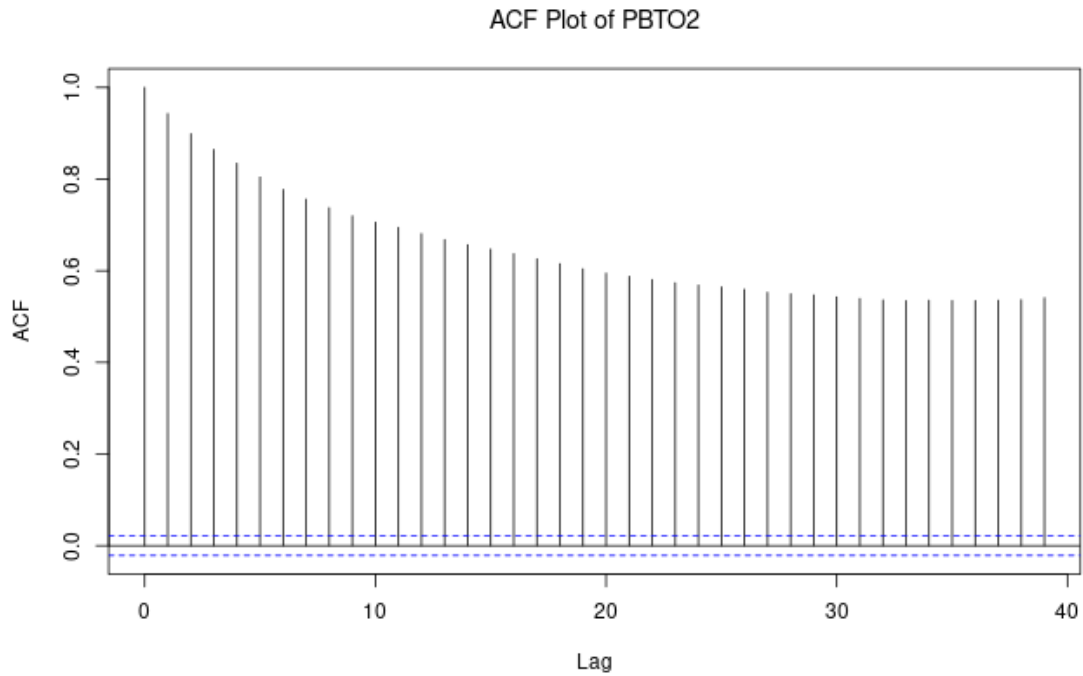
Subject 2



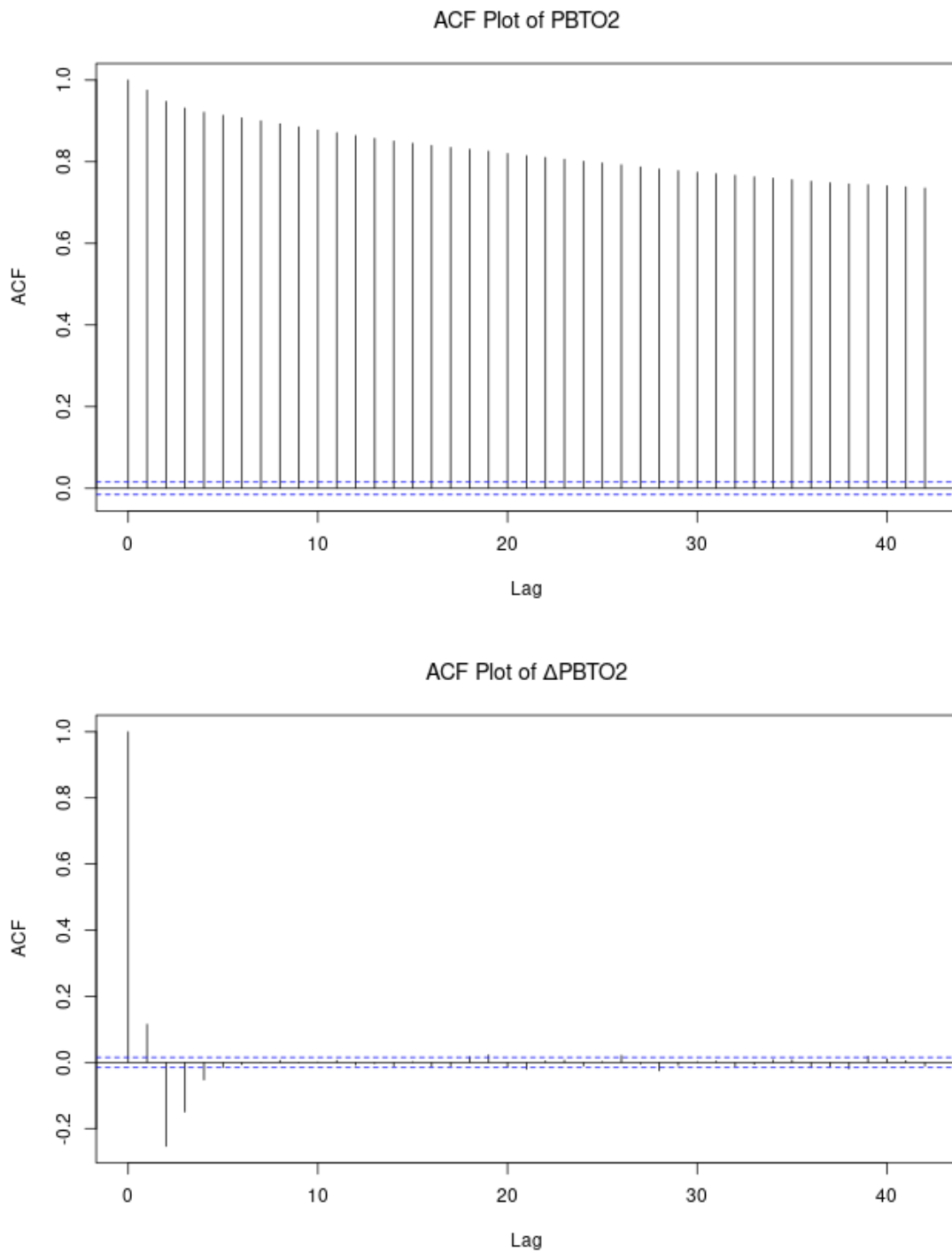
Supplementary File S1 Figure 2: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 2

Subject 3**Supplementary File S1 Figure 3: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 3**

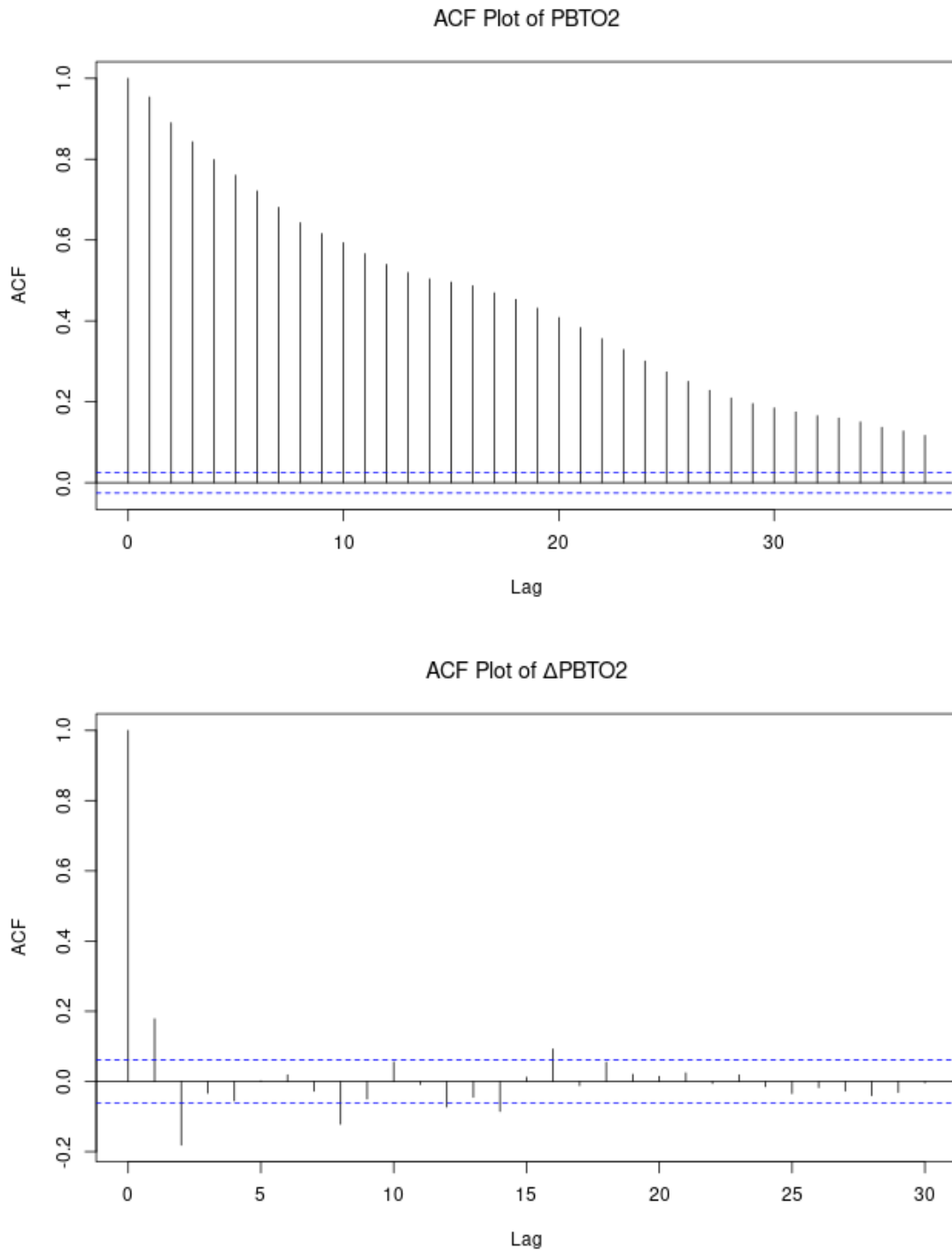
Subject 4



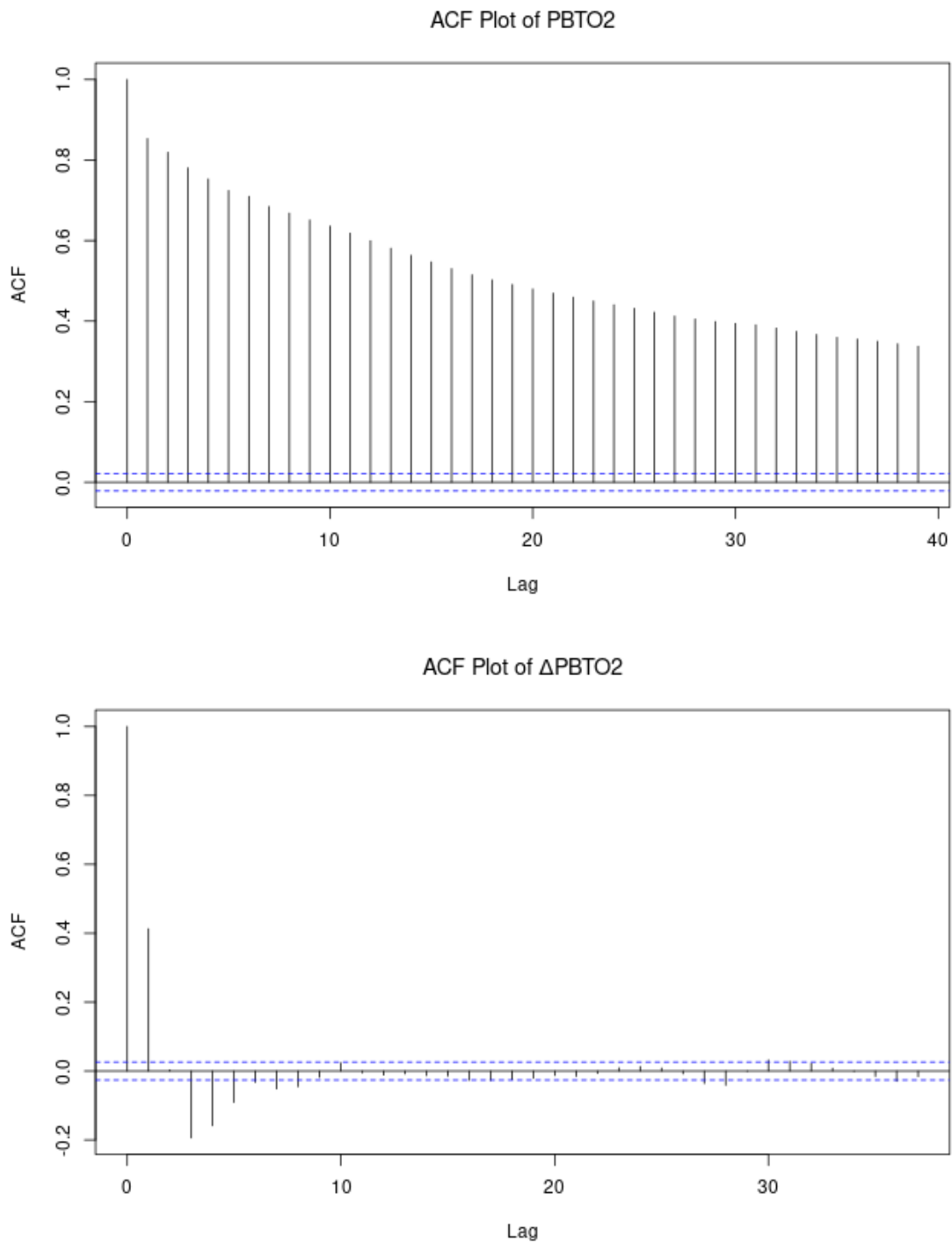
Supplementary File S1 Figure 4: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 4

Subject 5**Supplementary File S1 Figure 5: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 5**

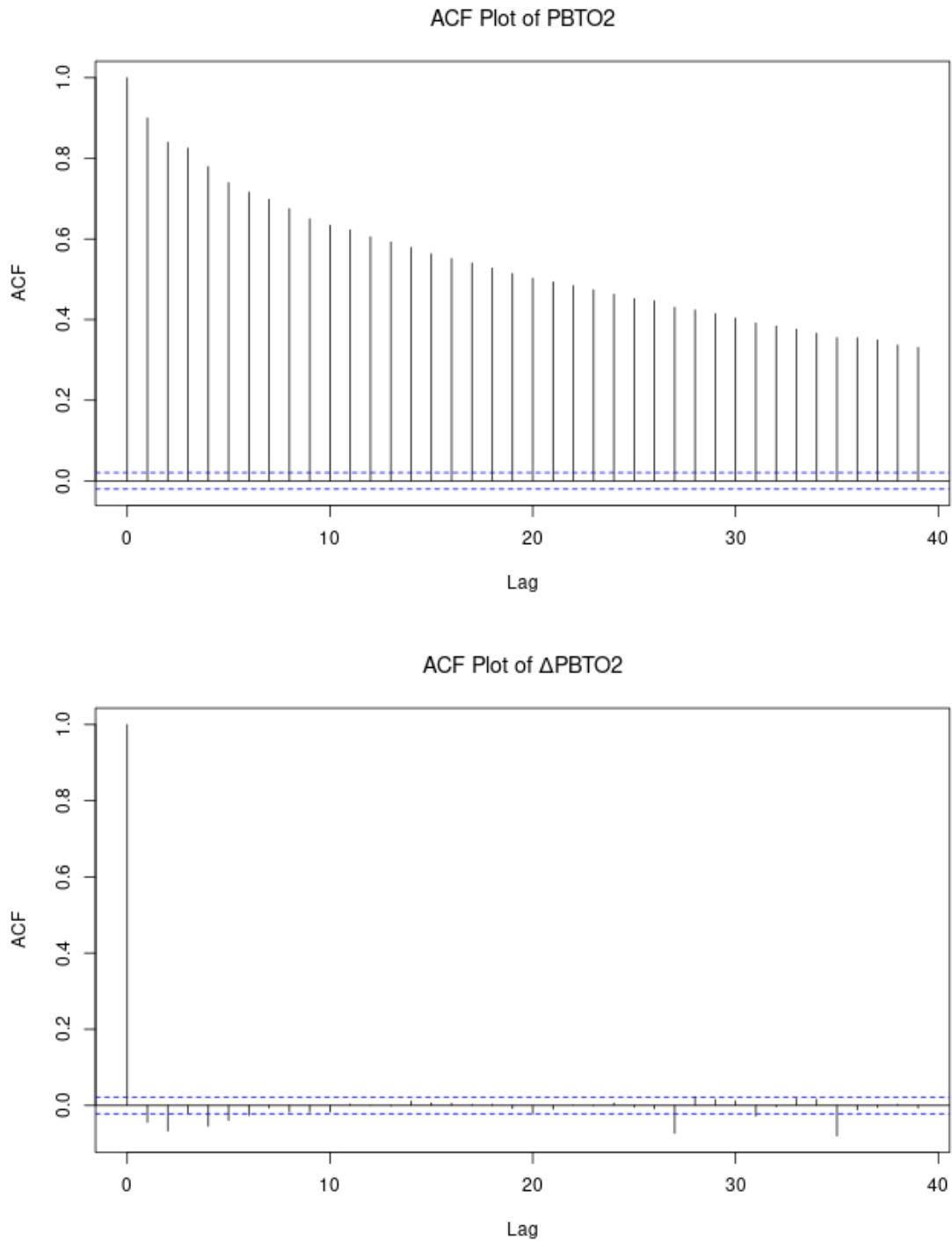
Subject 6



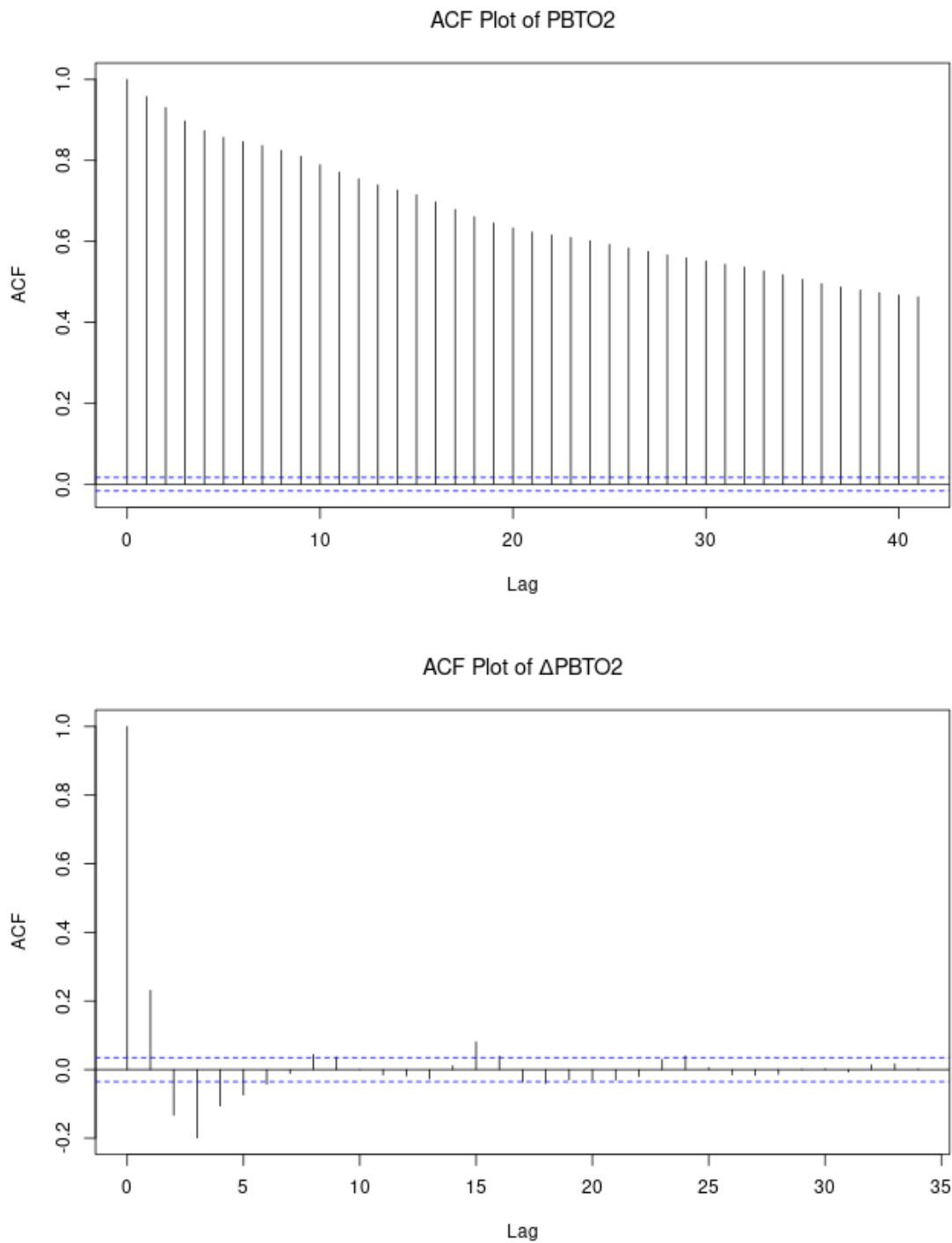
Supplementary File S1 Figure 6: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 6

Subject 7**Supplementary File S1 Figure 7: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 7**

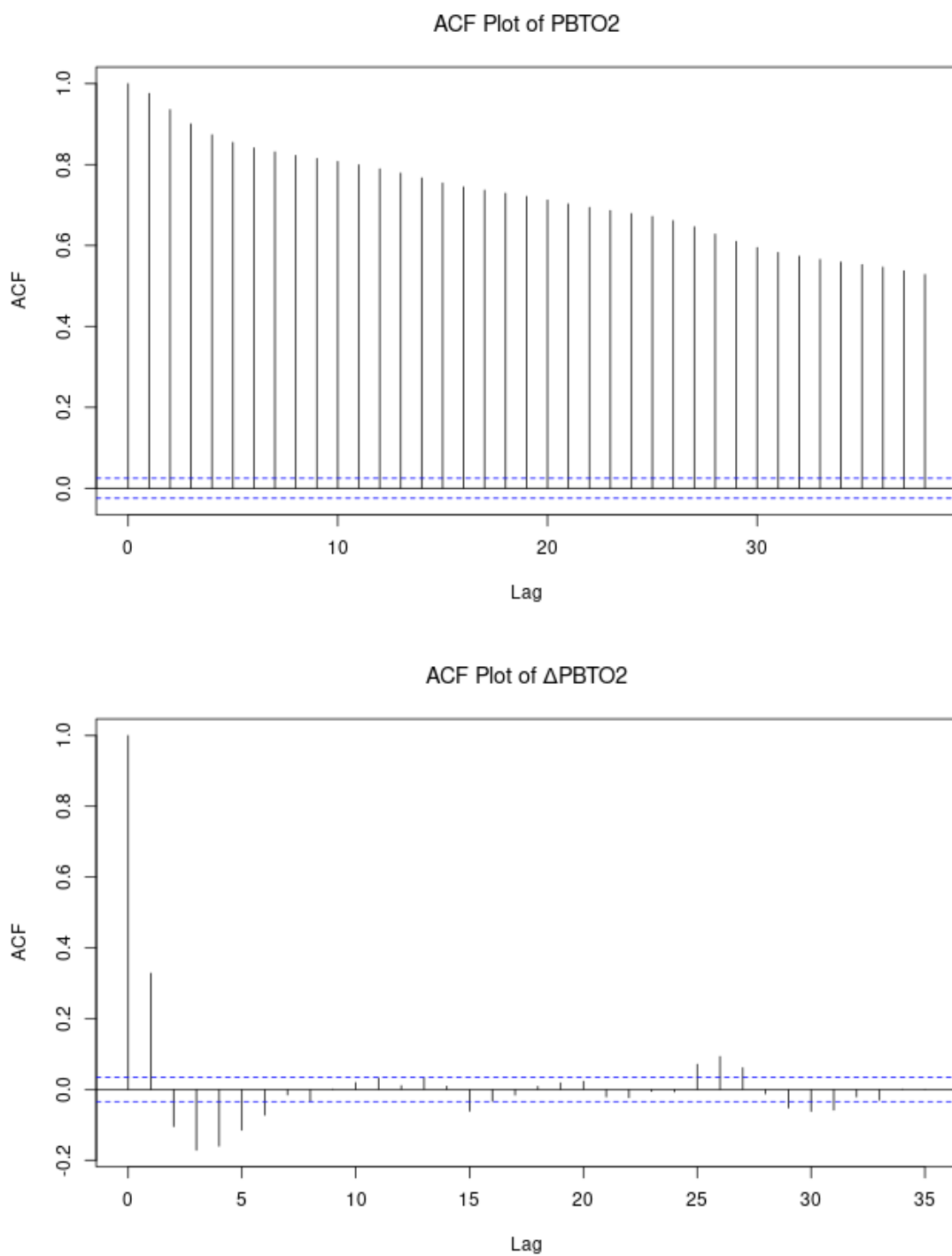
Subject 8



Supplementary File S1 Figure 8: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 8

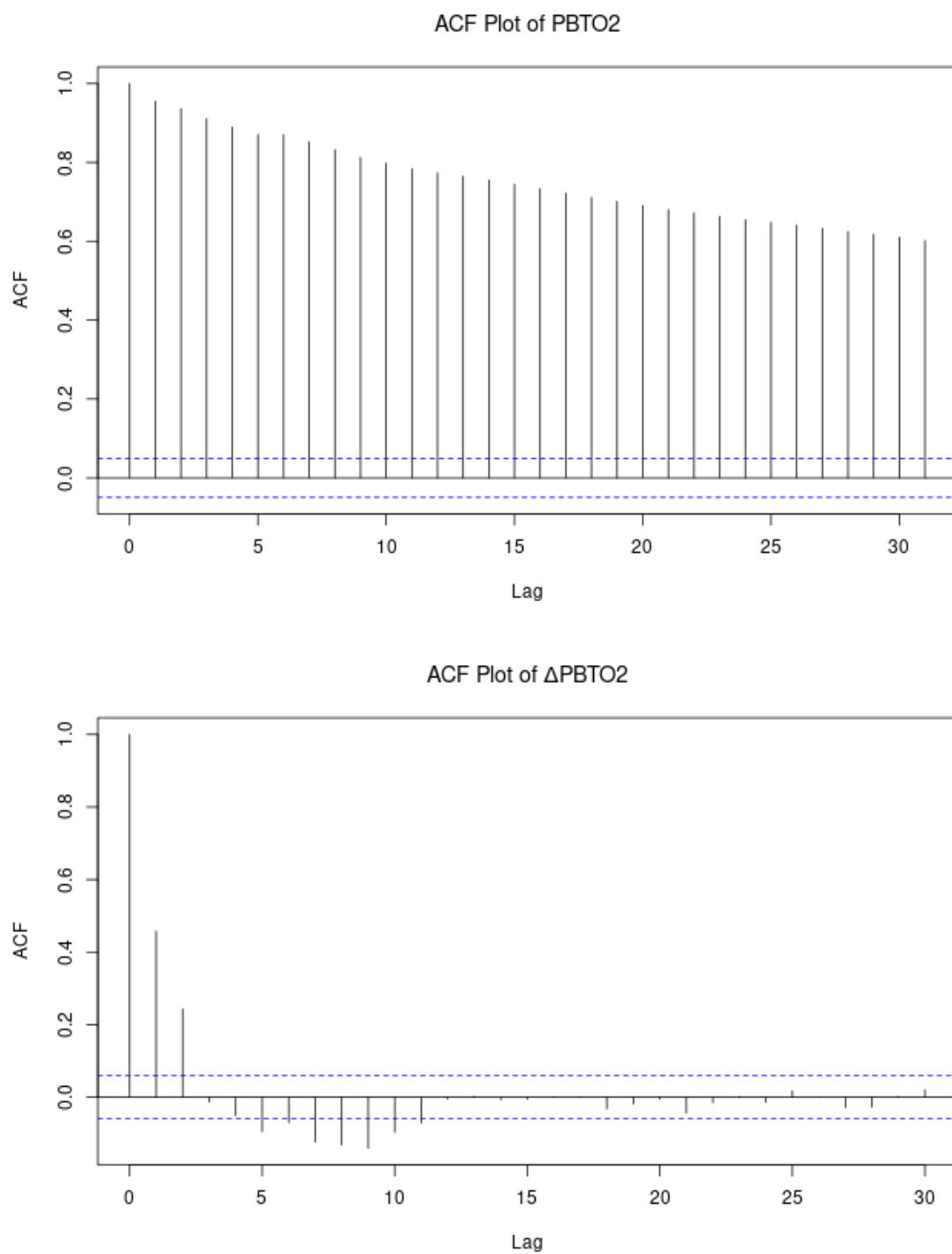
Subject 9**Supplementary File S1 Figure 9: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 9**

Subject 10



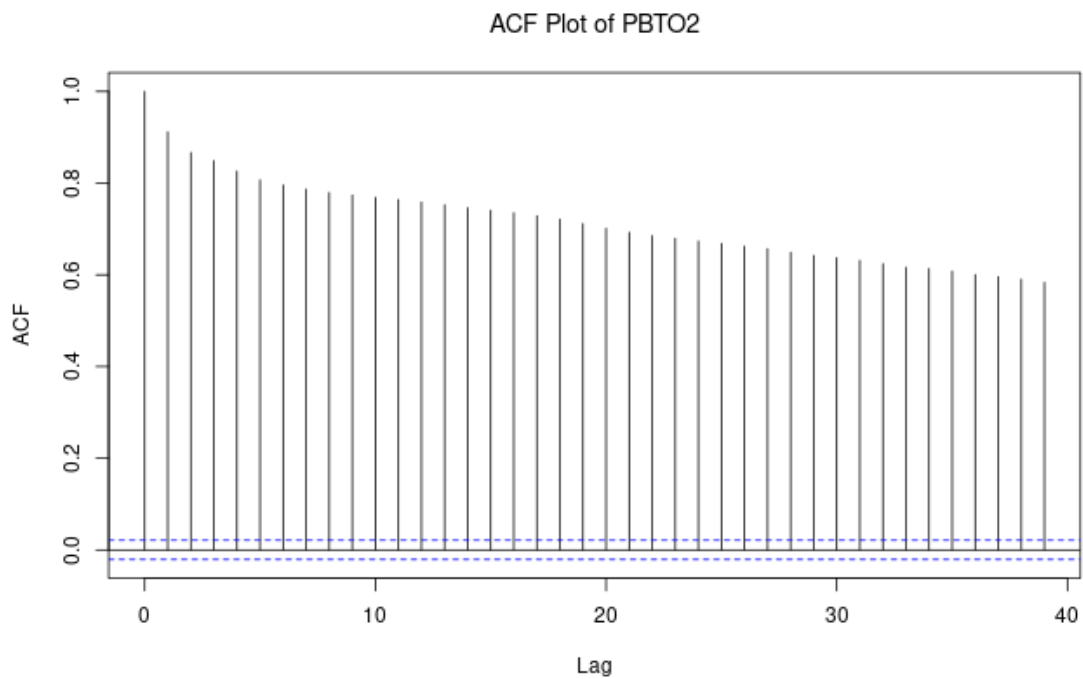
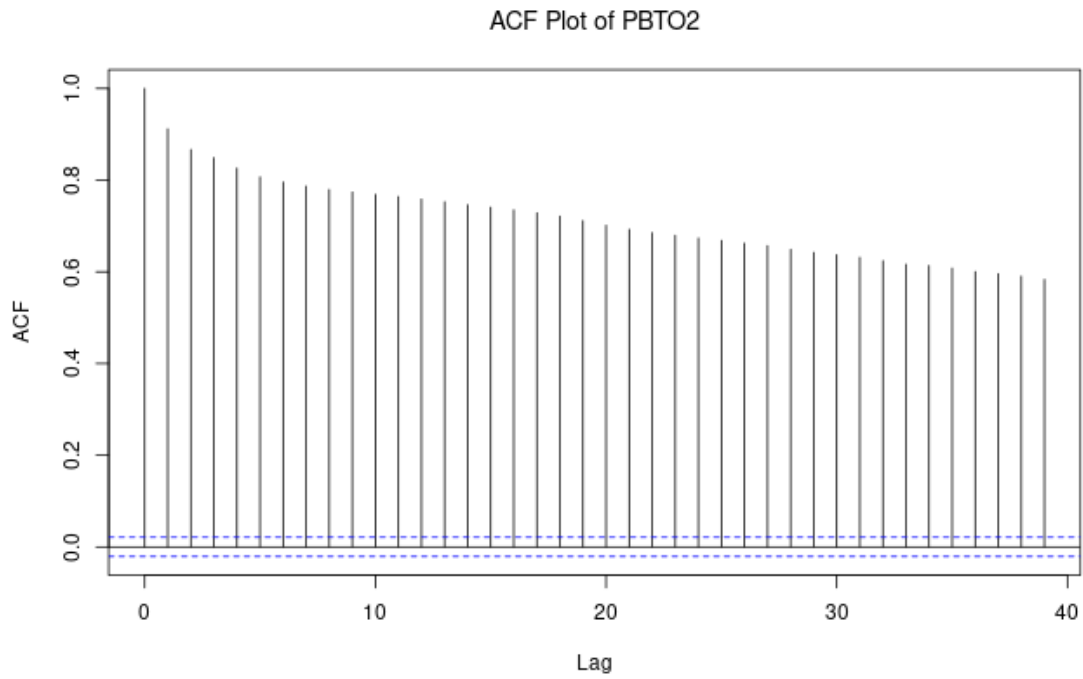
Supplementary File S1 Figure 10: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 10

Subject 11



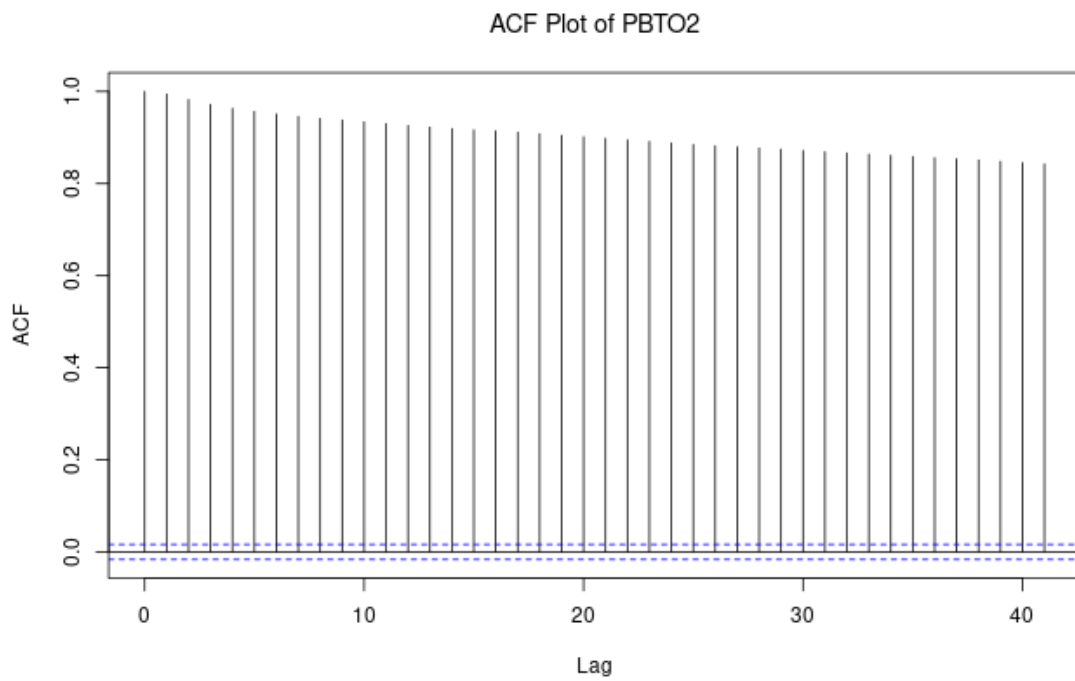
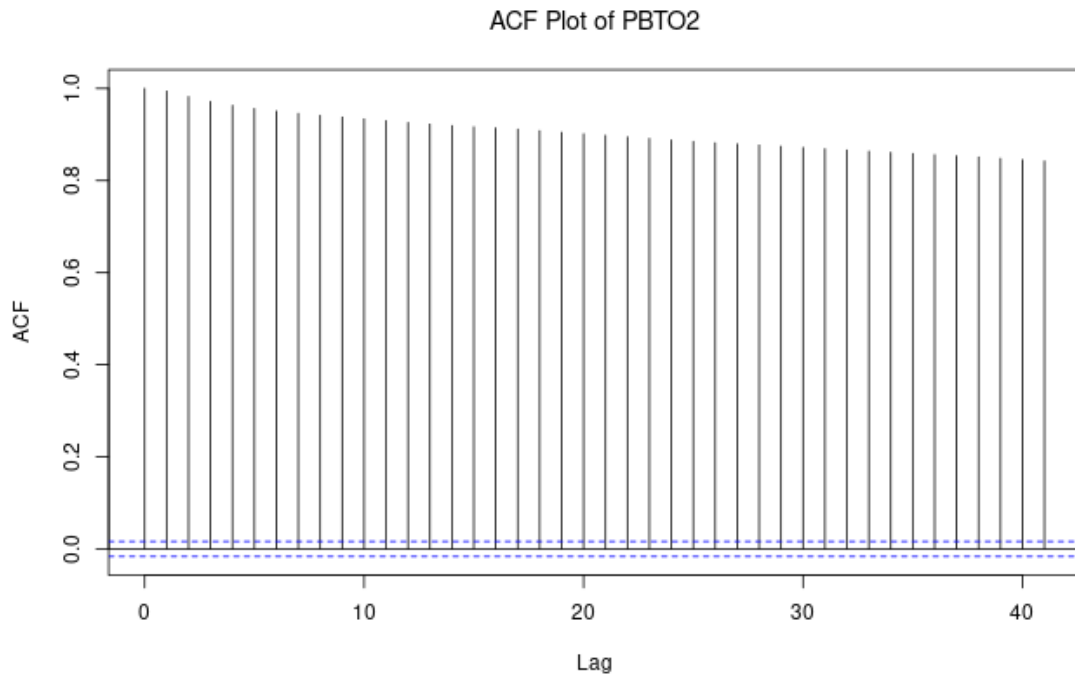
Supplementary File S1 Figure 11: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 11

Subject 12



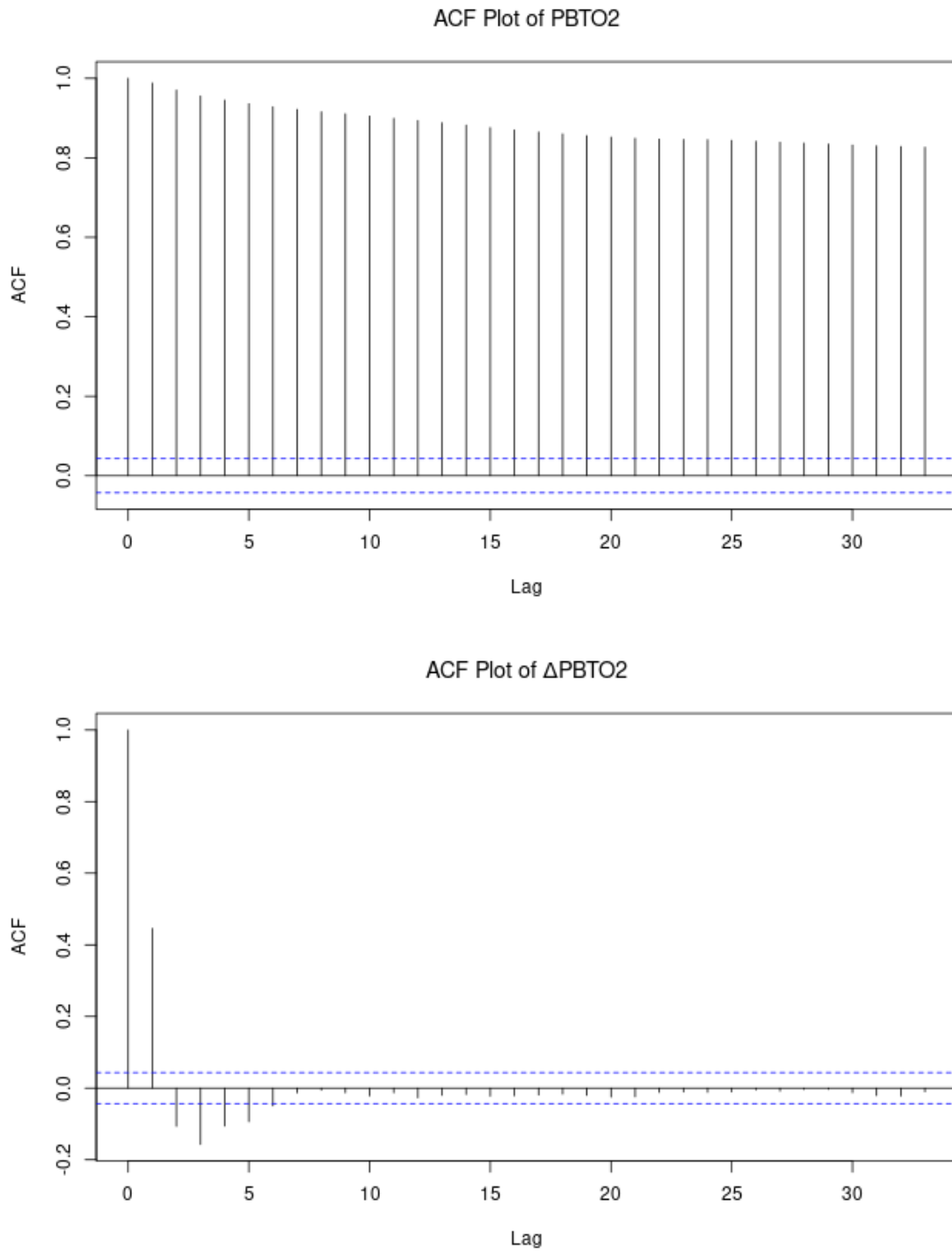
Supplementary File S1 Figure 12: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 12

Subject 13



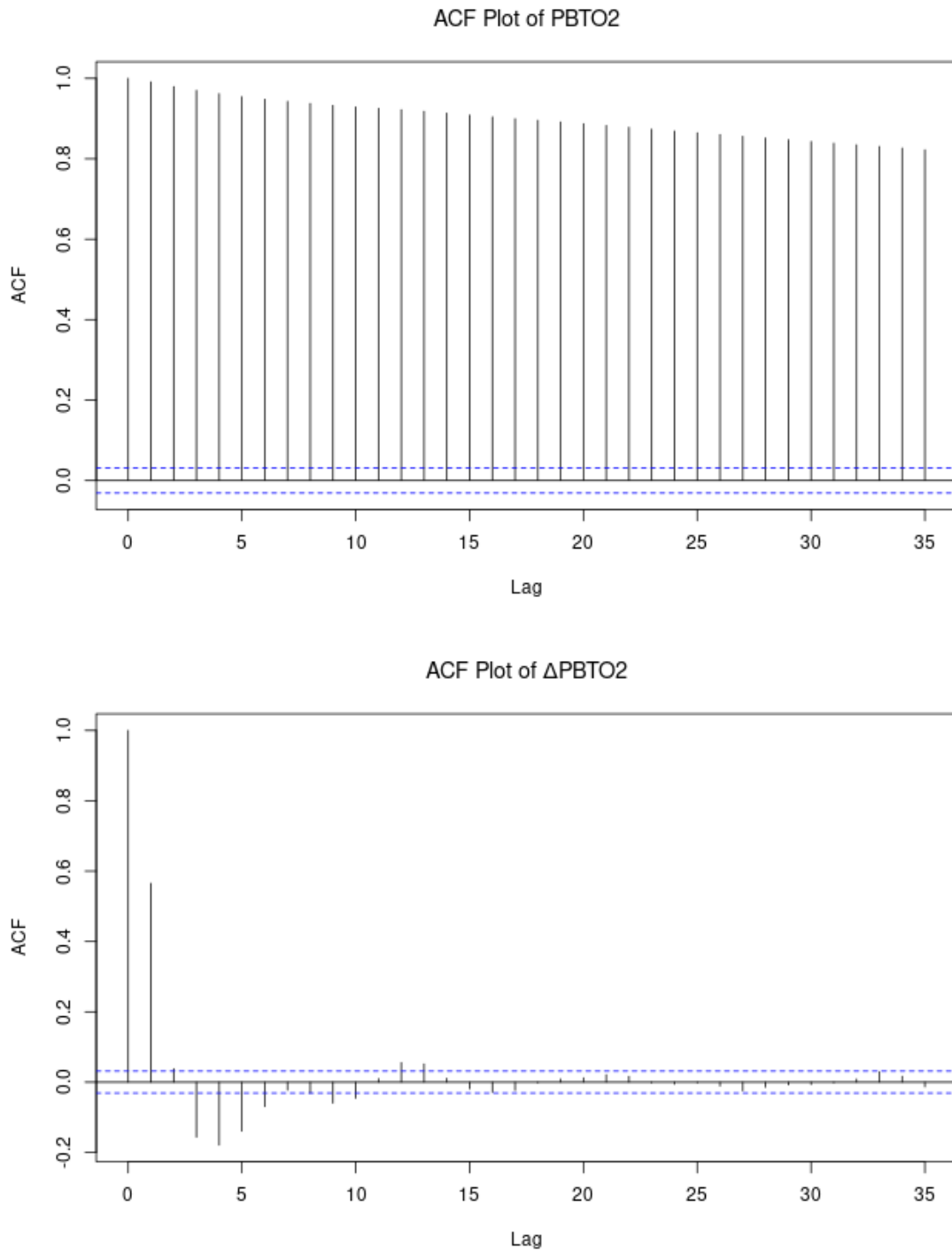
Supplementary File S1 Figure 13: ACF Plots of PbtO_2 (Top) and ΔPbtO_2 (Bottom) for Subject 13

Subject 14



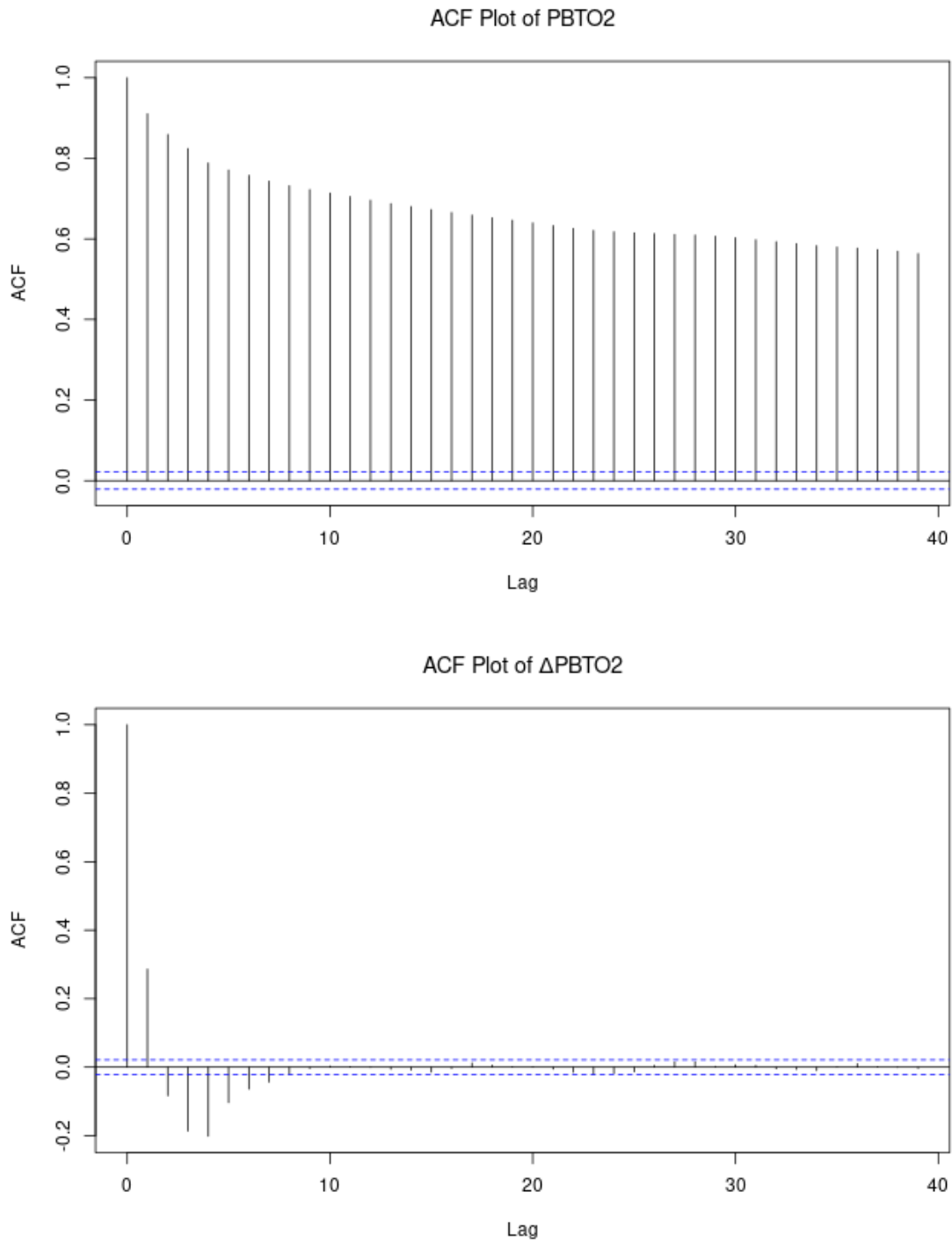
Supplementary File S1 Figure 14: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 14

Subject 15



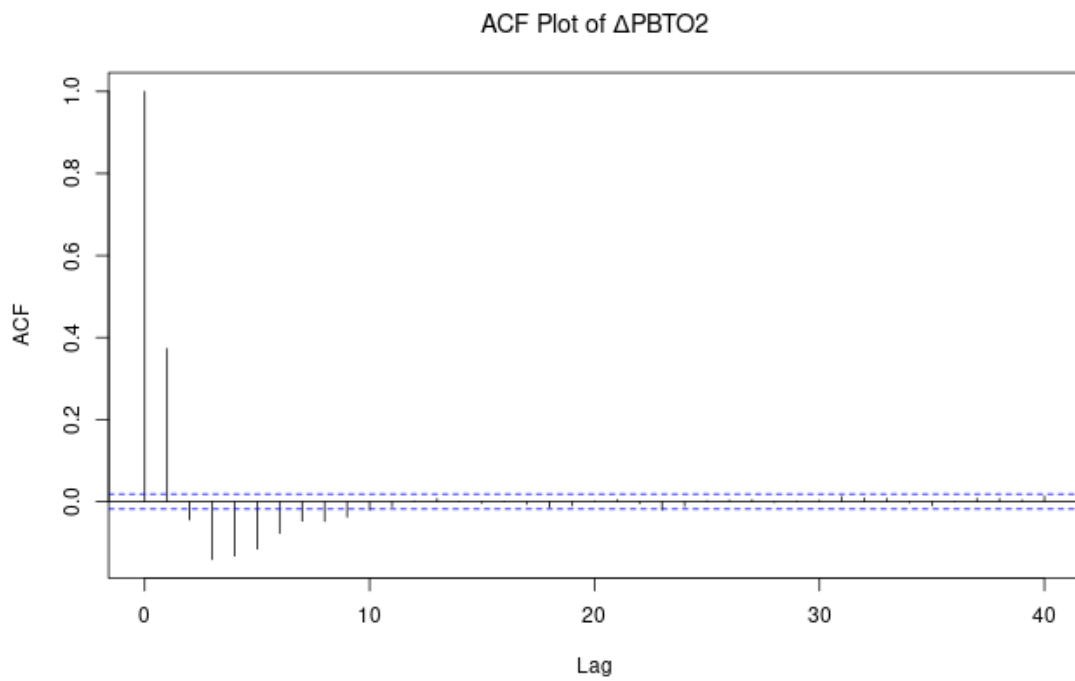
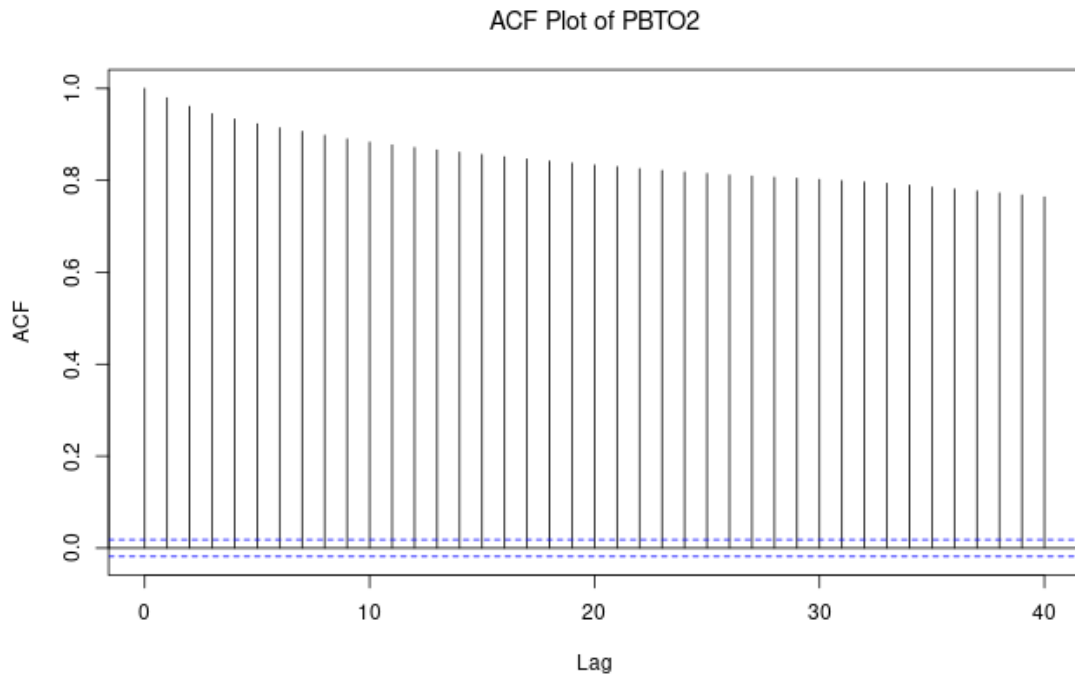
Supplementary File S1 Figure 15: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 15

Subject 16



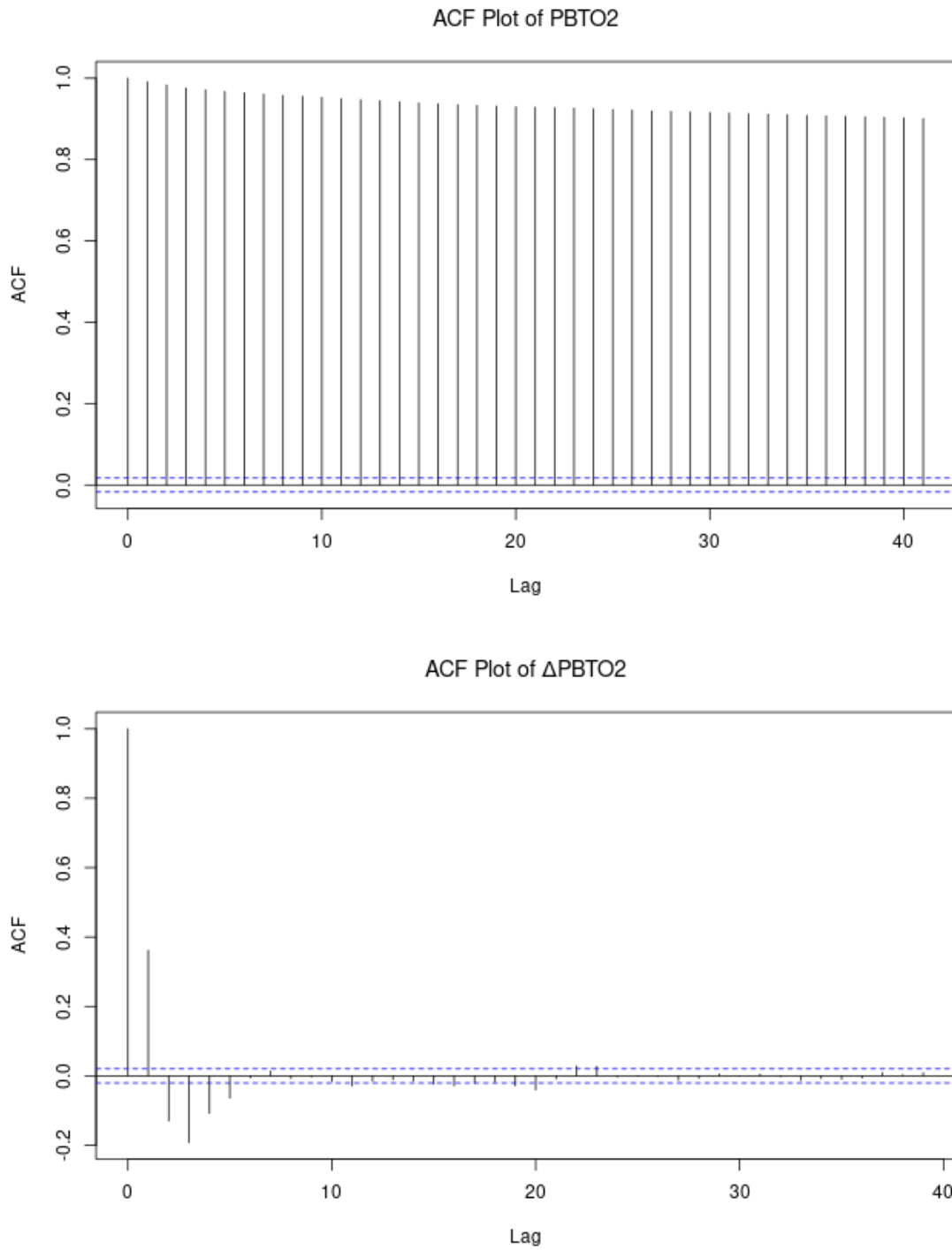
Supplementary File S1 Figure 16: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 16

Subject 17



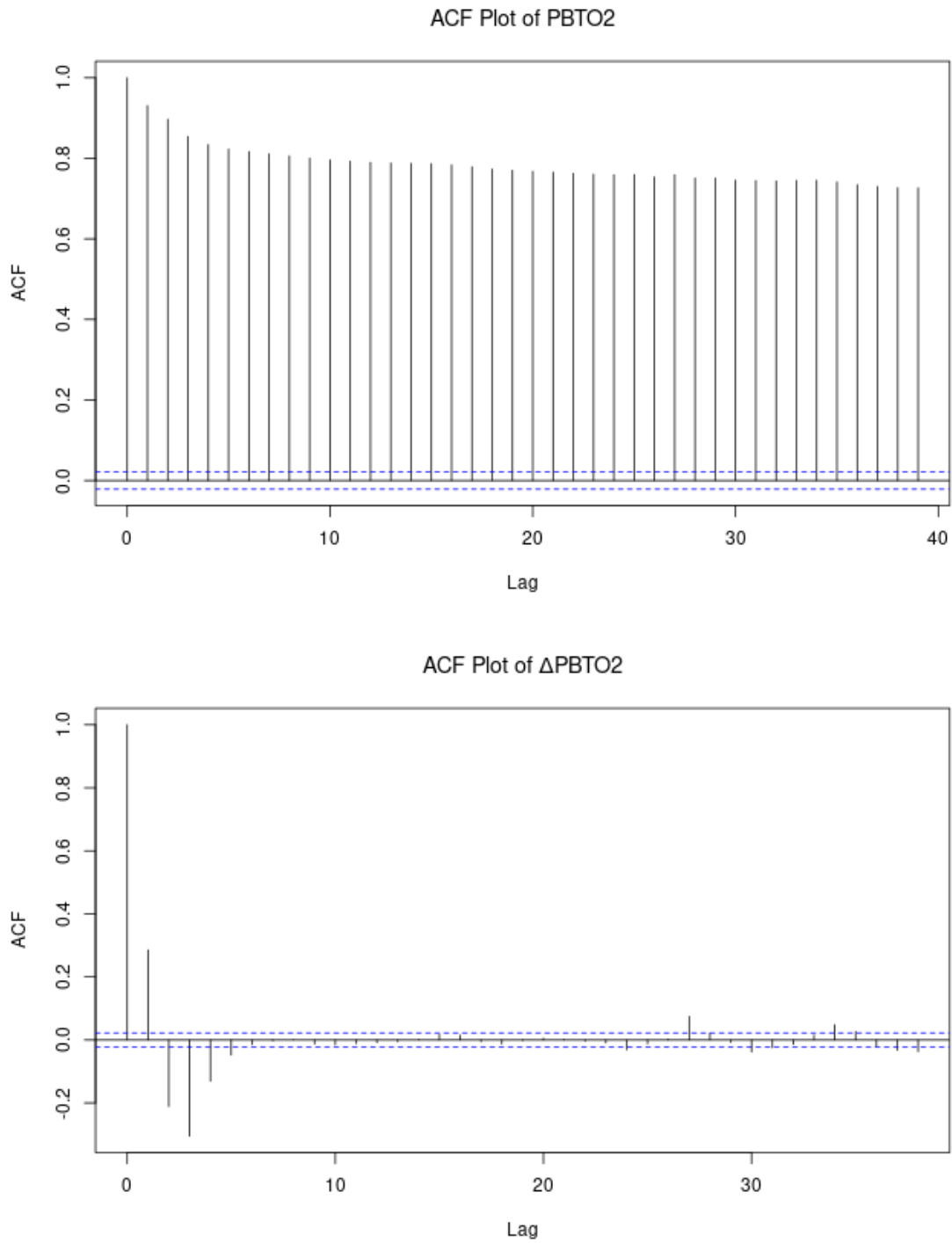
Supplementary File S1 Figure 17: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 17

Subject 18



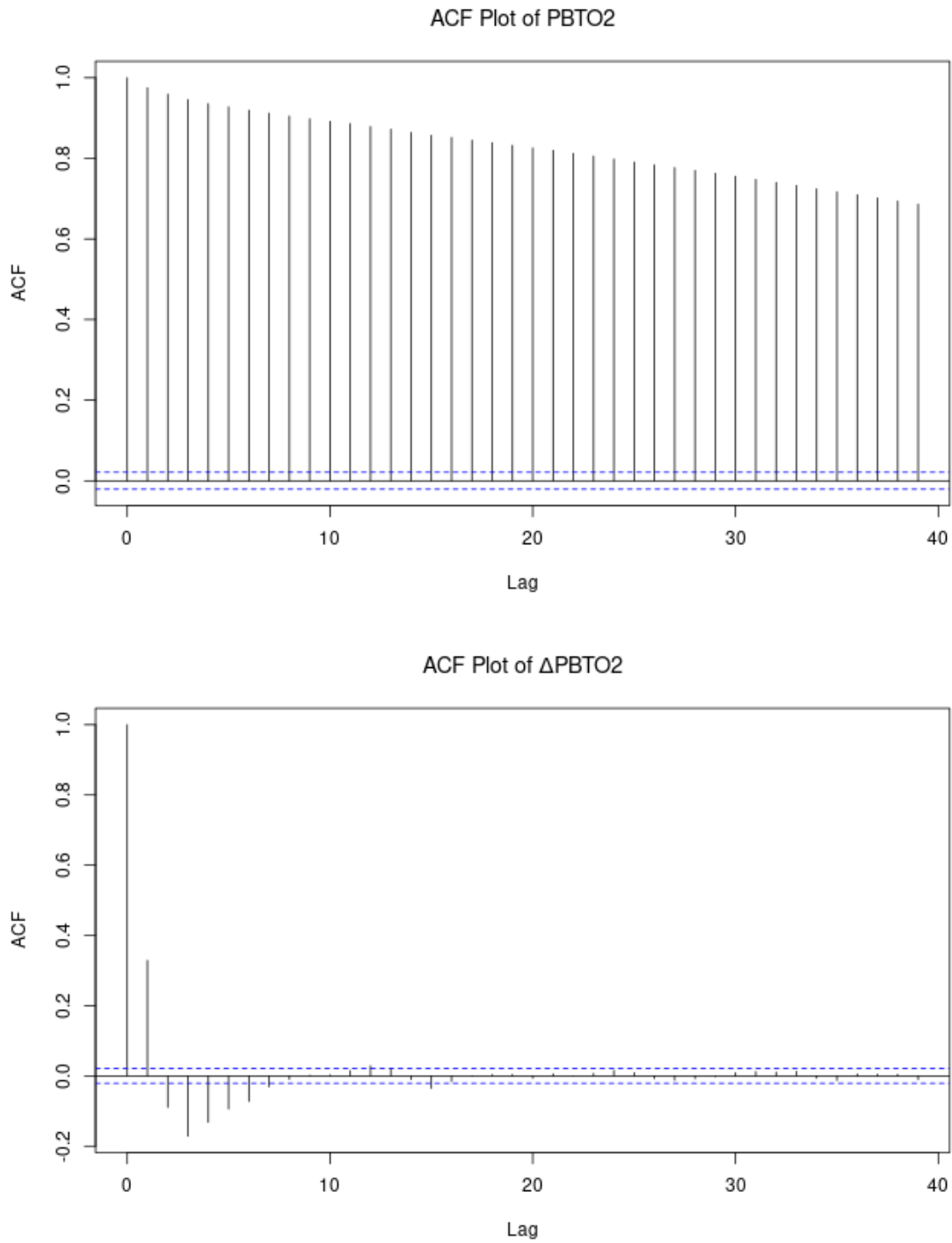
Supplementary File S1 Figure 18: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 18

Subject 19



Supplementary File S1 Figure 19: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 19

Subject 20

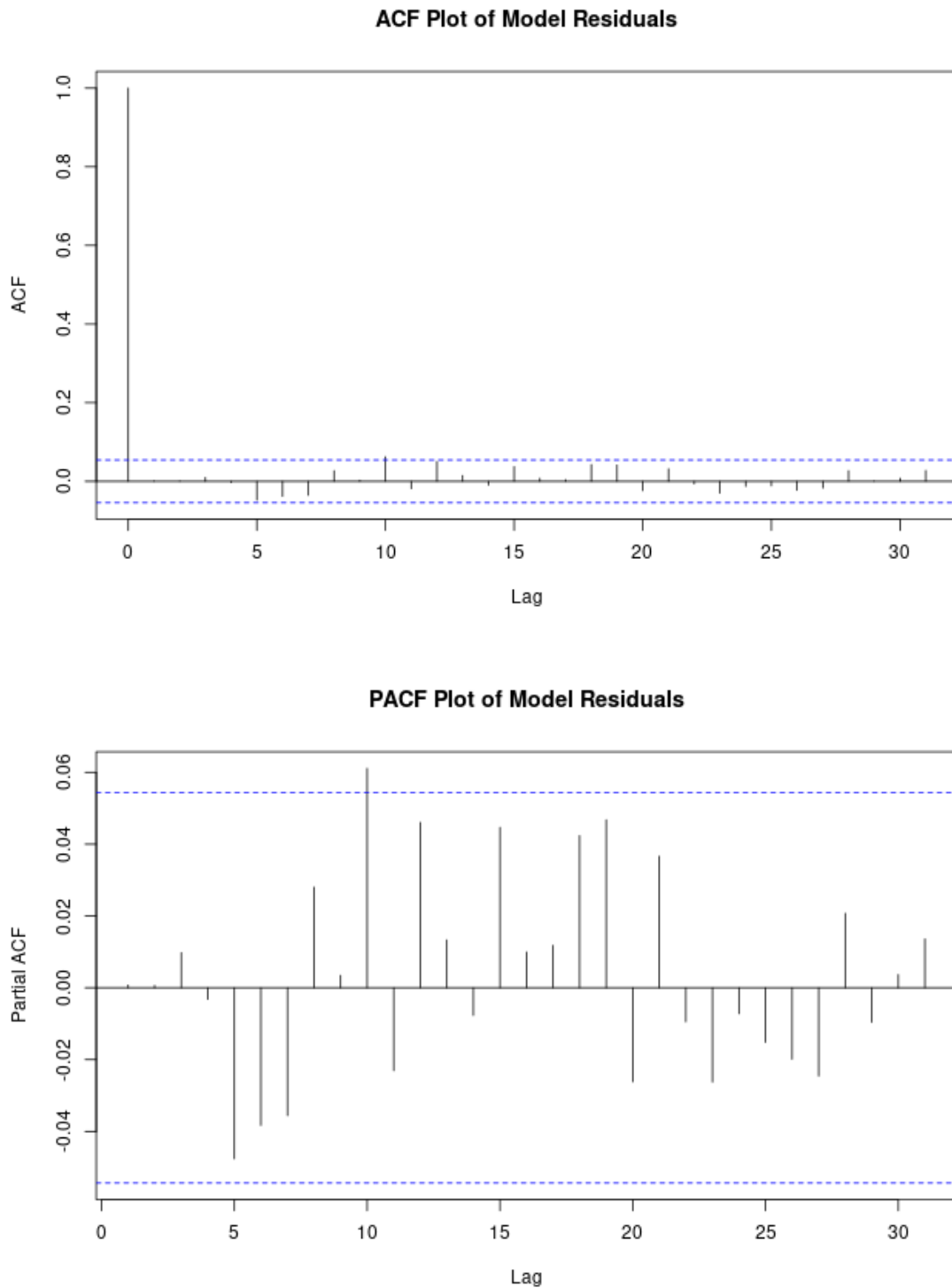


Supplementary File S1 Figure 20: ACF Plots of PbtO₂ (Top) and Δ PbtO₂ (Bottom) for Subject 20

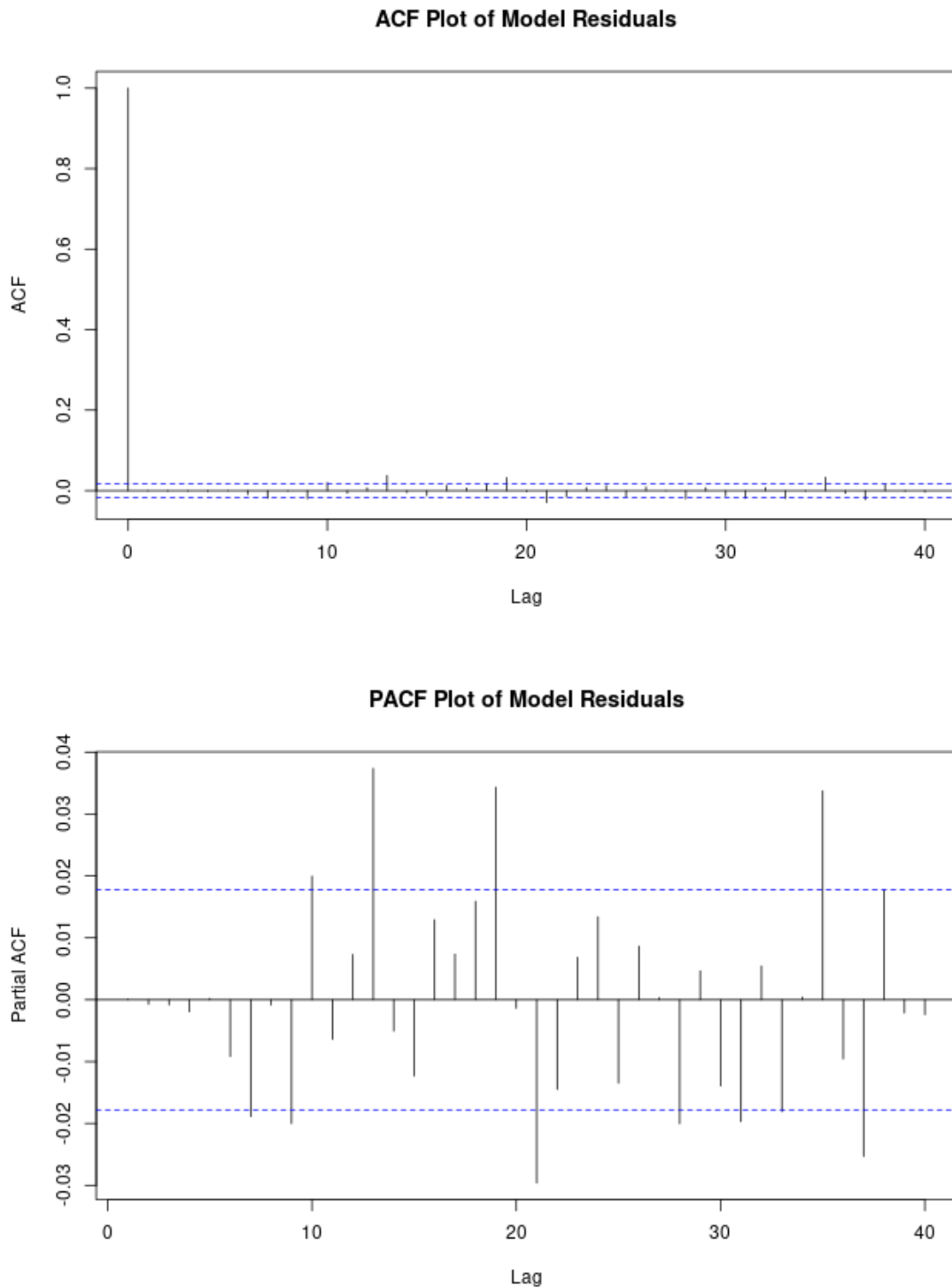
2 Supplementary File S2: Evaluation of residuals of the linear $\Delta PbtO_2 \sim \Delta rSO_2Lag1$ models to ensure autocorrelative structure was accounted for

Plot Legend: *For the following plots the dashed blue line represents the significance levels which were set to a correlation level of $\pm(2/N^{1/2})$, where N is the number of samples. ACF = Autocorrelative function, PACF = Partial Autocorrelative function, $\Delta PbtO_2$ = change in brain tissue oxygen tension, ΔrSO_2Lag1 = the one-minute lagged change in regional cerebral oxygen saturation.*

Subject 1

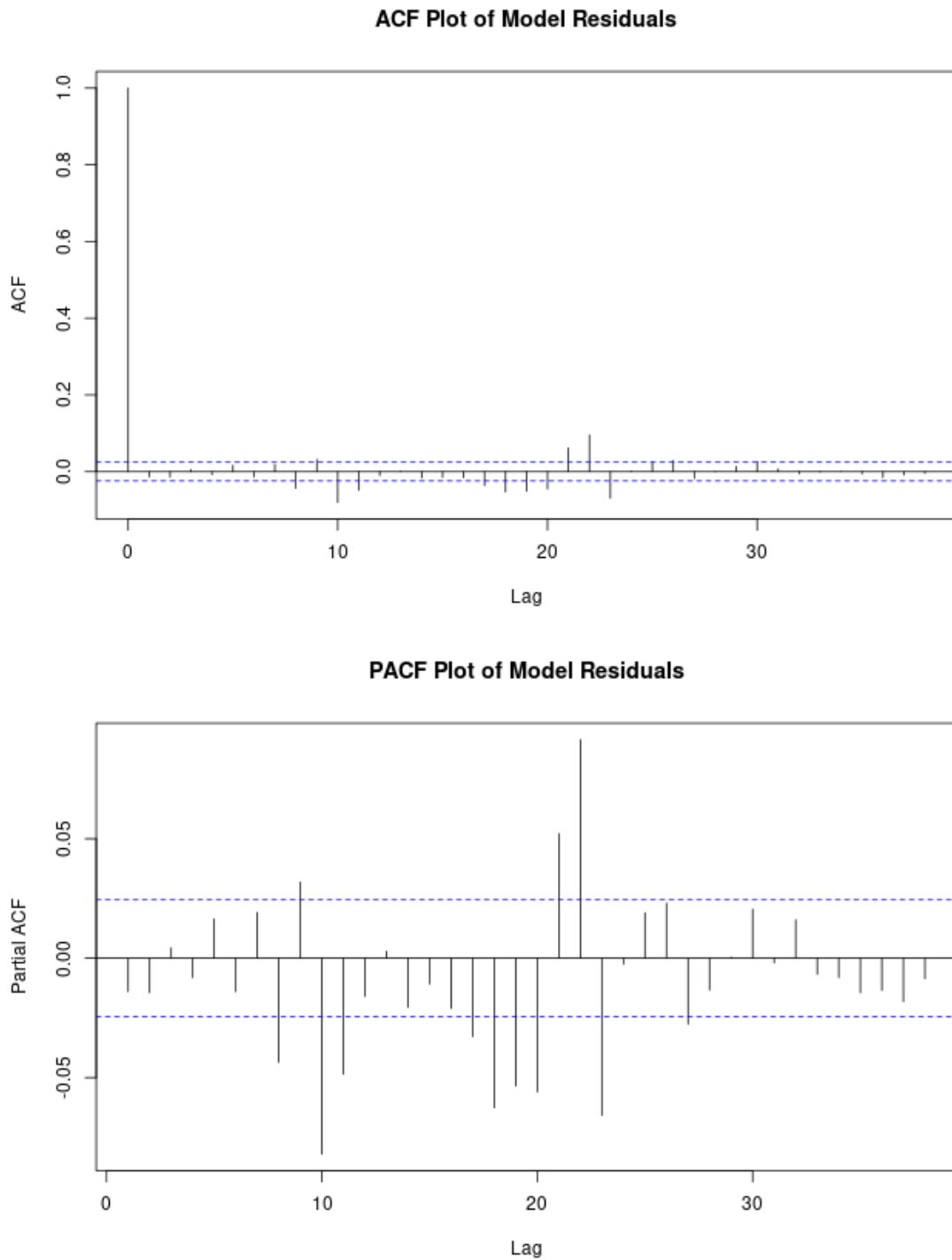


Supplementary File S2 Figure 1: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 1

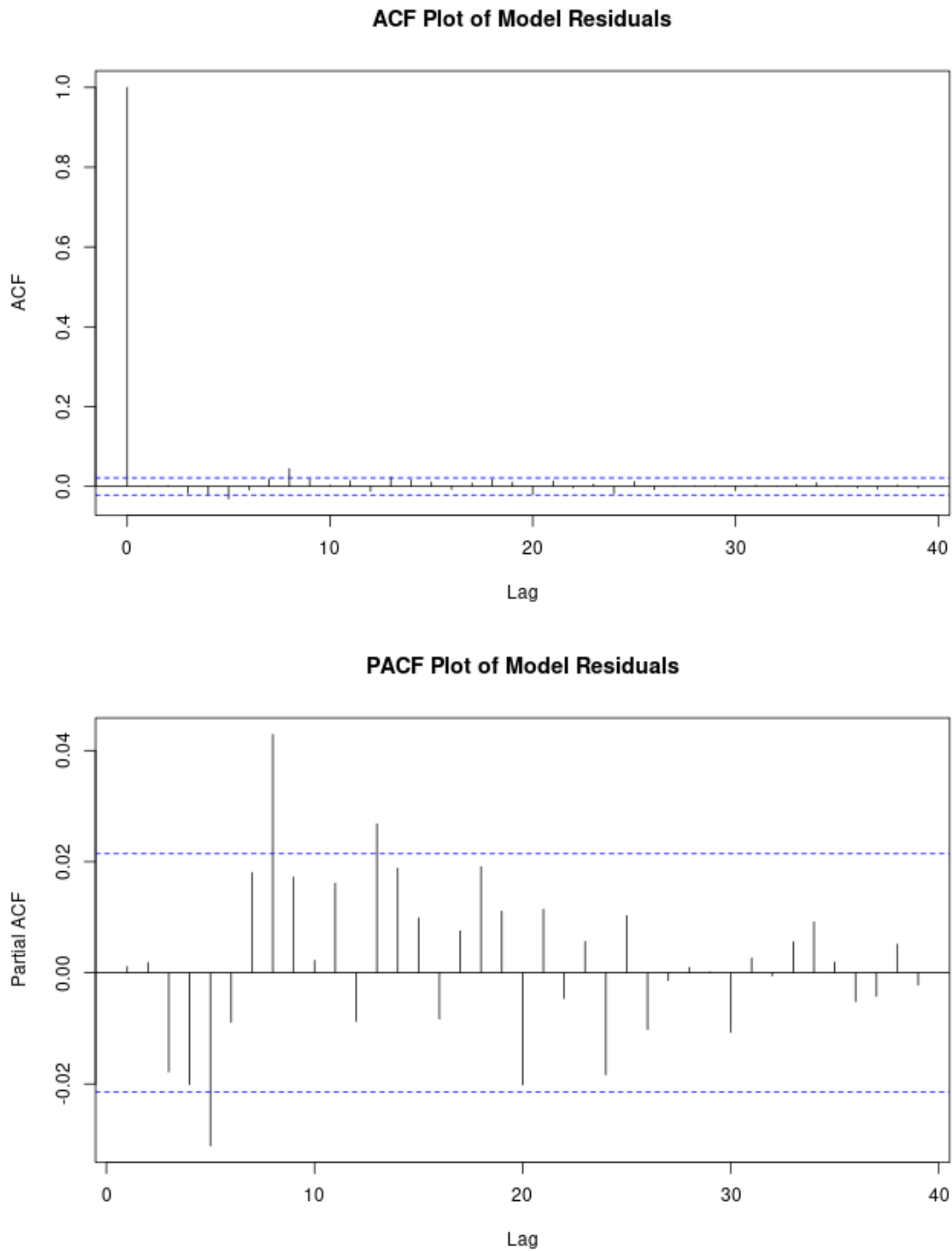
Subject 2

Supplementary File S2 Figure 2: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 2

Subject 3

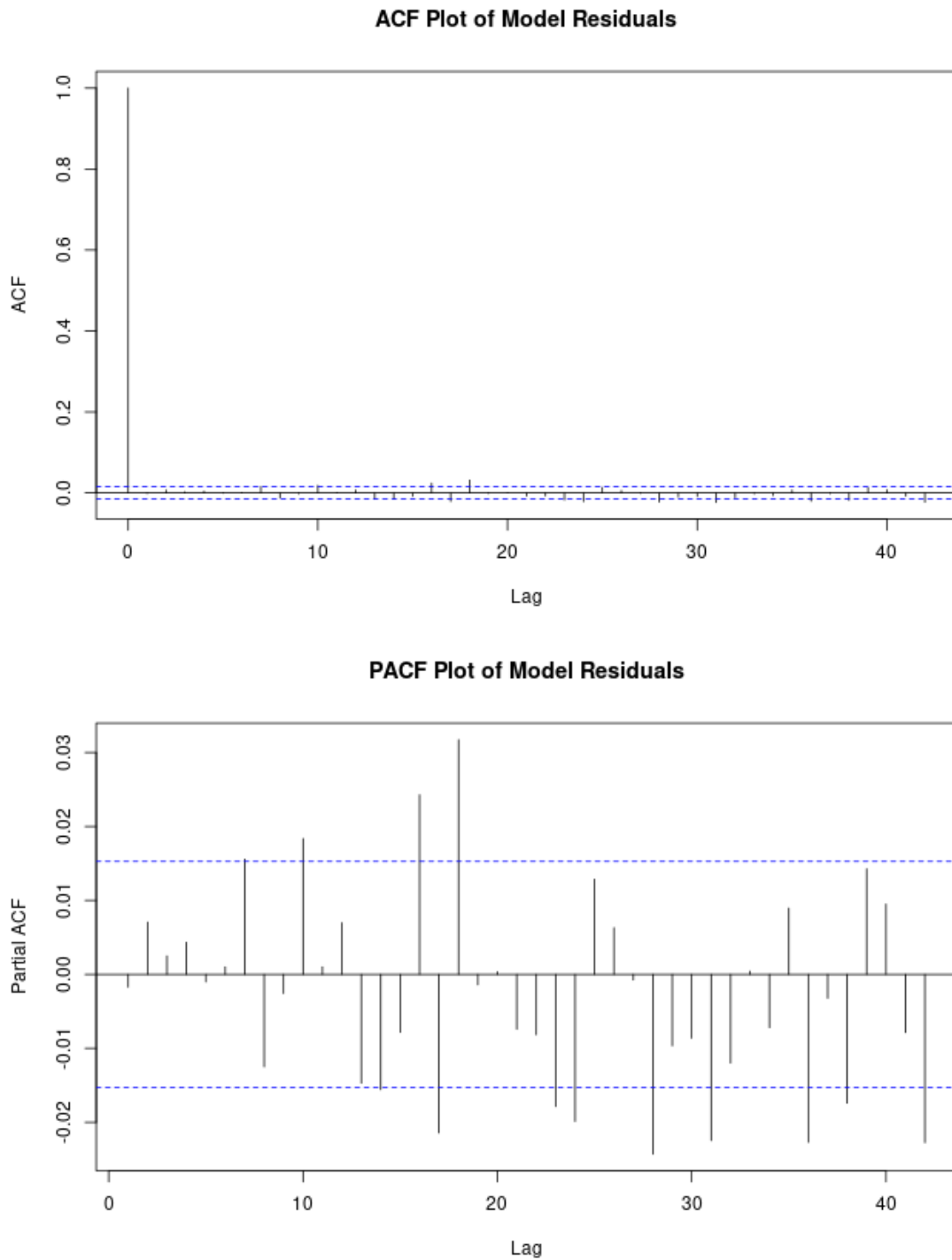


Supplementary File S2 Figure 3: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 3

Subject 4

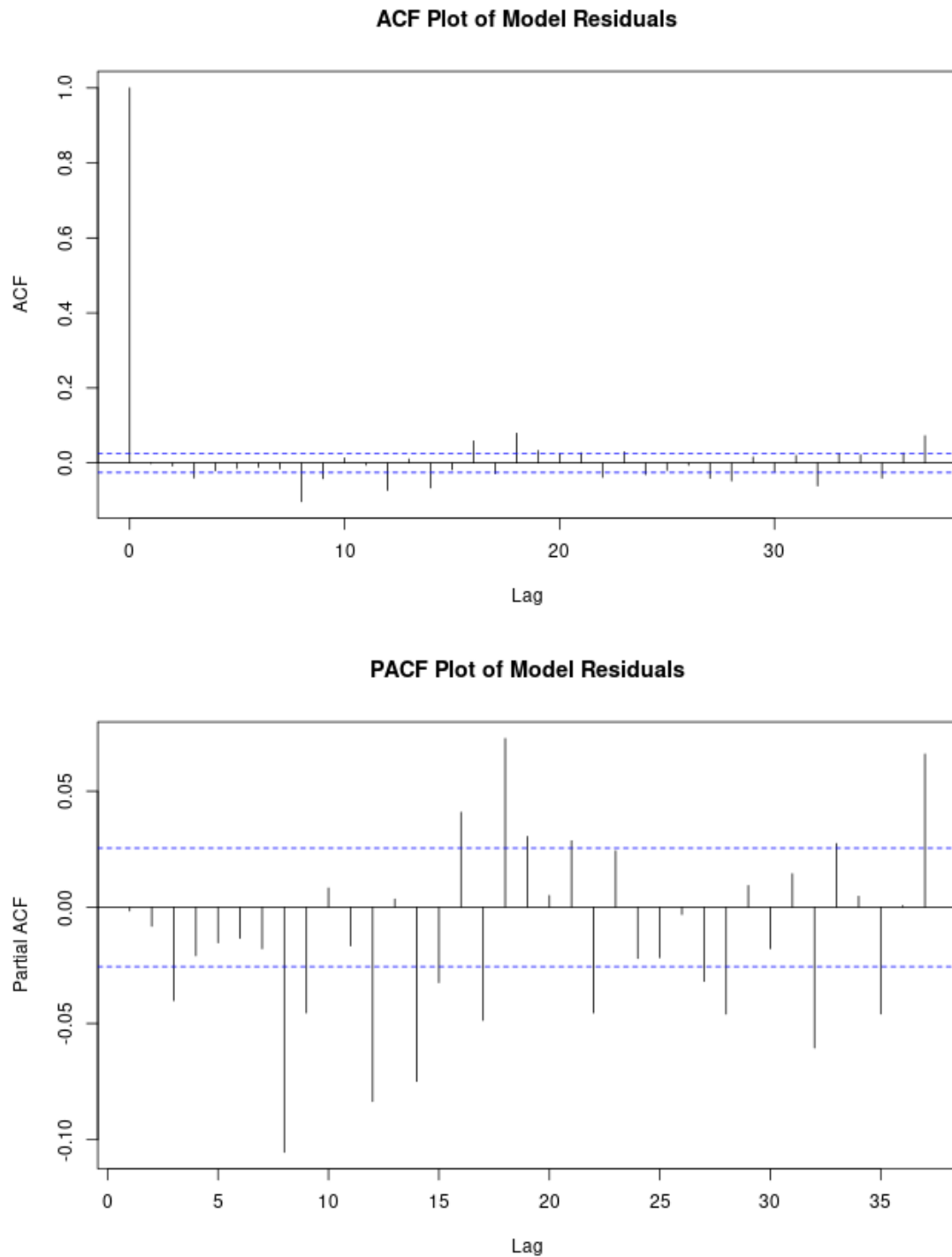
Supplementary File S2 Figure 4: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 4

Subject 5



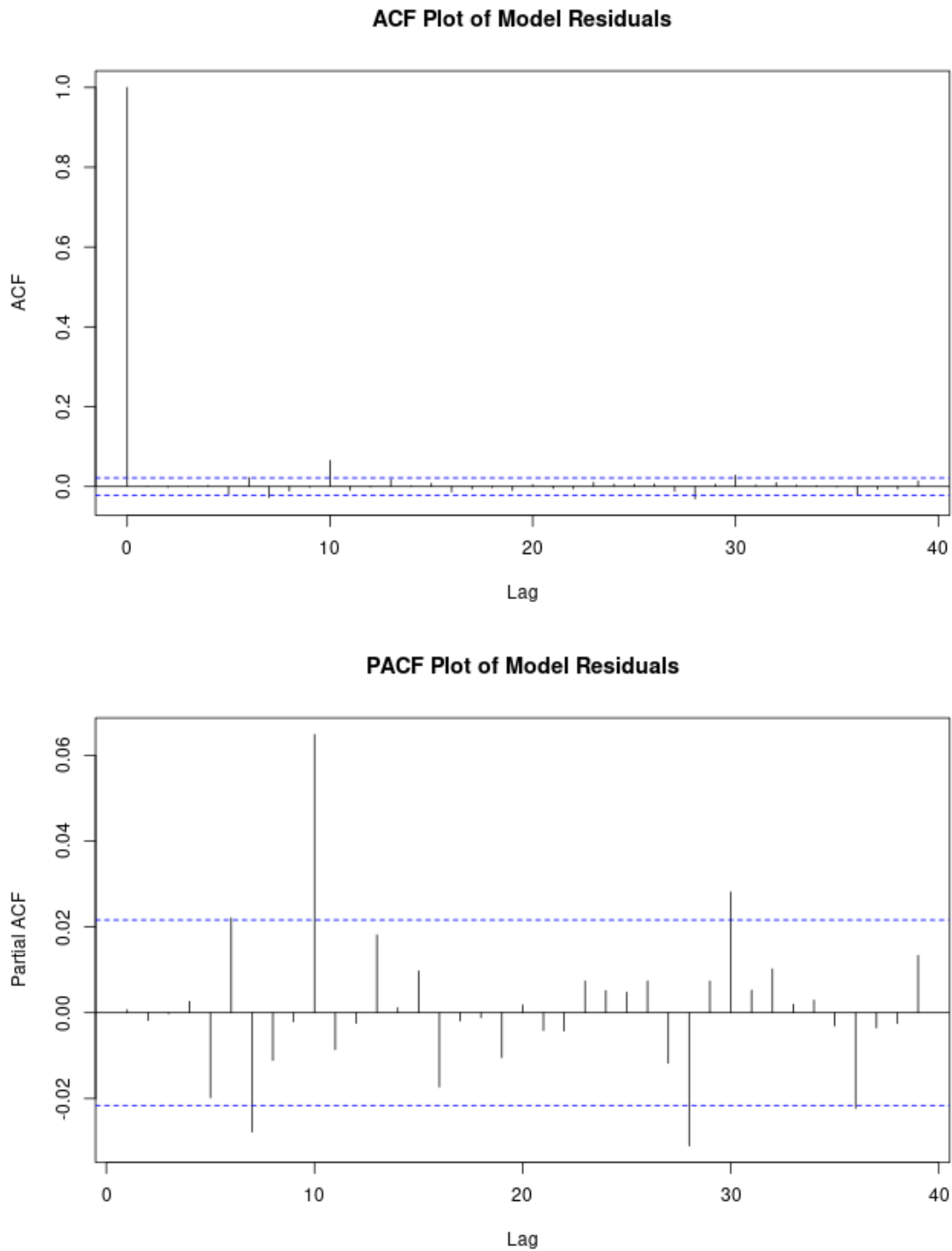
Supplementary File S2 Figure 5: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 5

Subject 6



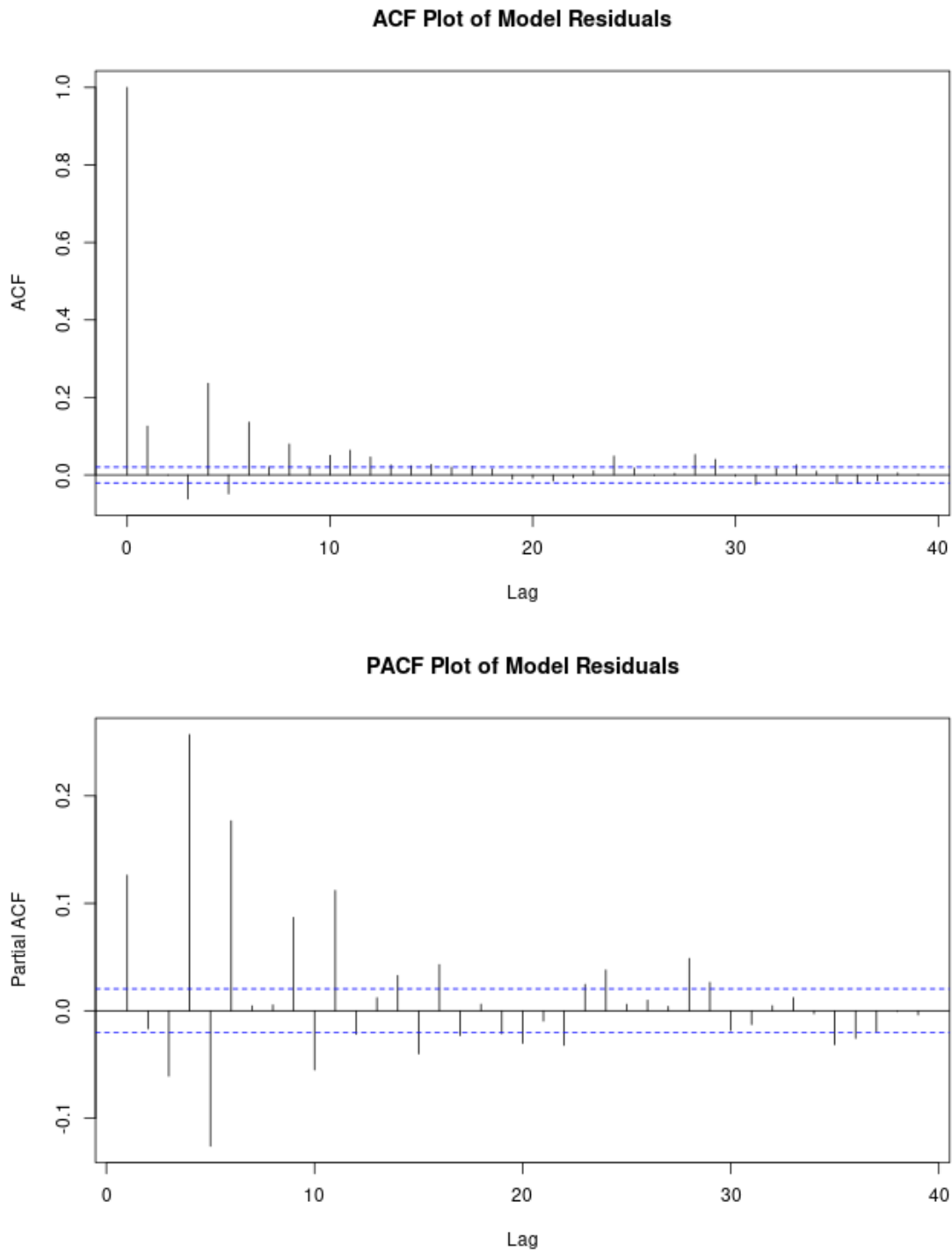
Supplementary File S2 Figure 6: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 6

Subject 7



Supplementary File S2 Figure 7: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 7

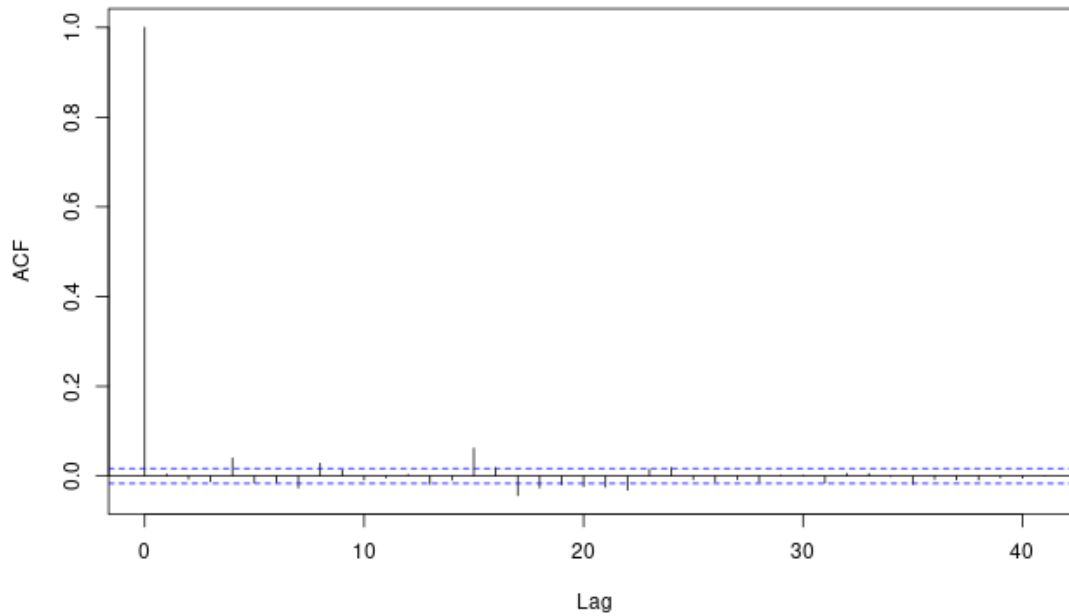
Subject 8



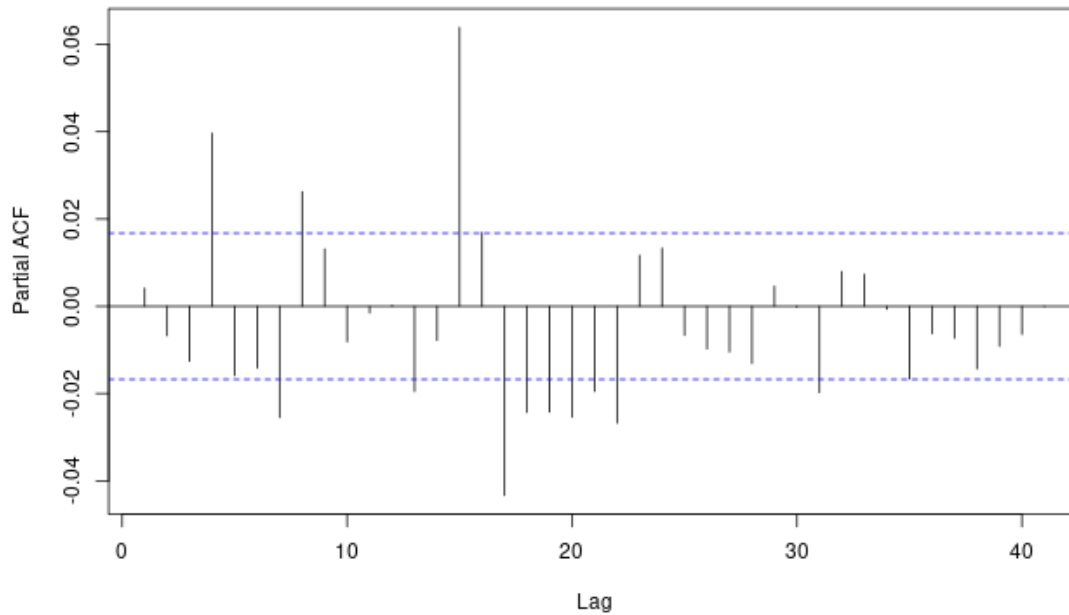
Supplementary File S2 Figure 8: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 8

Subject 9

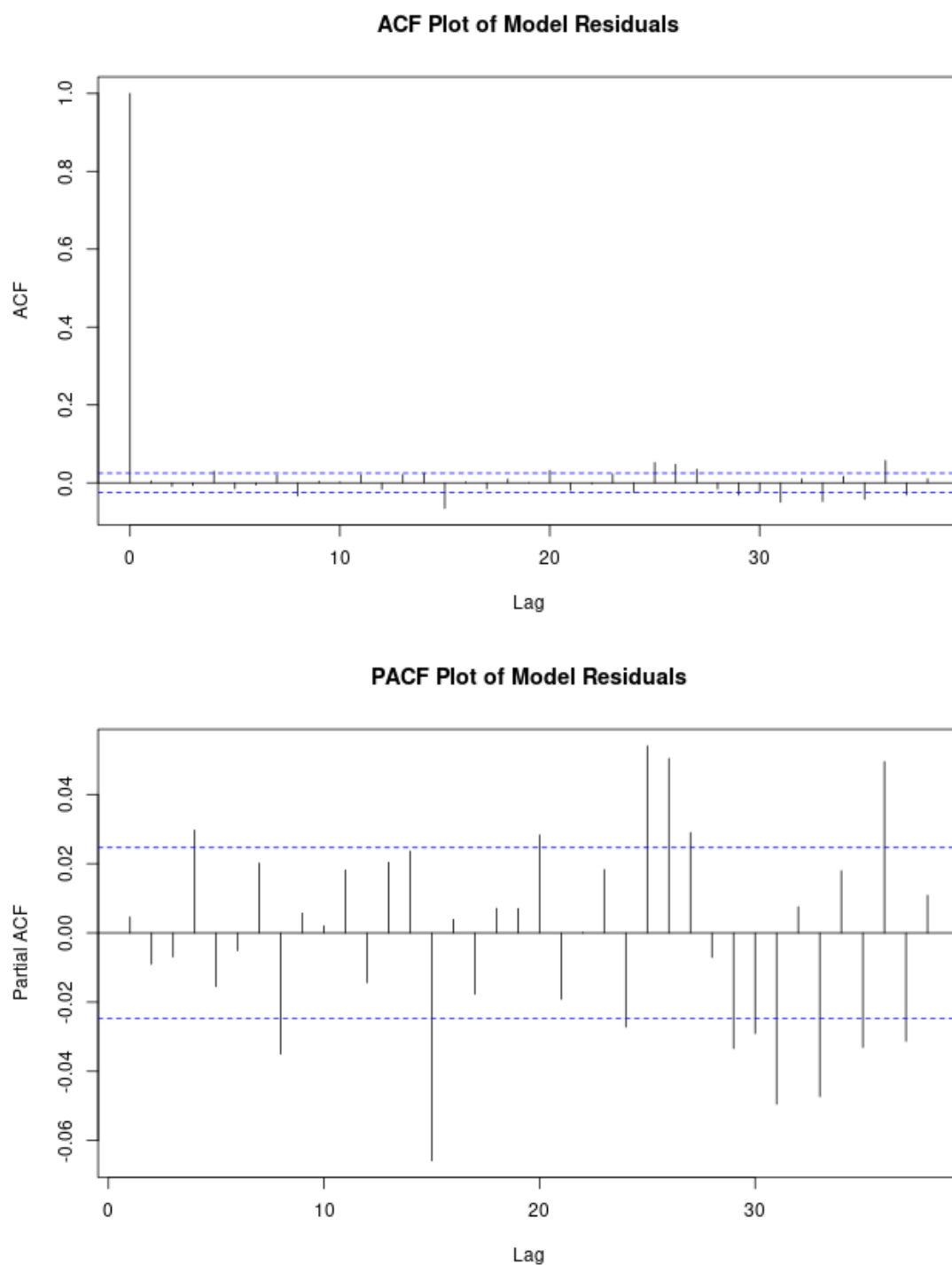
ACF Plot of Model Residuals



PACF Plot of Model Residuals



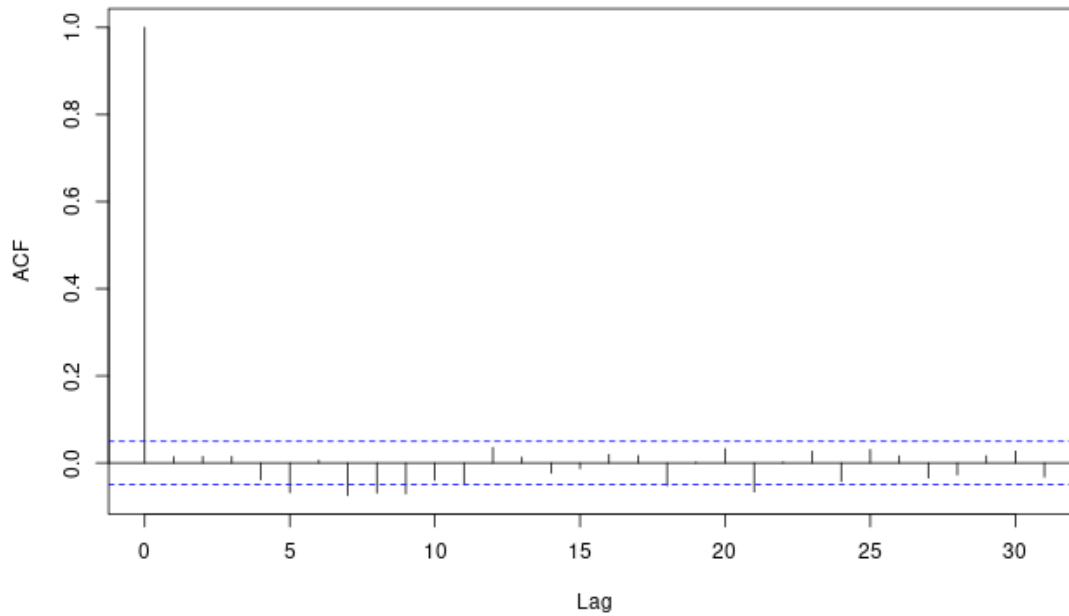
Supplementary File S2 Figure 9: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 9

Subject 10

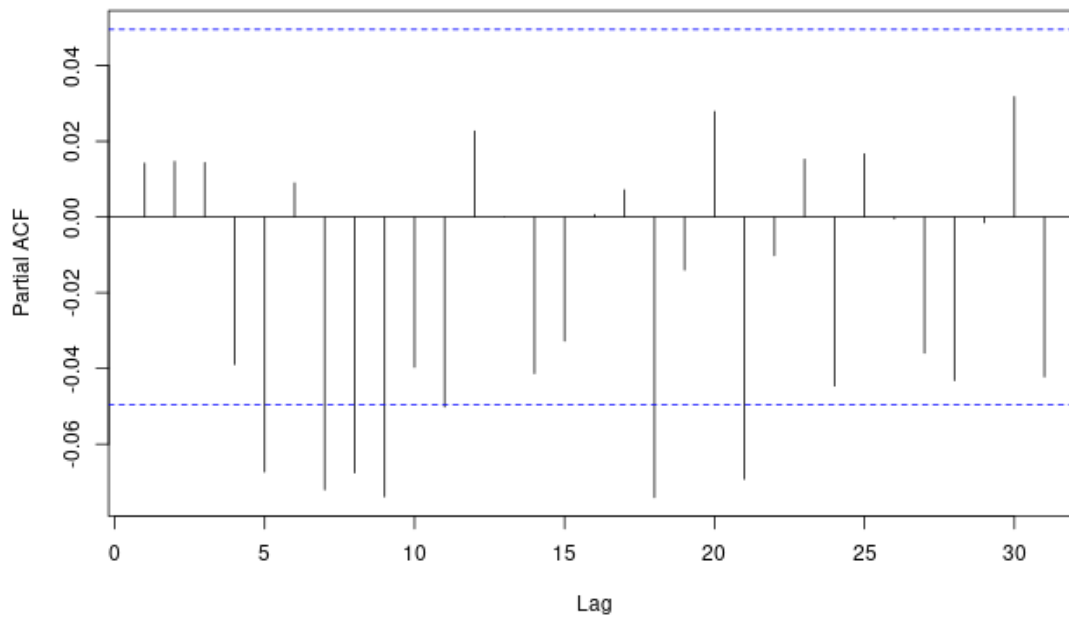
Supplementary File S2 Figure 10: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 10

Subject 11

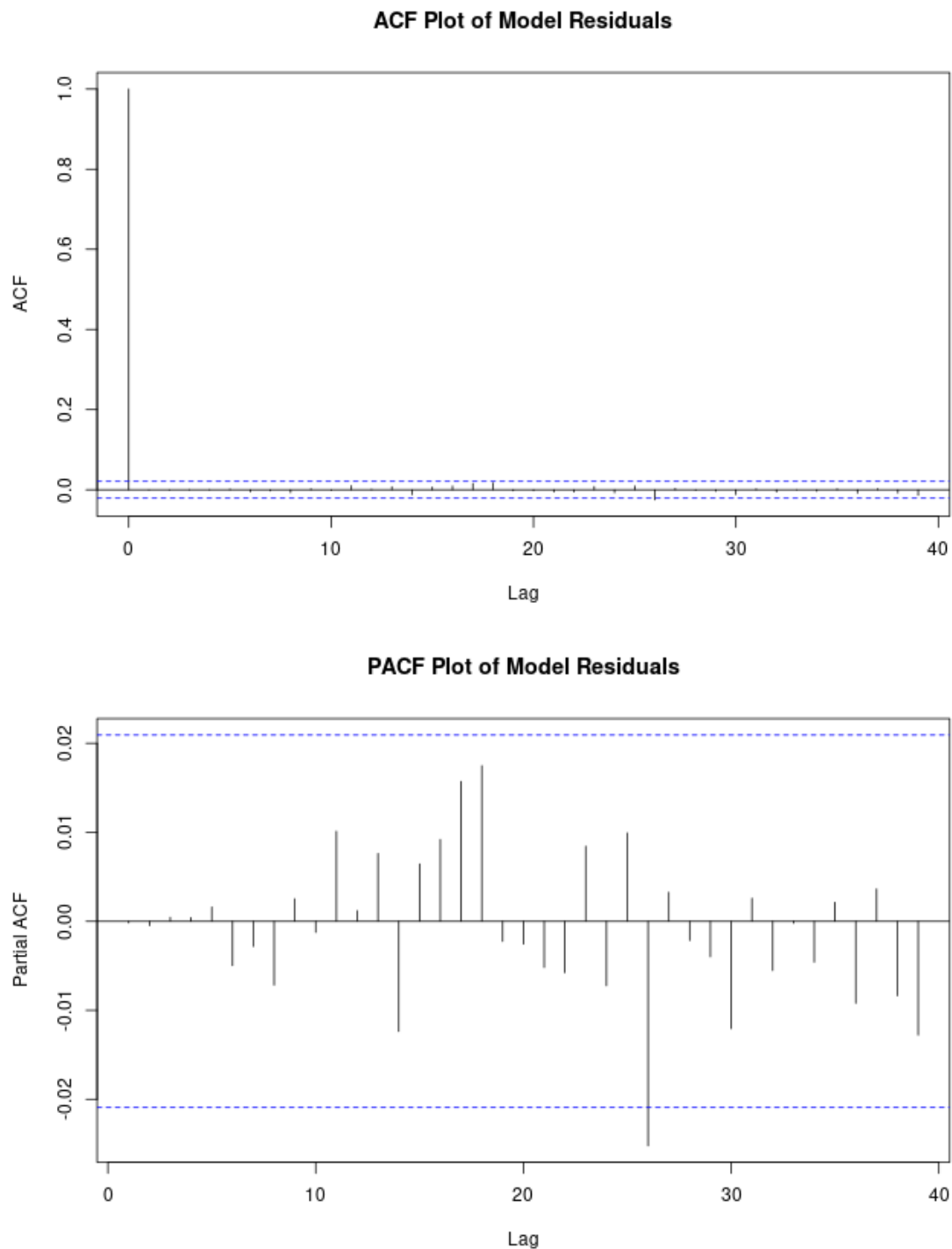
ACF Plot of Model Residuals



PACF Plot of Model Residuals



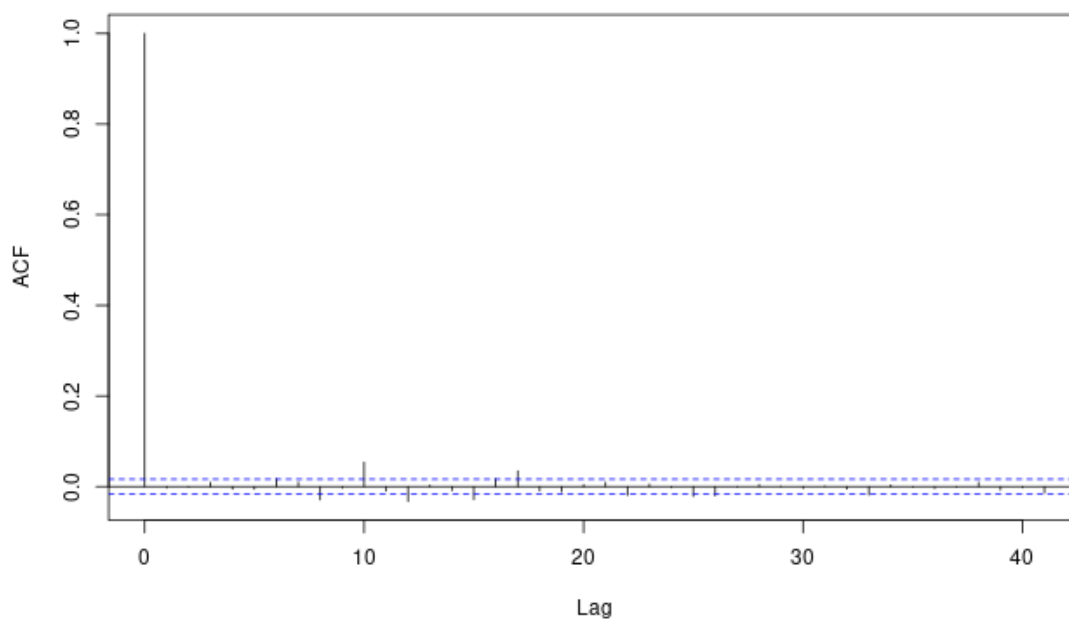
Supplementary File S2 Figure 11: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 11

Subject 12

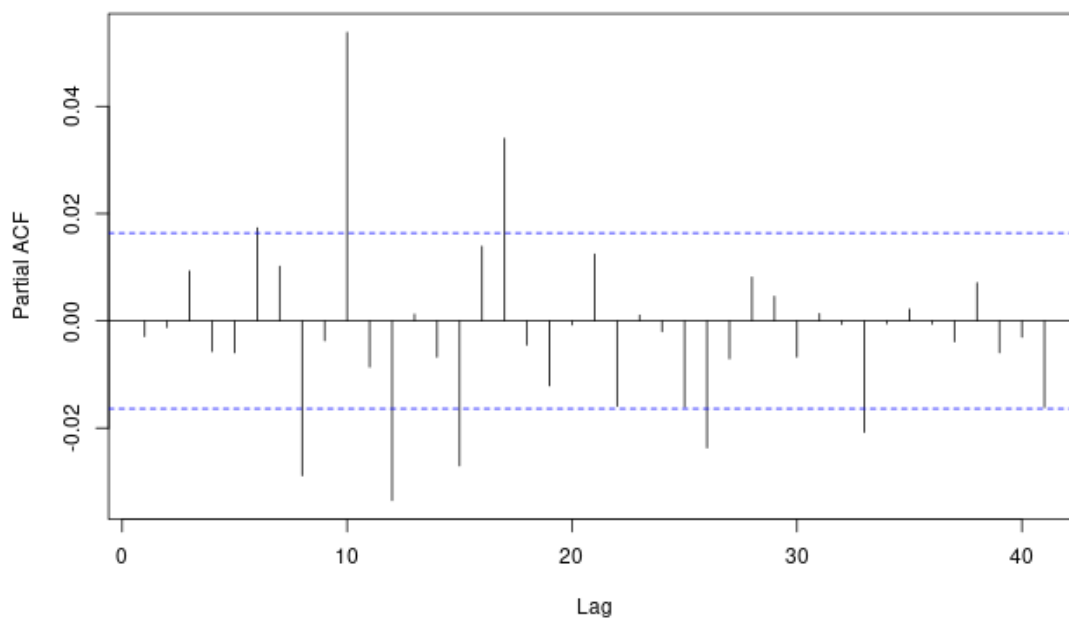
Supplementary File S2 Figure 12: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 12

Subject 13

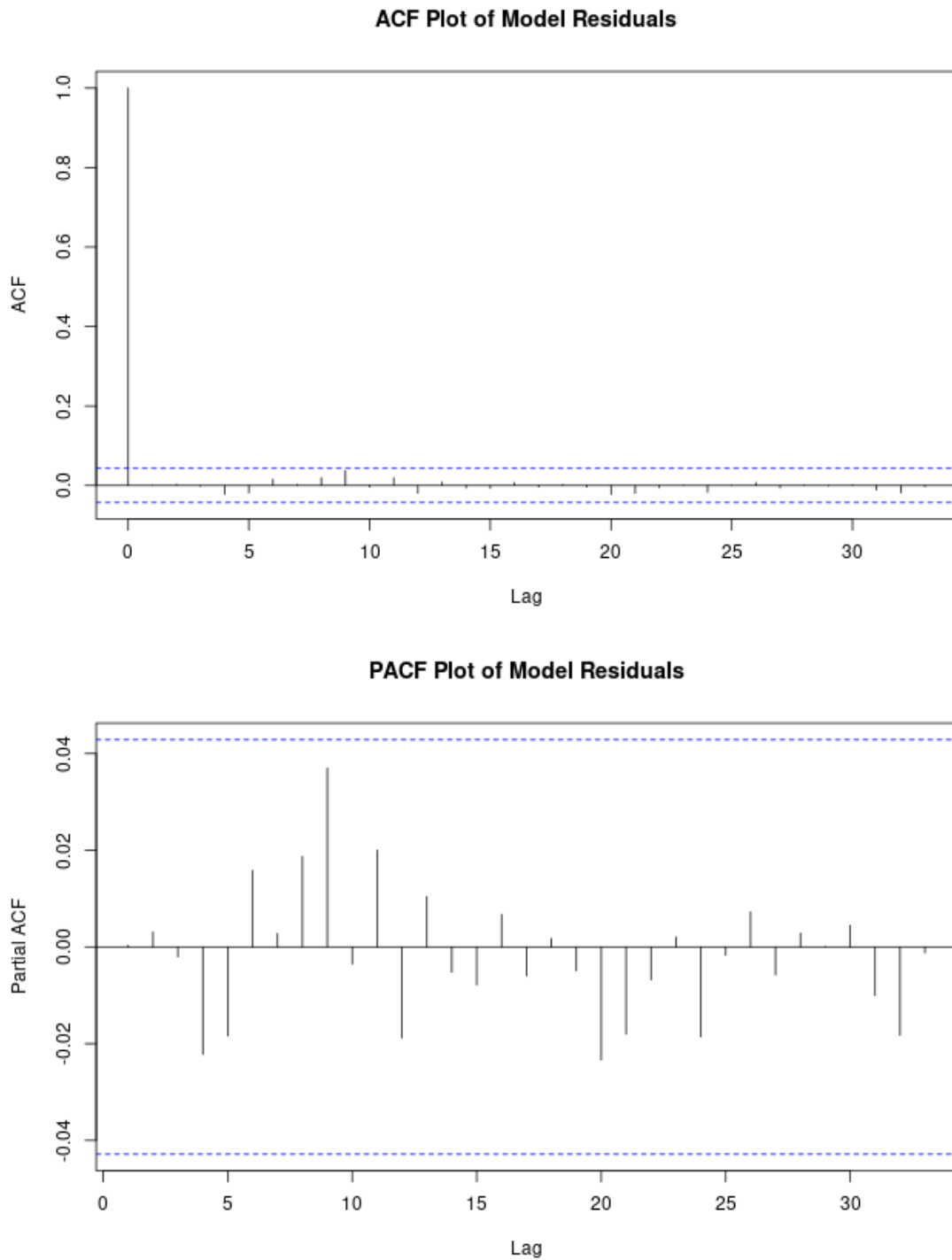
ACF Plot of Model Residuals



PACF Plot of Model Residuals

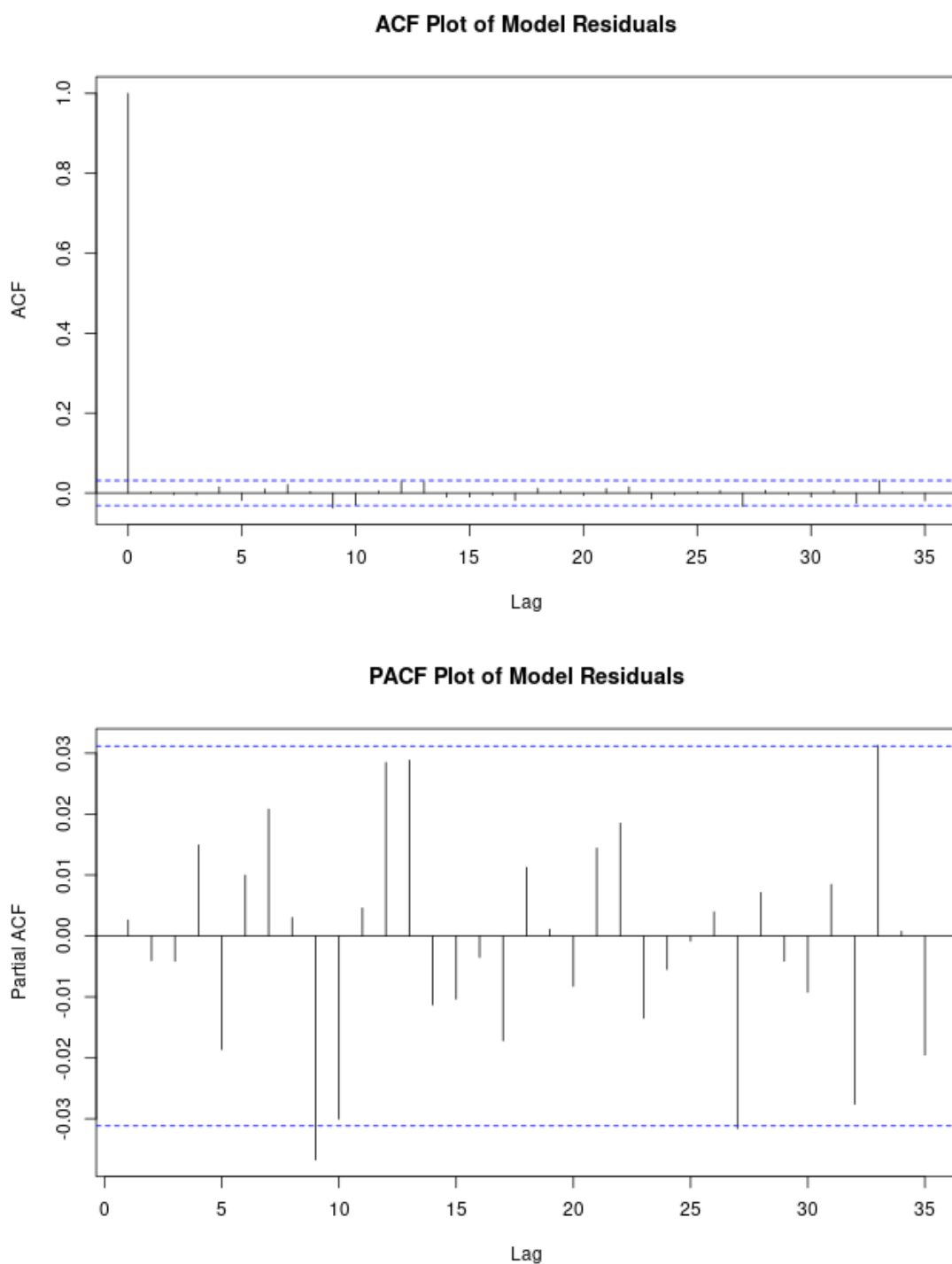


Supplementary File S2 Figure 13: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 13

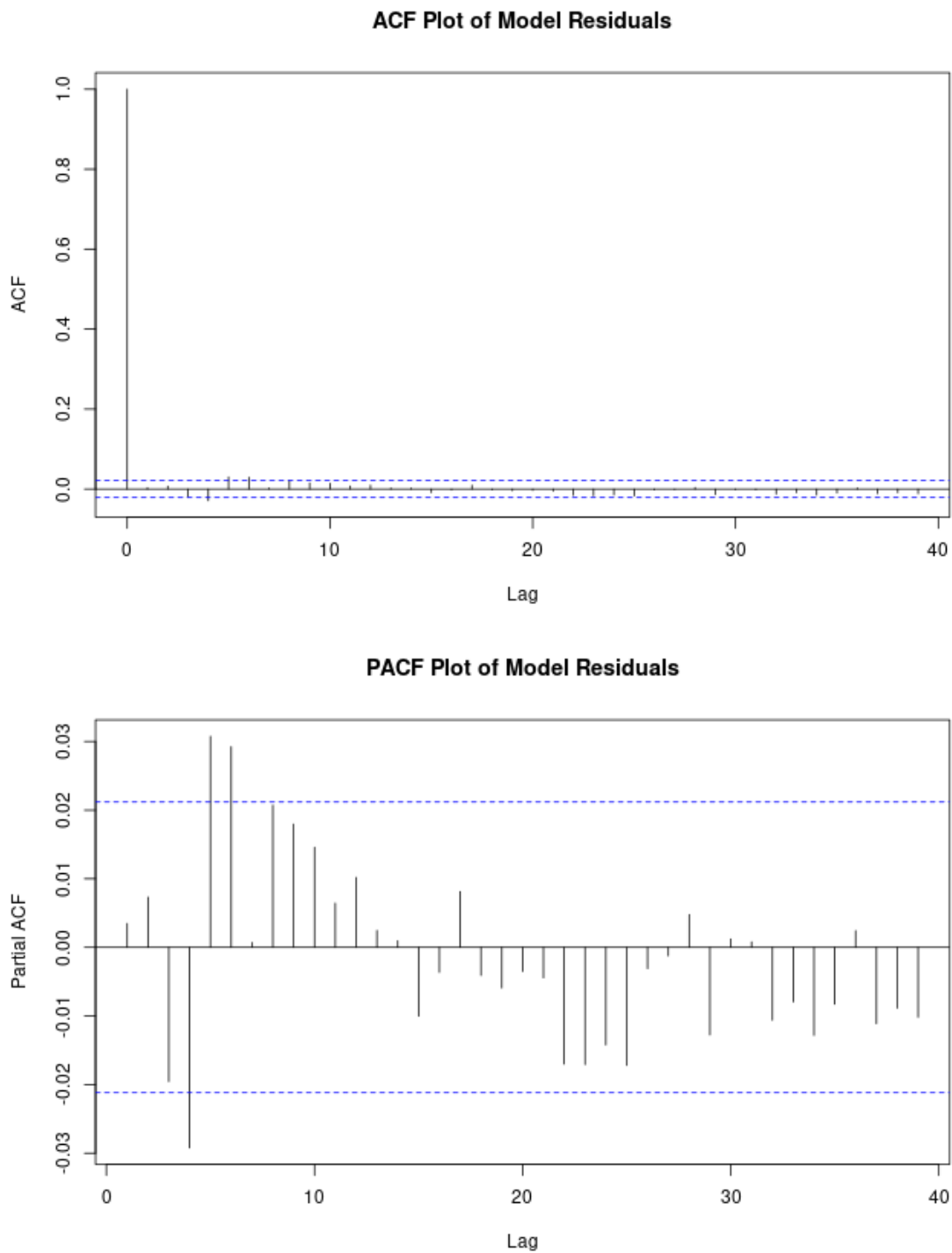
Subject 14

Supplementary File S2 Figure 14: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 14

Subject 15



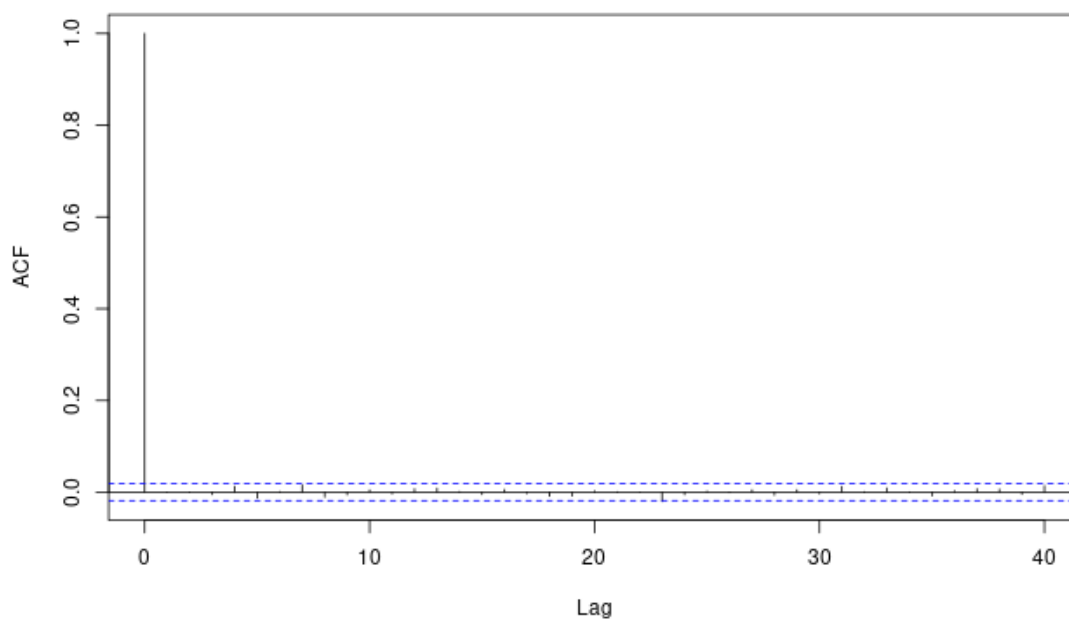
Supplementary File S2 Figure 15: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 15

Subject 16

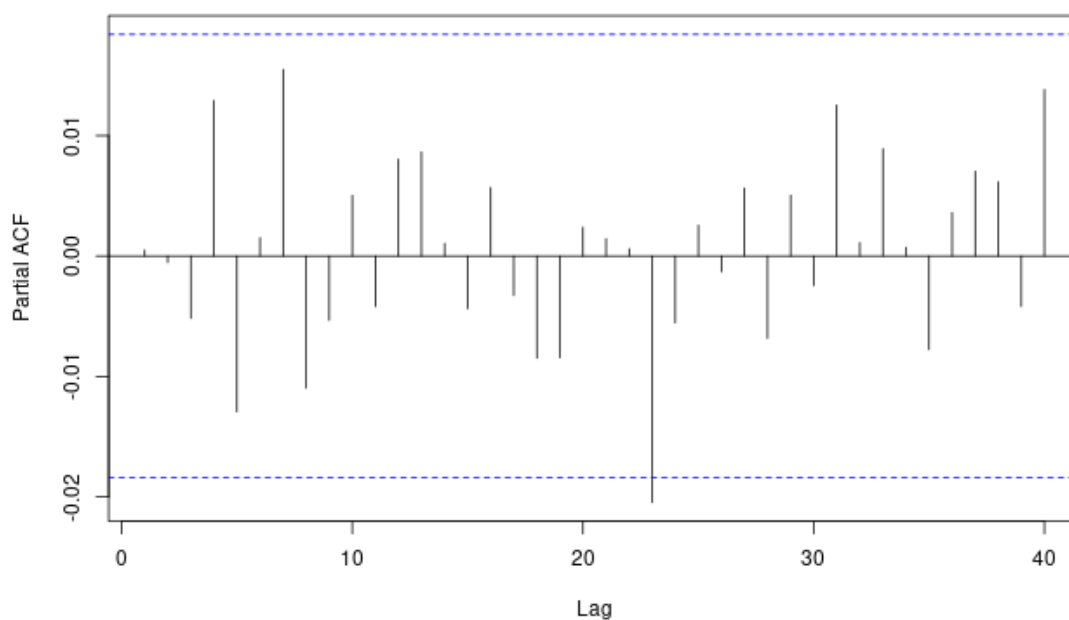
Supplementary File S2 Figure 16: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 16

Subject 17

ACF Plot of Model Residuals

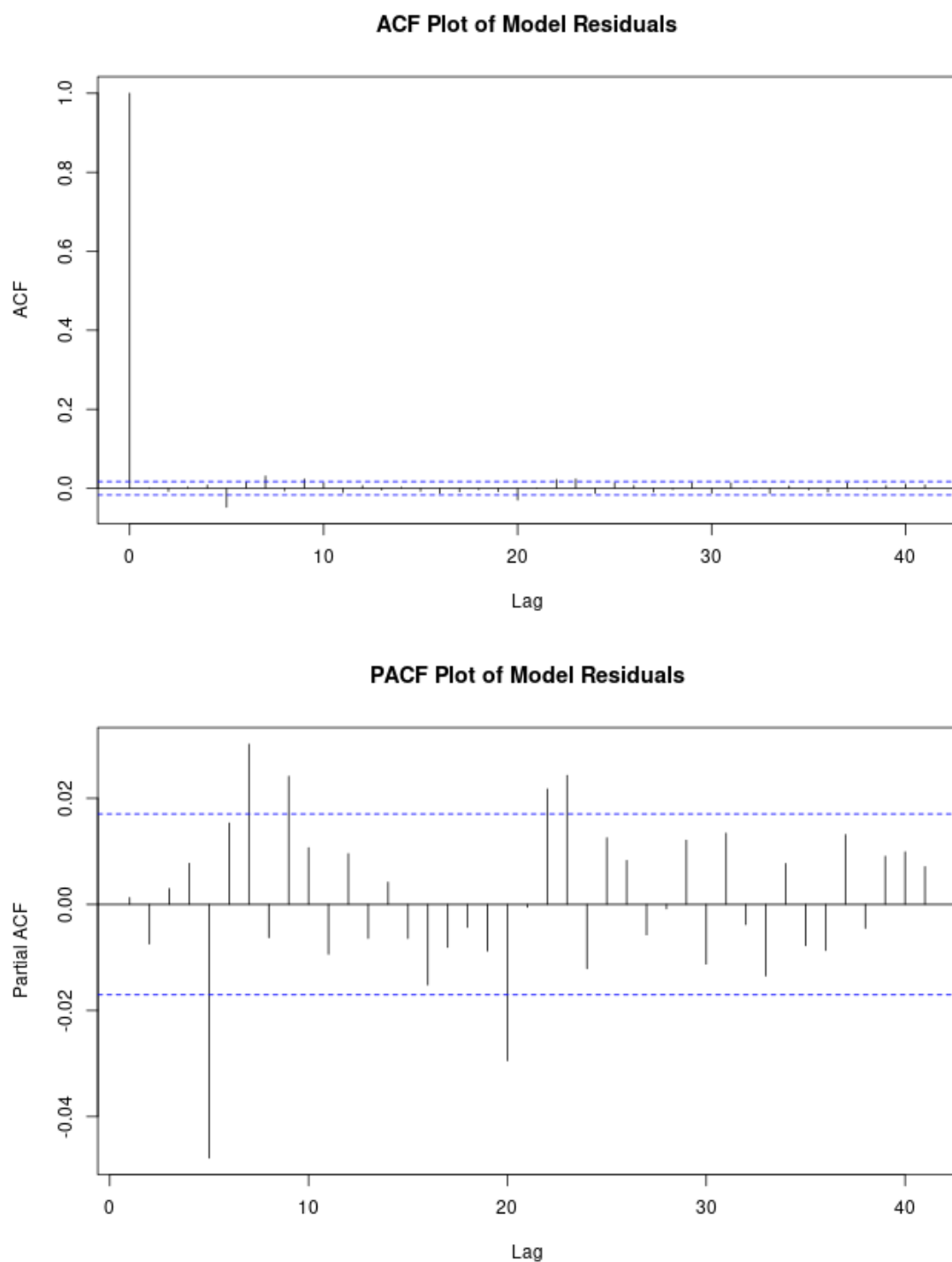


PACF Plot of Model Residuals



Supplementary File S2 Figure 17: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 17

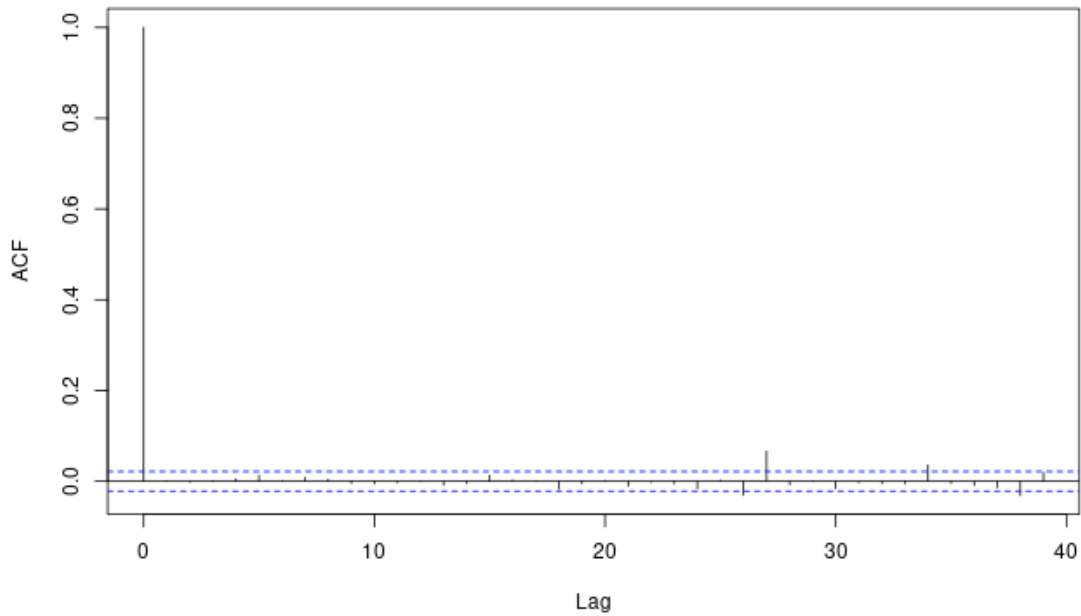
Subject 18



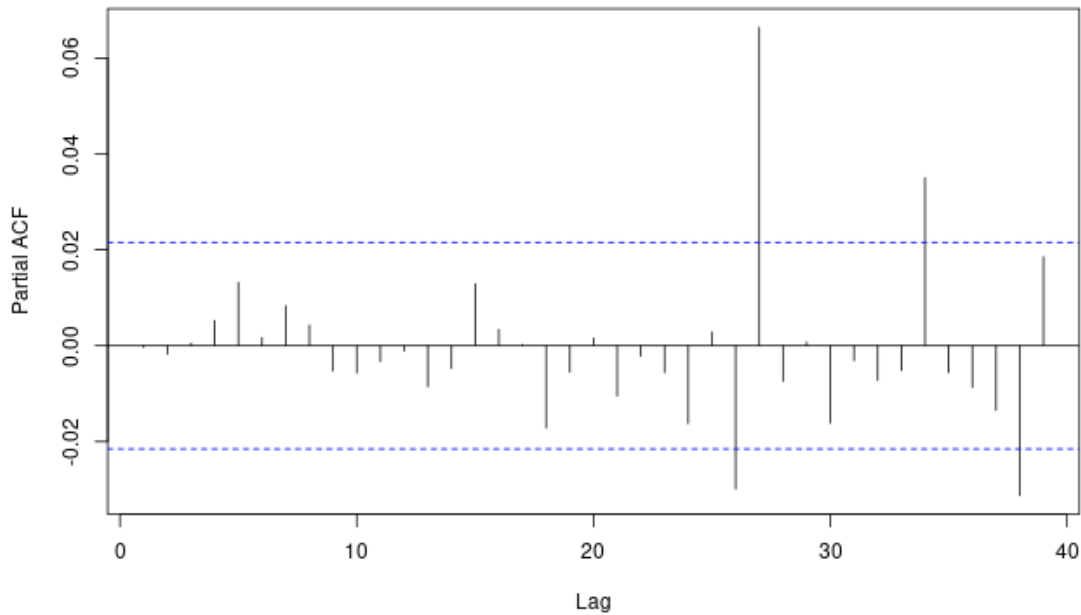
Supplementary File S2 Figure 18: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 18

Subject 19

ACF Plot of Model Residuals

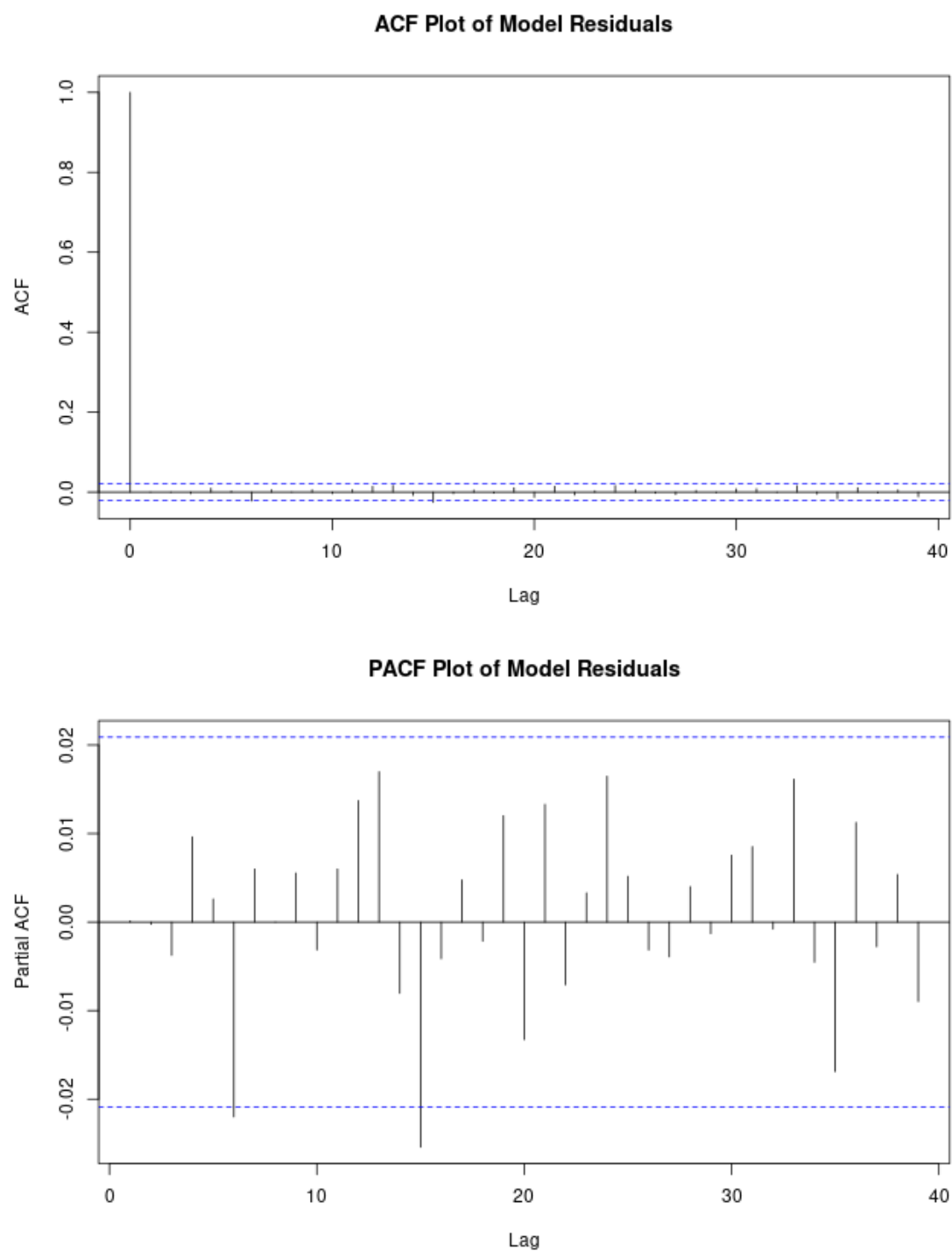


PACF Plot of Model Residuals



Supplementary File S2 Figure 19: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 19

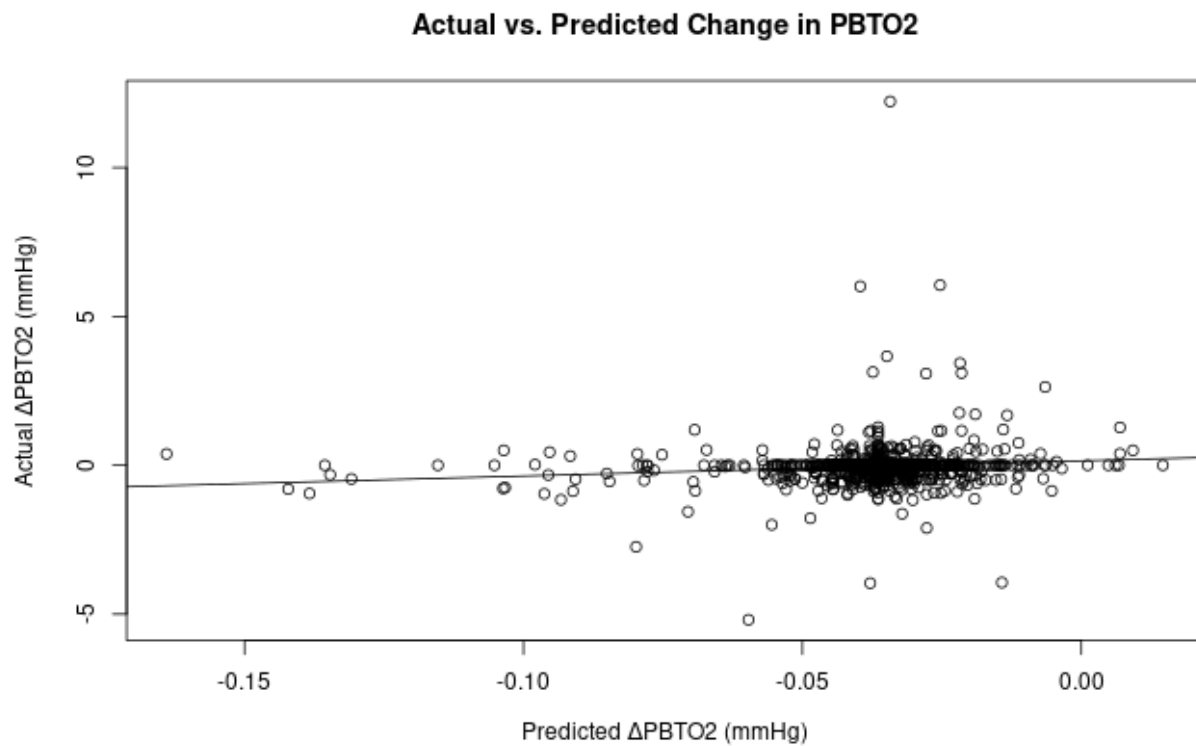
Subject 20



Supplementary File S2 Figure 20: Evaluation residuals of the linear $\Delta\text{PbtO}_2 \sim \Delta\text{rSO}_2\text{Lag1}$ models to ensure autocorrelative structure was accounted for. ACF (top) and PACF (bottom) plots of residuals of the model for Subject 20

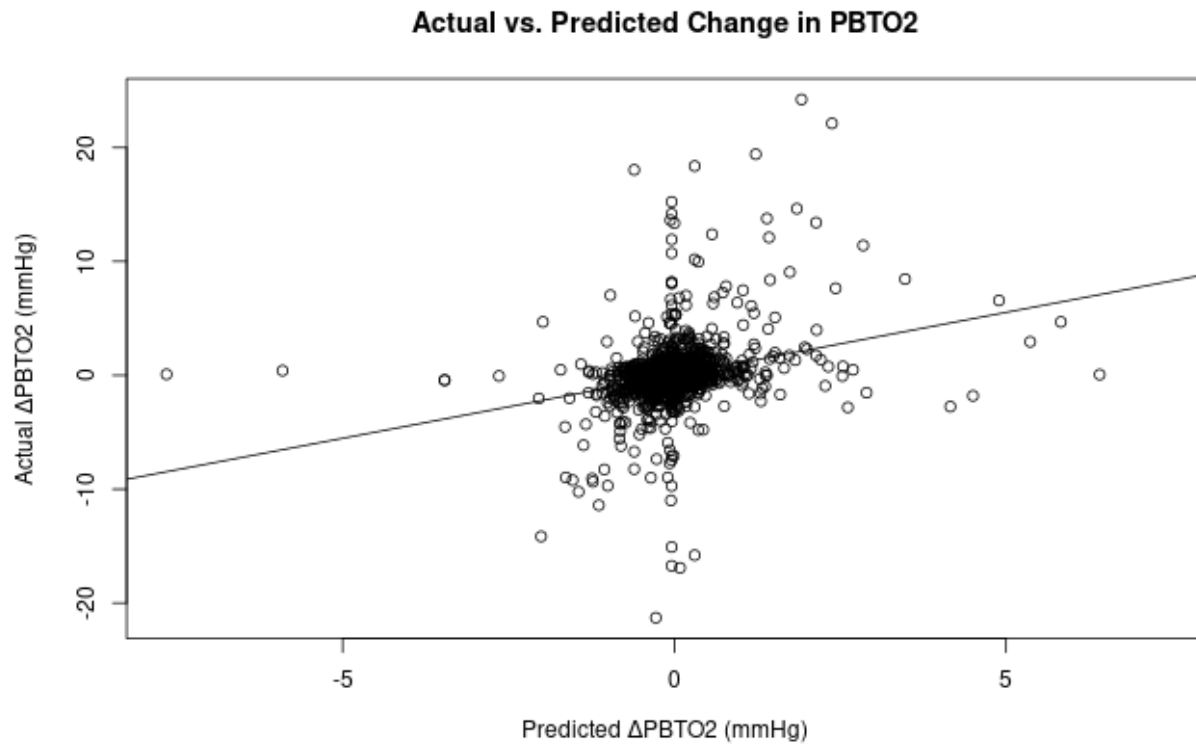
3 Supplementary File S3: Scatter plots of actual vs predicted values of $\Delta PbtO_2$ for each subject

Plot Legend: $\Delta PbtO_2$ = *change in brain tissue oxygen tension.*

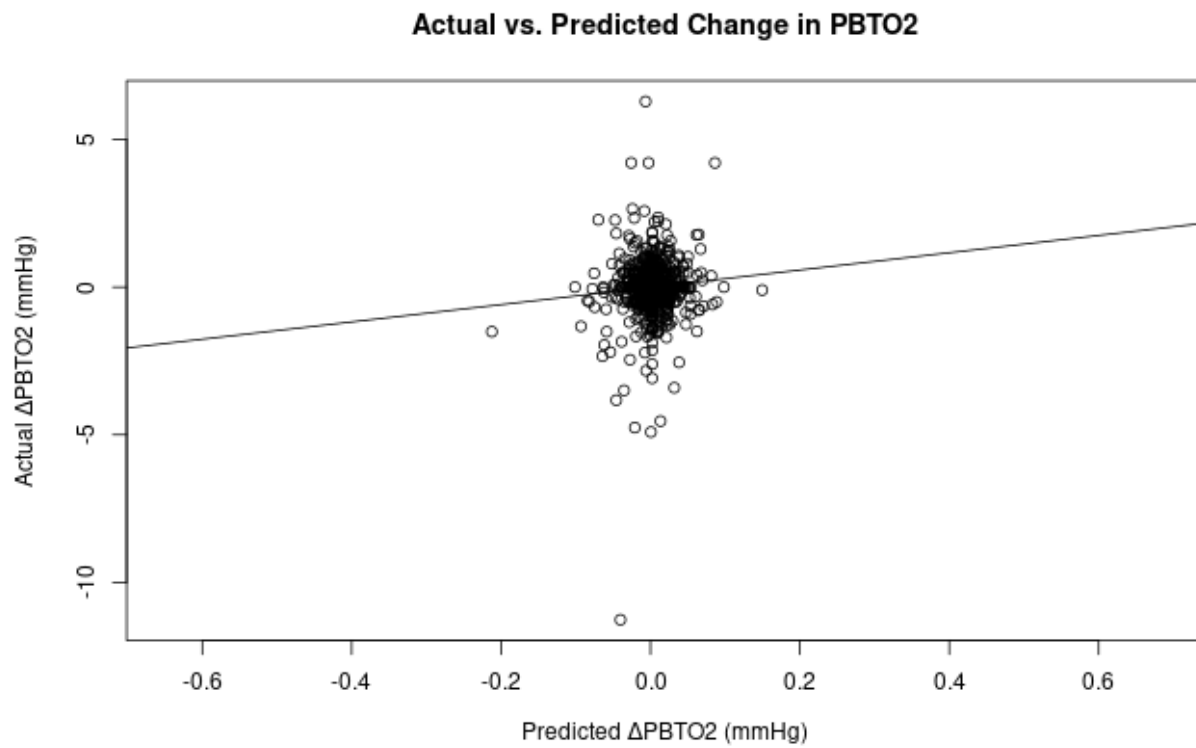
Subject 1

Supplementary File S3 Figure 1: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 1.

Subject 2



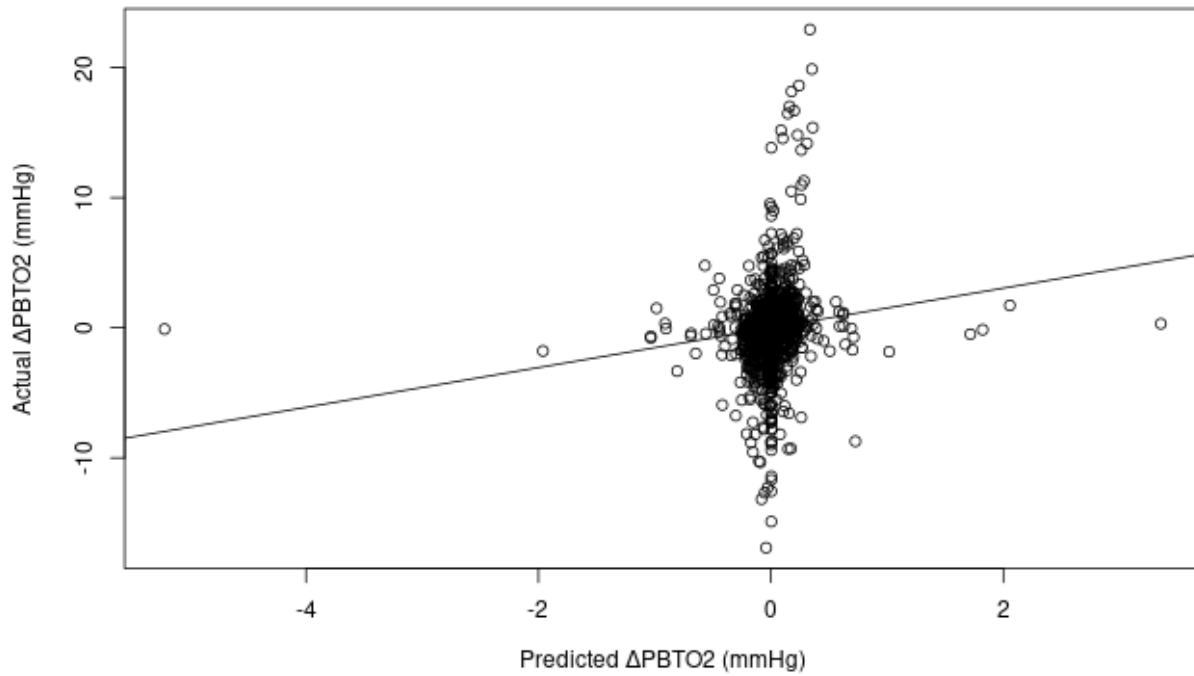
Supplementary File S3 Figure 2: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 2.

Subject 3

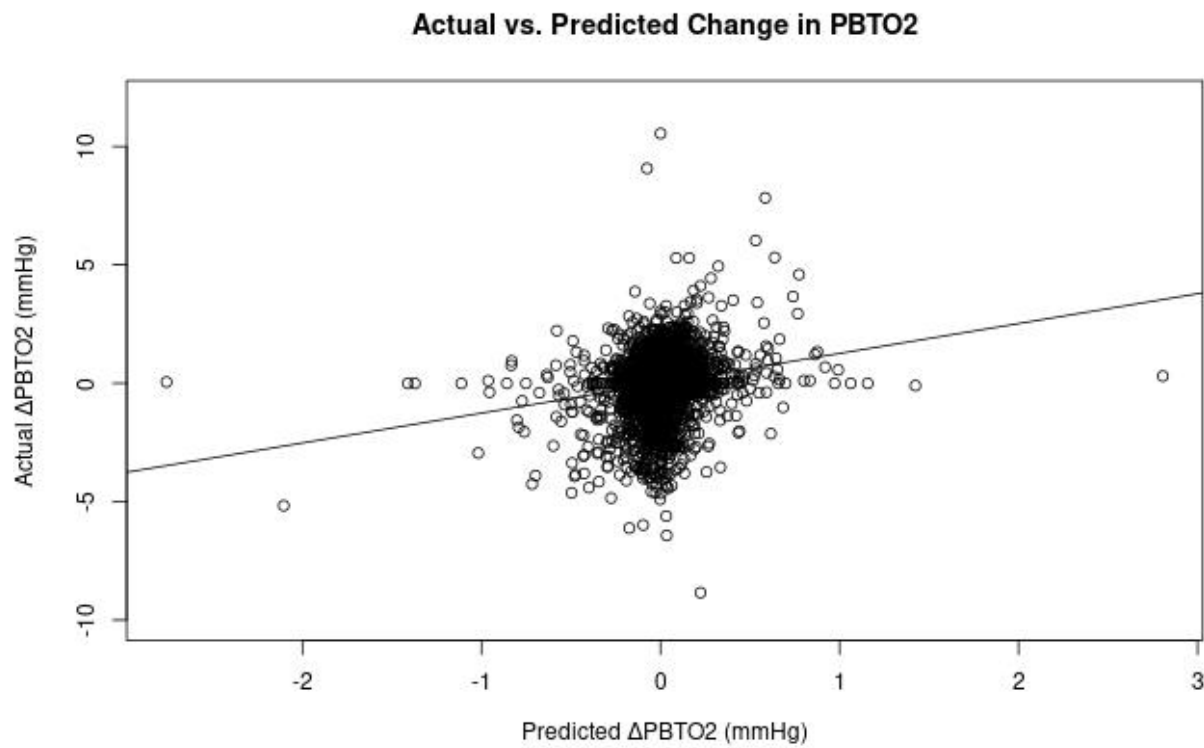
Supplementary File S3 Figure 3: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 3.

Subject 4

Actual vs. Predicted Change in PBT02

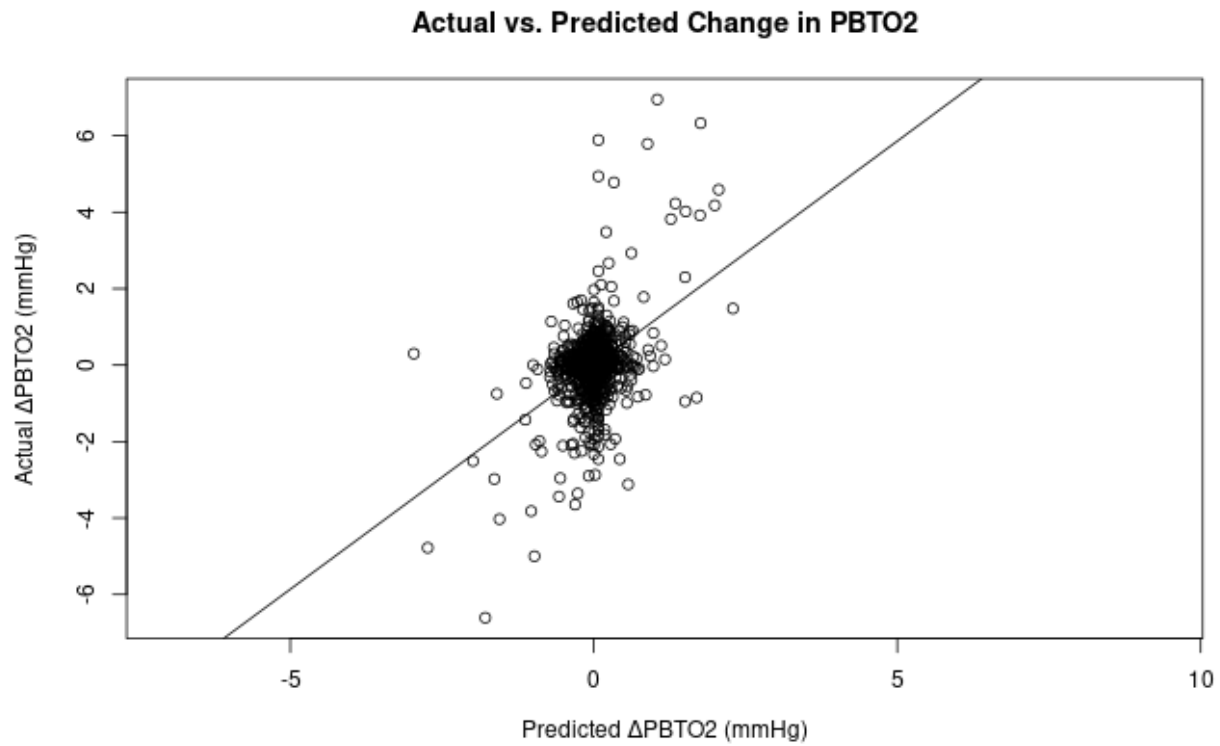


Supplementary File S3 Figure 4: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 4.

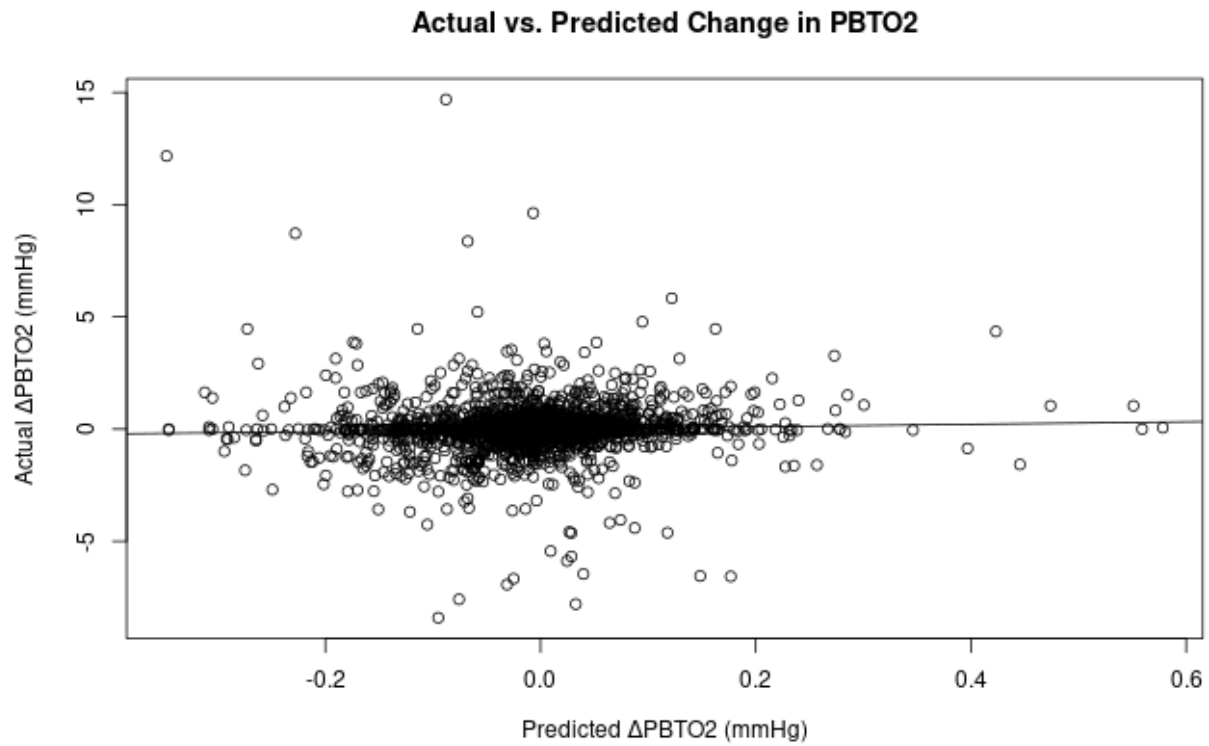
Subject 5

Supplementary File S3 Figure 5: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 5.

Subject 6

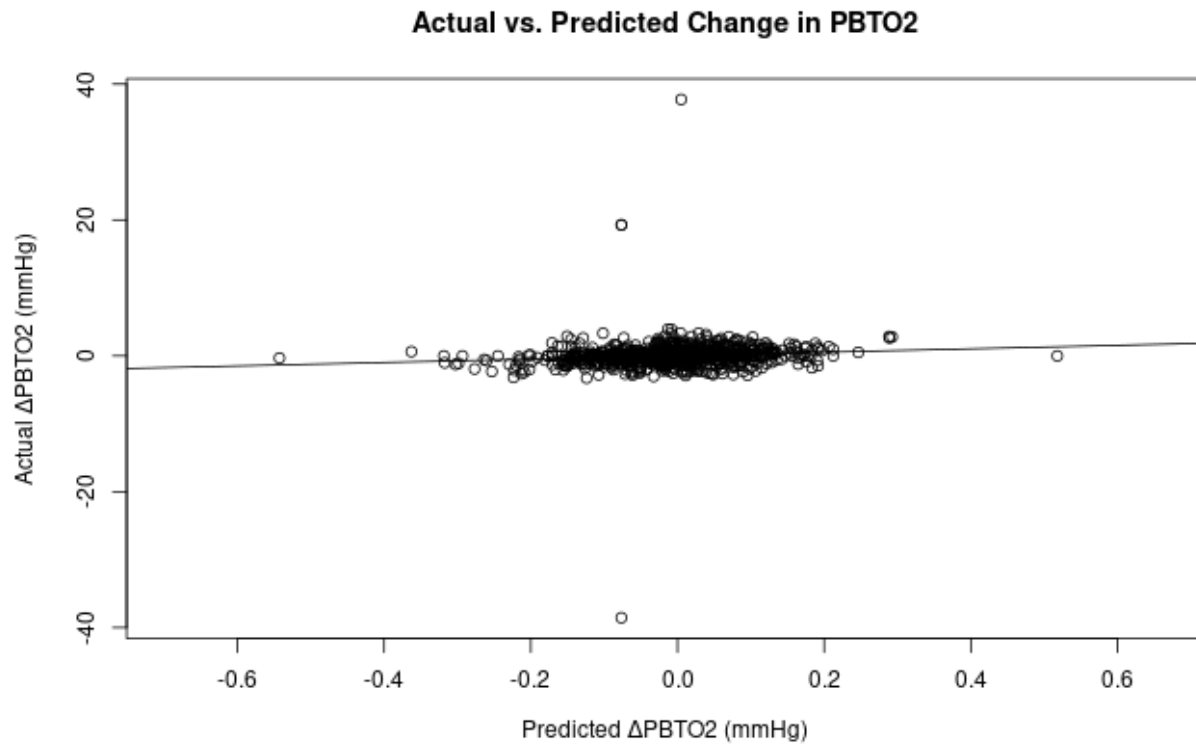


Supplementary File S3 Figure 6: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 6.

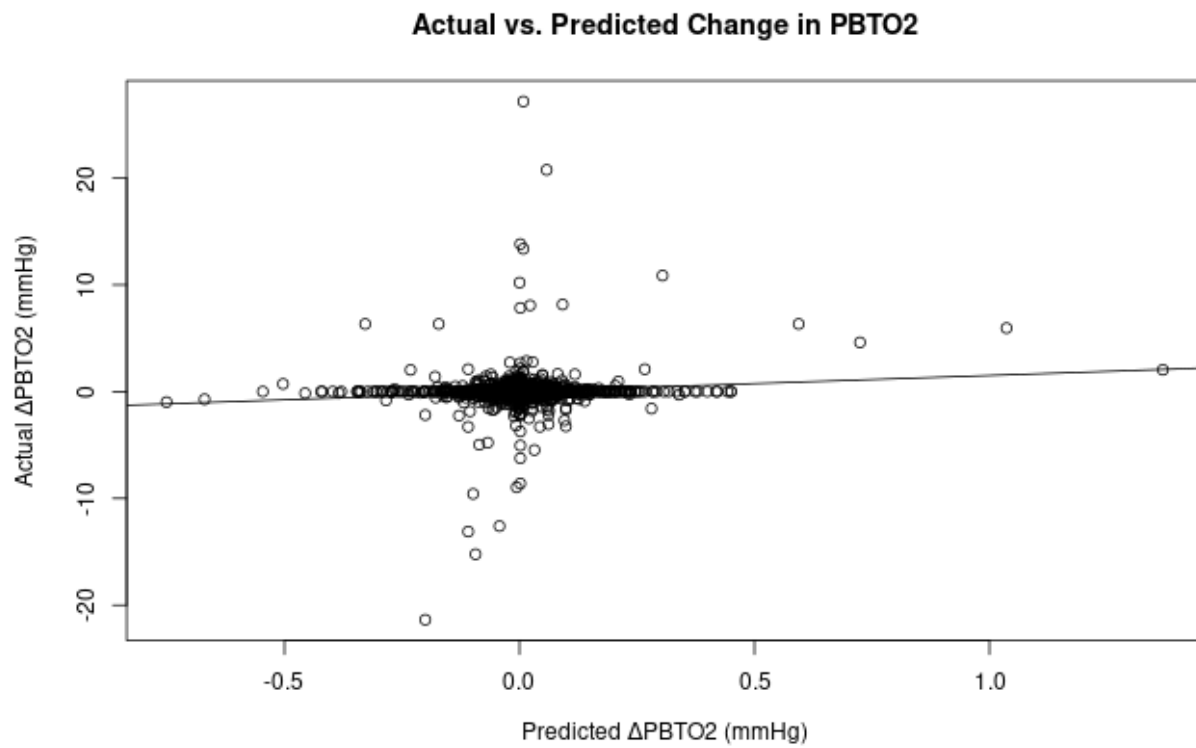
Subject 7

Supplementary File S3 Figure 7: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 7.

Subject 8



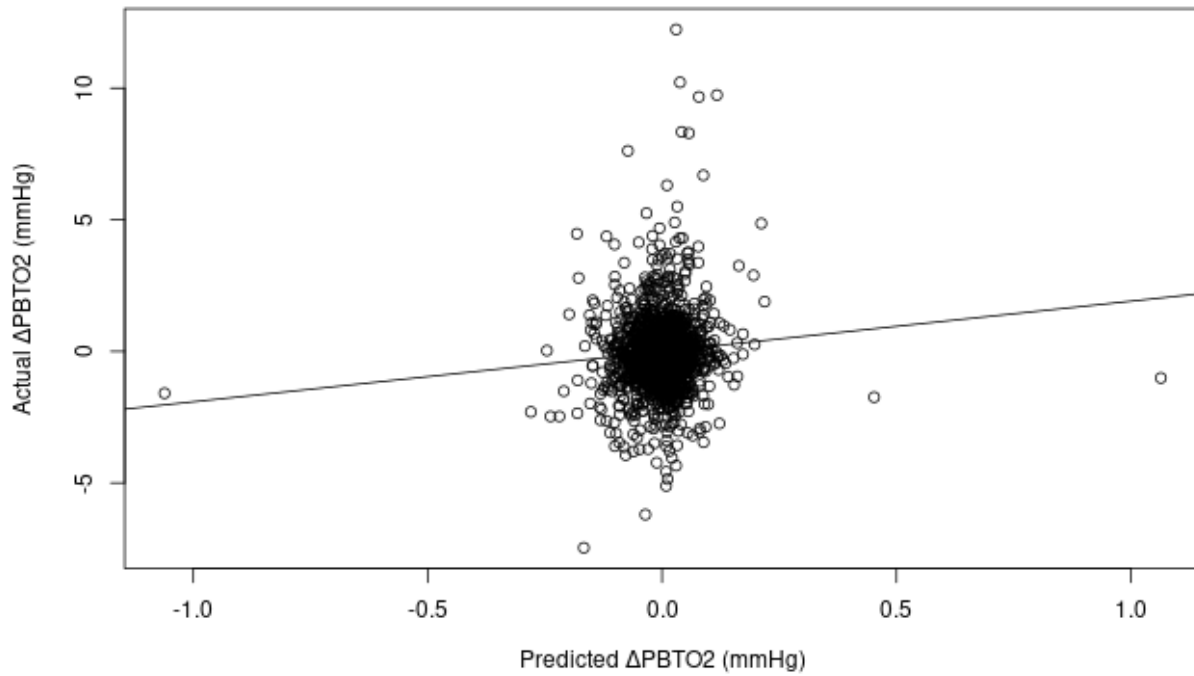
Supplementary File S3 Figure 8: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 8.

Subject 9

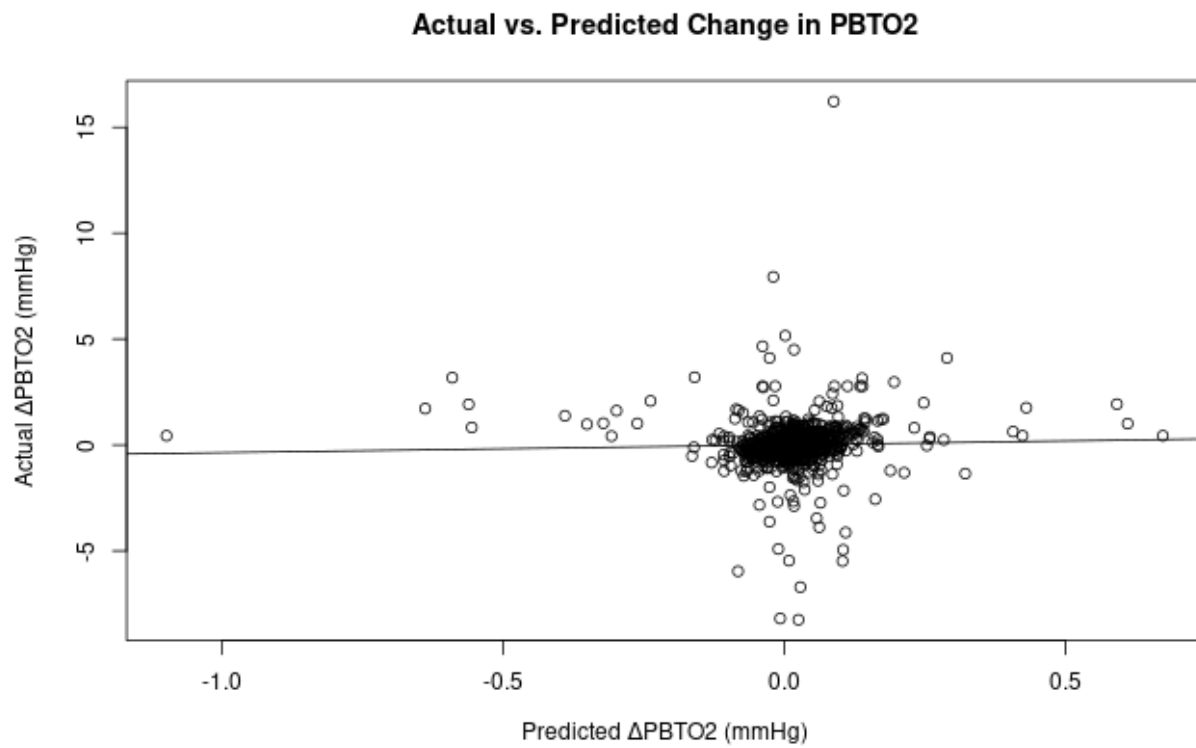
Supplementary File S3 Figure 9: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 9.

Subject 10

Actual vs. Predicted Change in PBT02

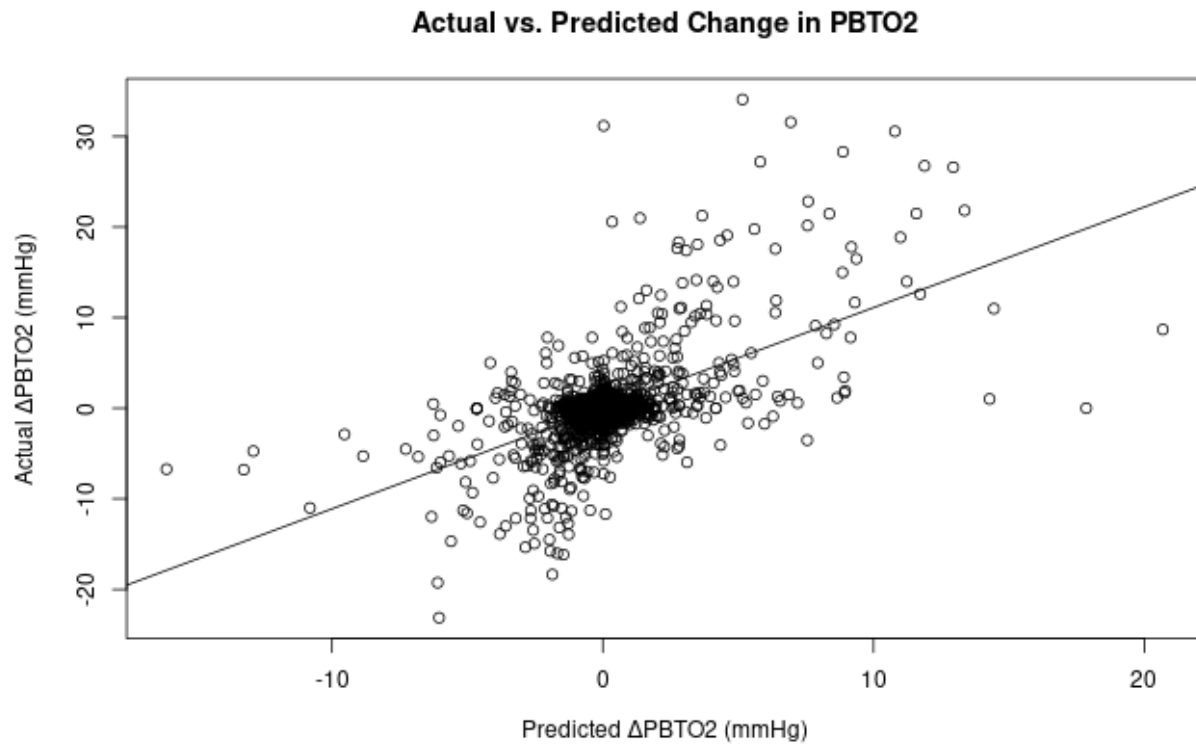


Supplementary File S3 Figure 10: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 10.

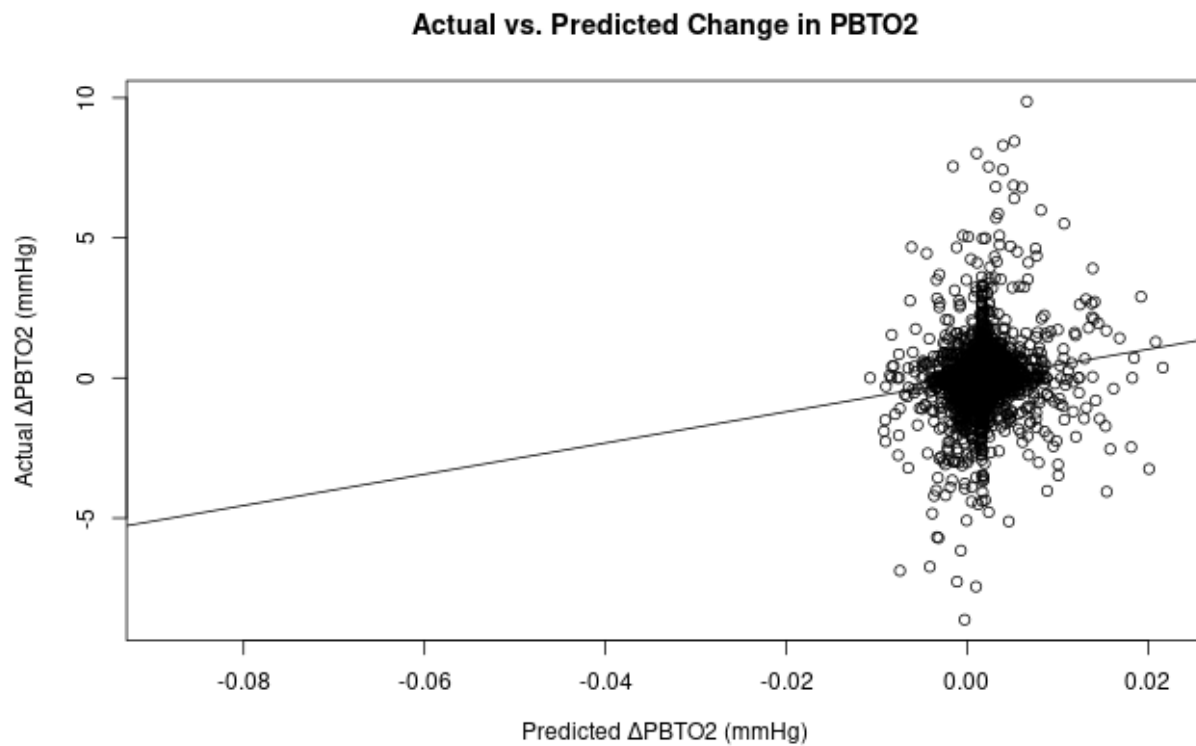
Subject 11

Supplementary File S3 Figure 11: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 11.

Subject 12



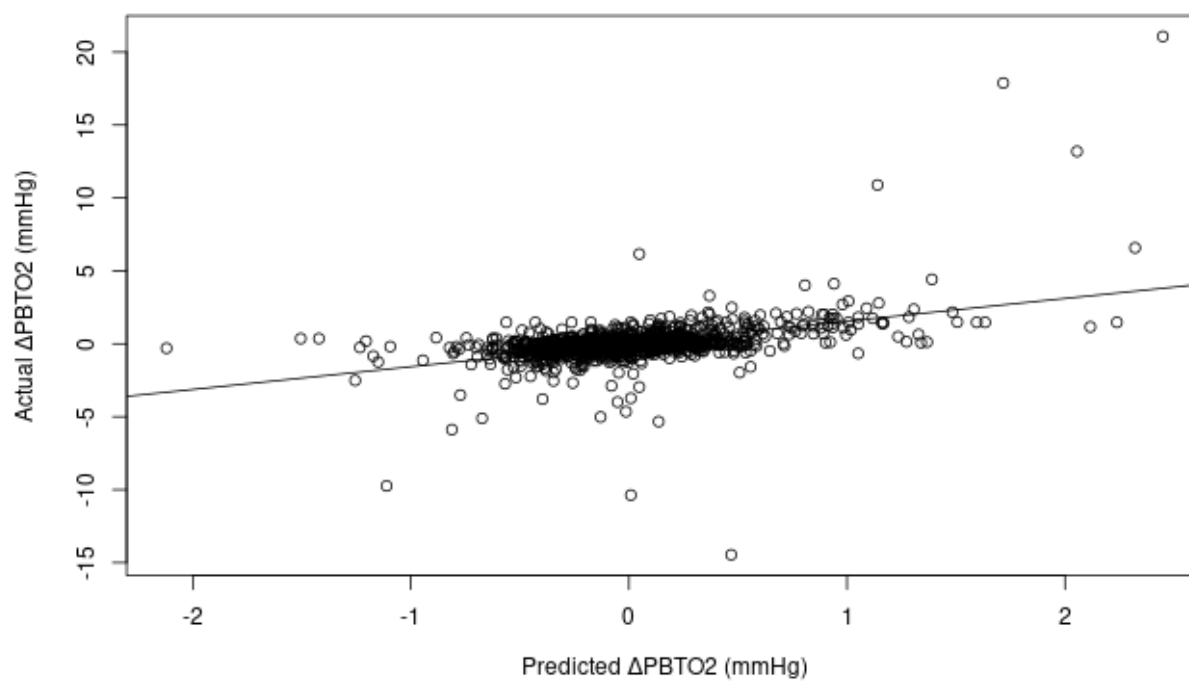
Supplementary File S3 Figure 12: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 12.

Subject 13

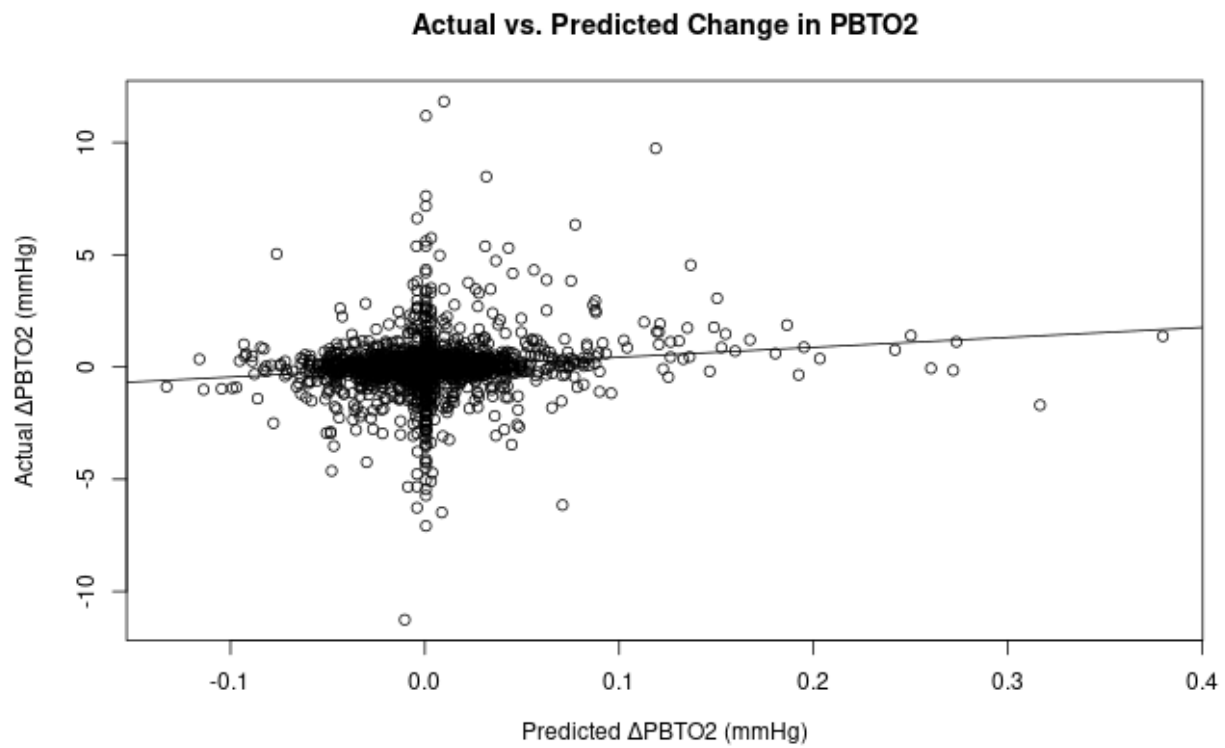
Supplementary File S3 Figure 13: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 13.

Subject 14

Actual vs. Predicted Change in PBT02

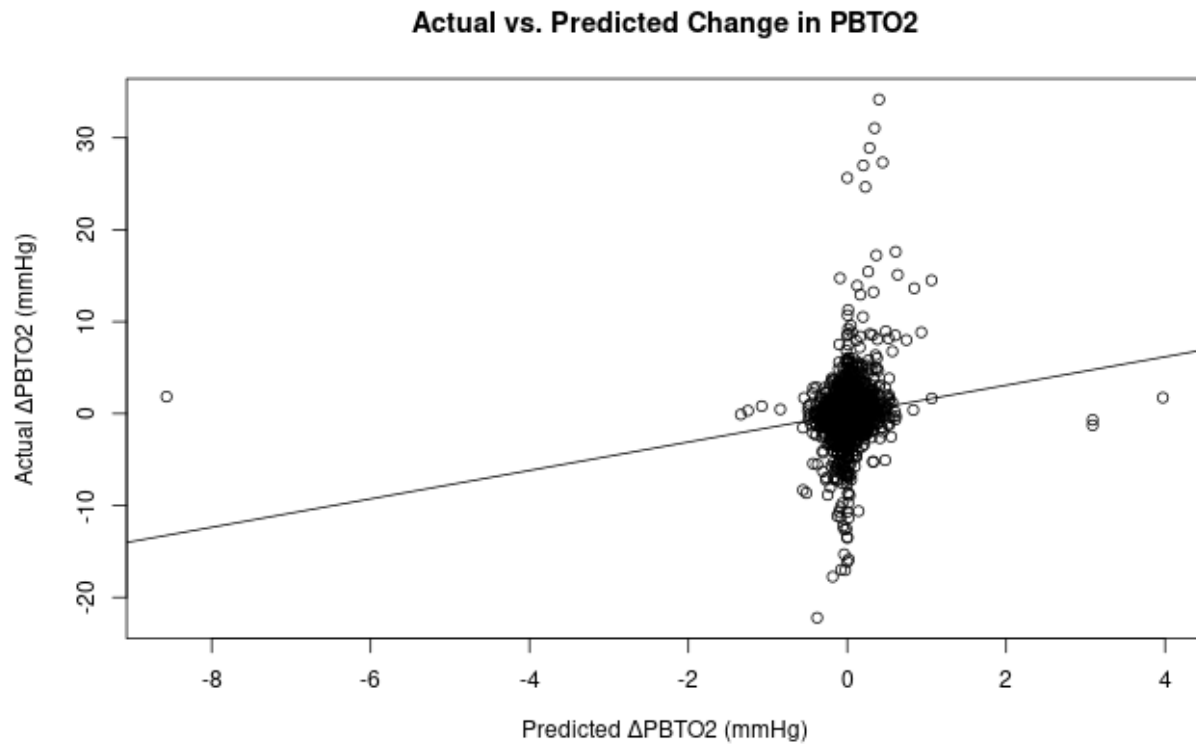


Supplementary File S3 Figure 14: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 14.

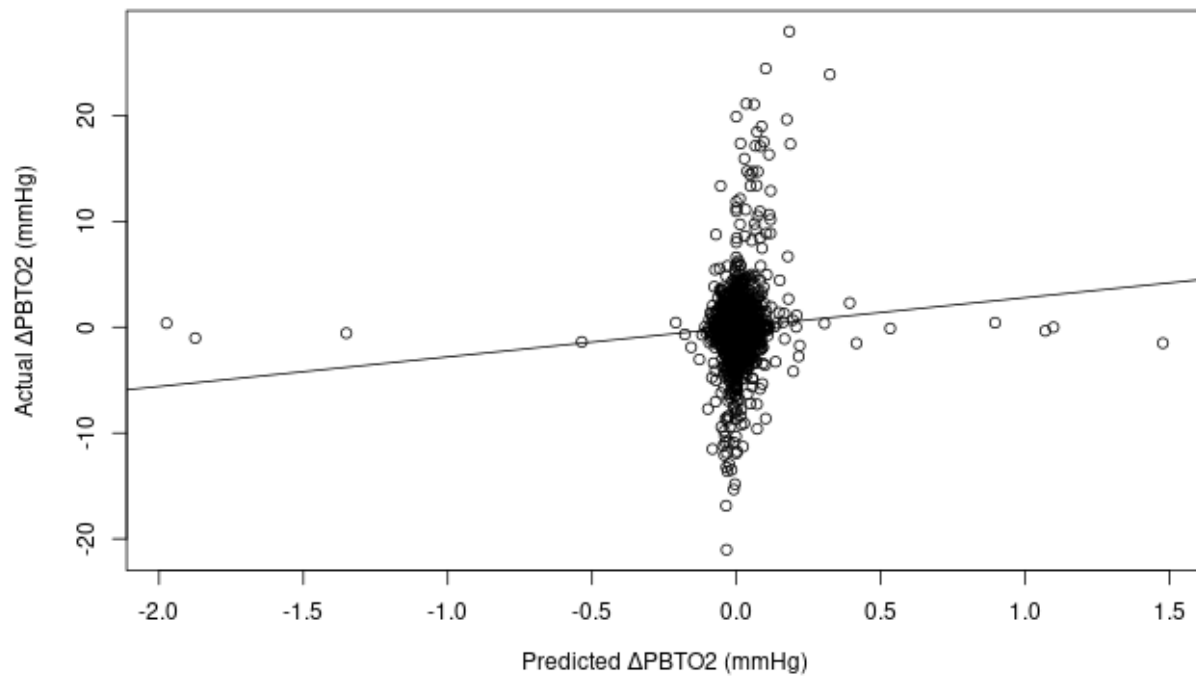
Subject 15

Supplementary File S3 Figure 15: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 15.

Subject 16

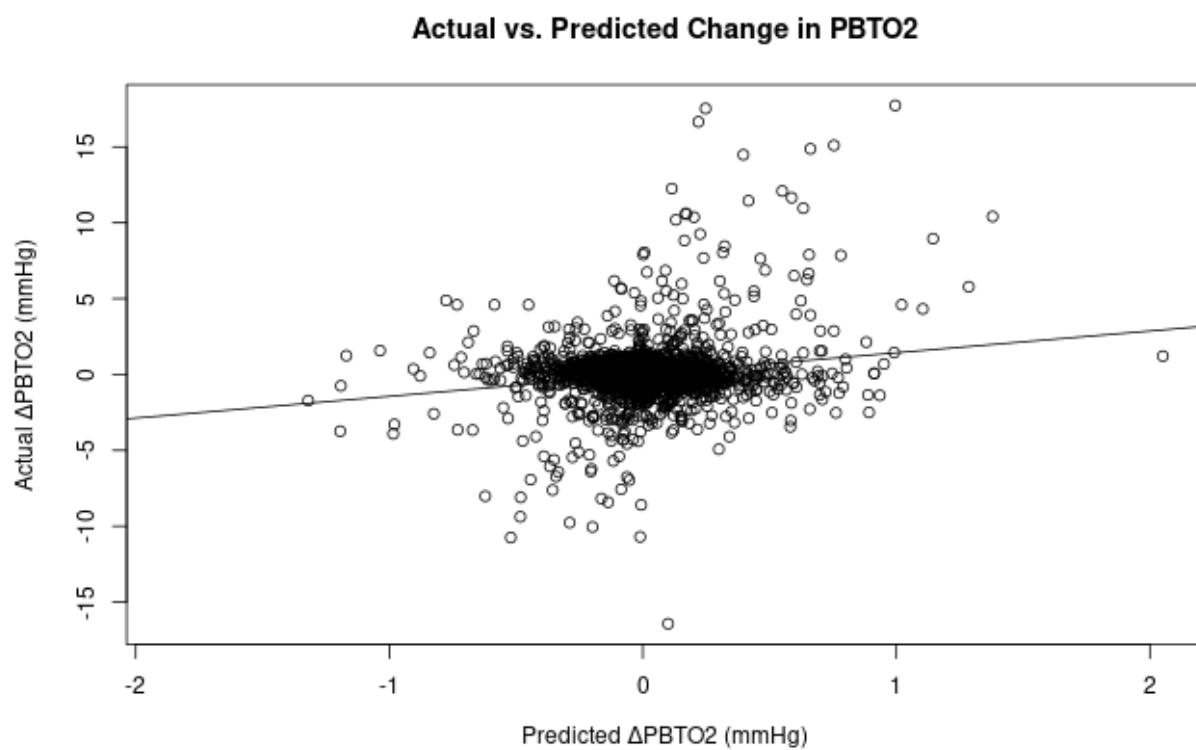


Supplementary File S3 Figure 16: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 16.

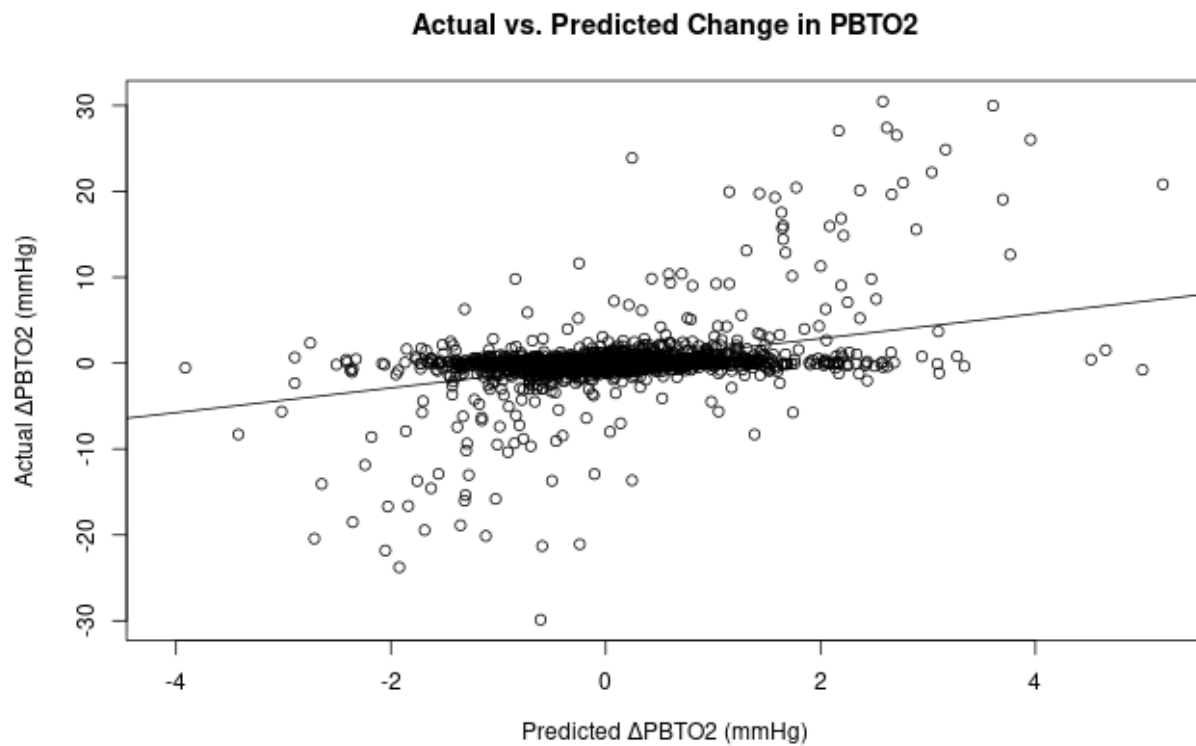
Subject 17**Actual vs. Predicted Change in PBT02**

Supplementary File S3 Figure 17: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 17.

Subject 18

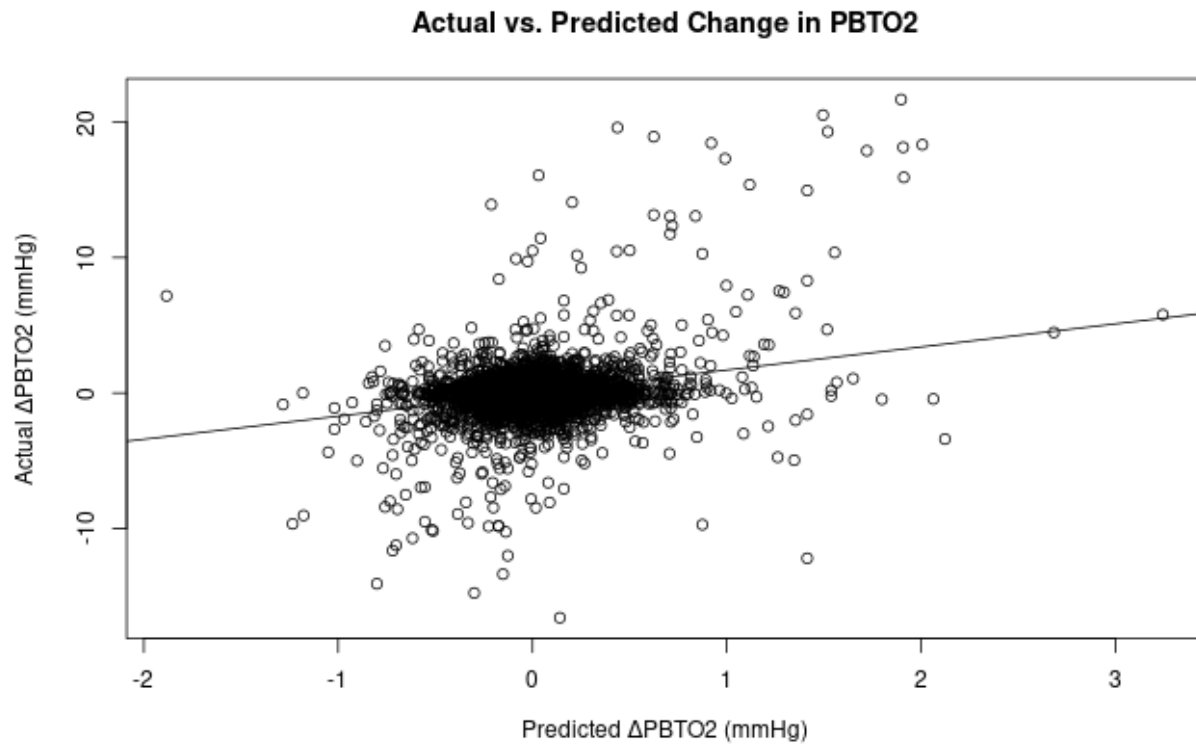


Supplementary File S3 Figure 18: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 18.

Subject 19

Supplementary File S3 Figure 19: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 19.

Subject 20

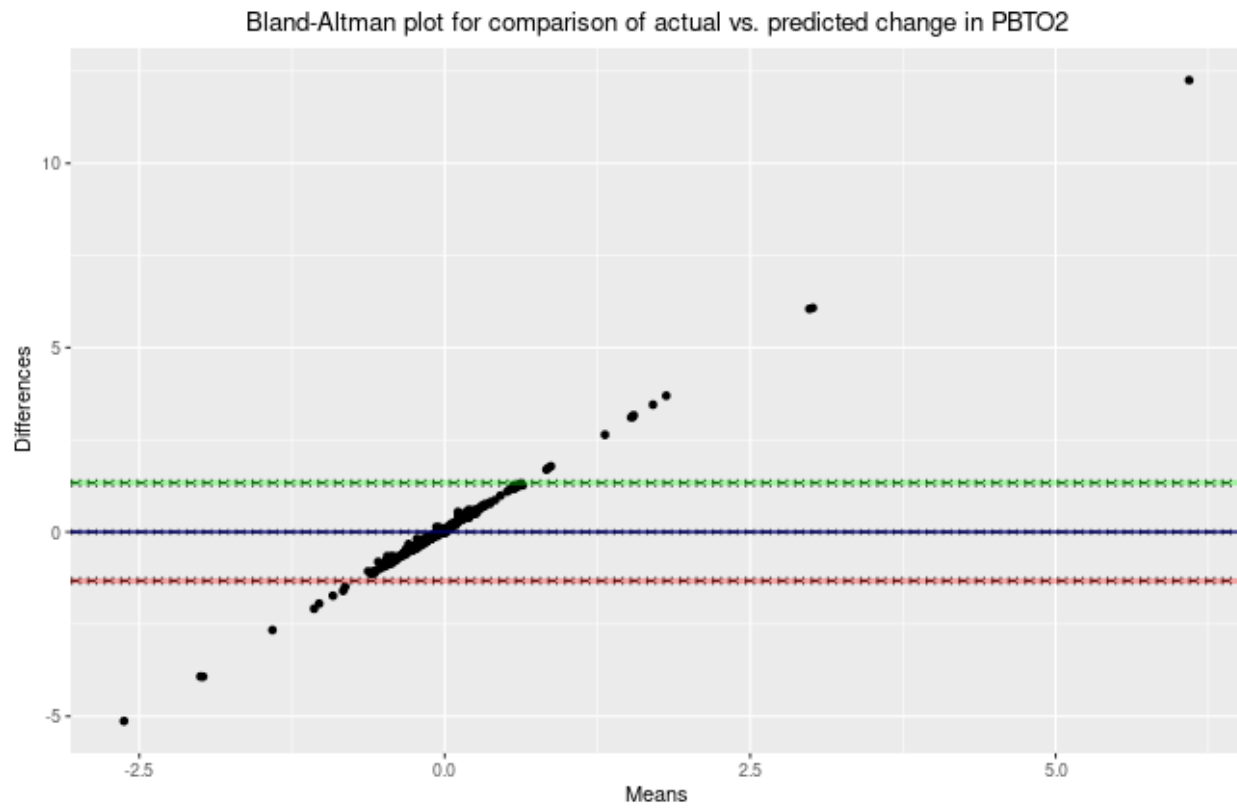


Supplementary File S3 Figure 20: Scatter plot of actual of actual vs predicted values of Δ PbtO2 for Subject 20.

4 **Supplementary File S4: Bland-Altman plots to evaluate model agreement**

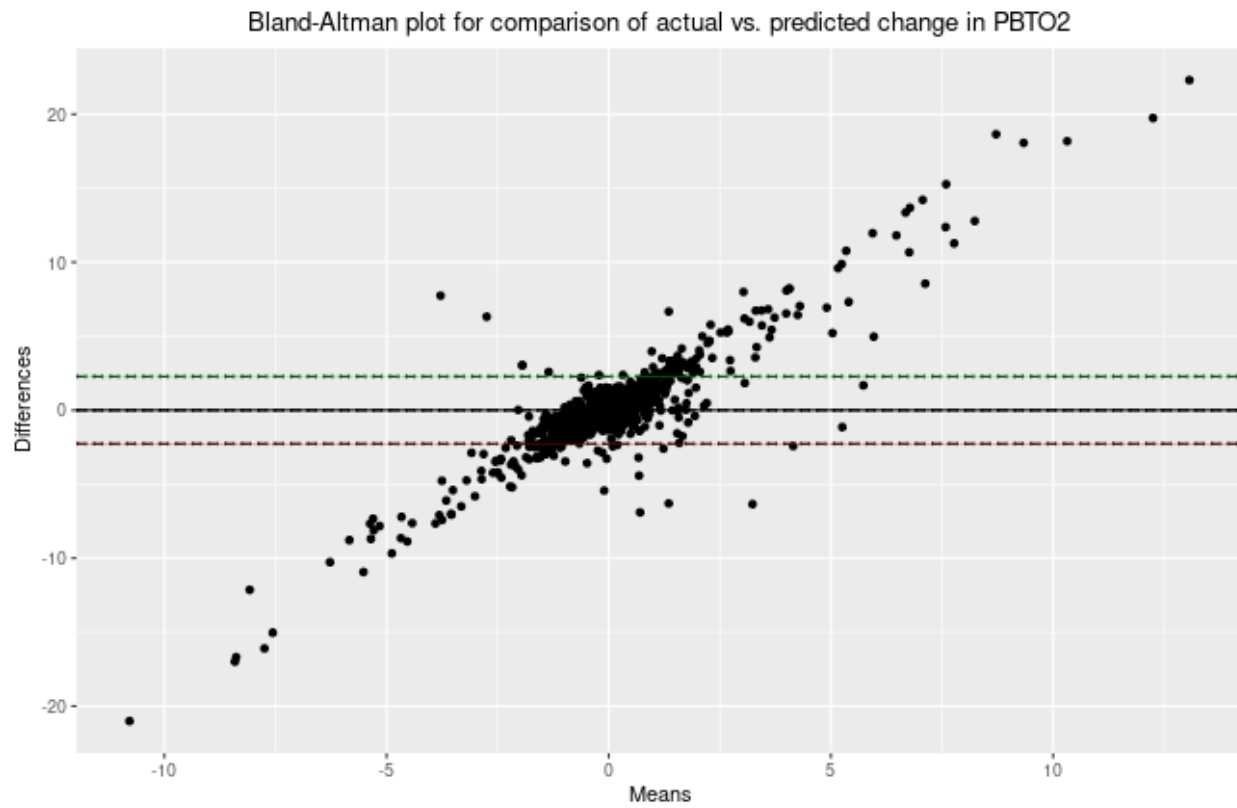
Plot Legend: $\Delta PbtO_2$ = *change in brain tissue oxygen tension*.

Subject 1



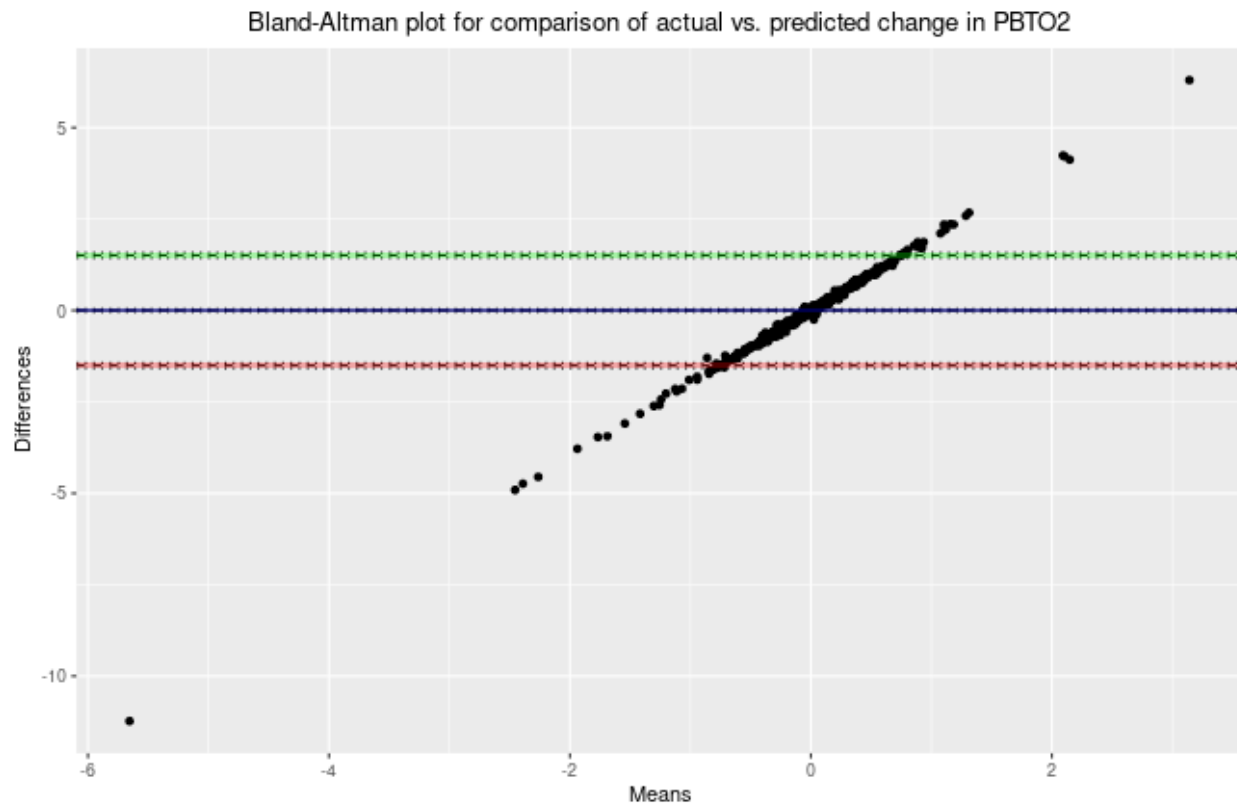
Supplementary File S4 Figure 1: Bland-Altman Plot comparing agreement between predicted values of Δ PbtO₂ and actual values of Δ PbtO₂ for Subject 1

Subject 2



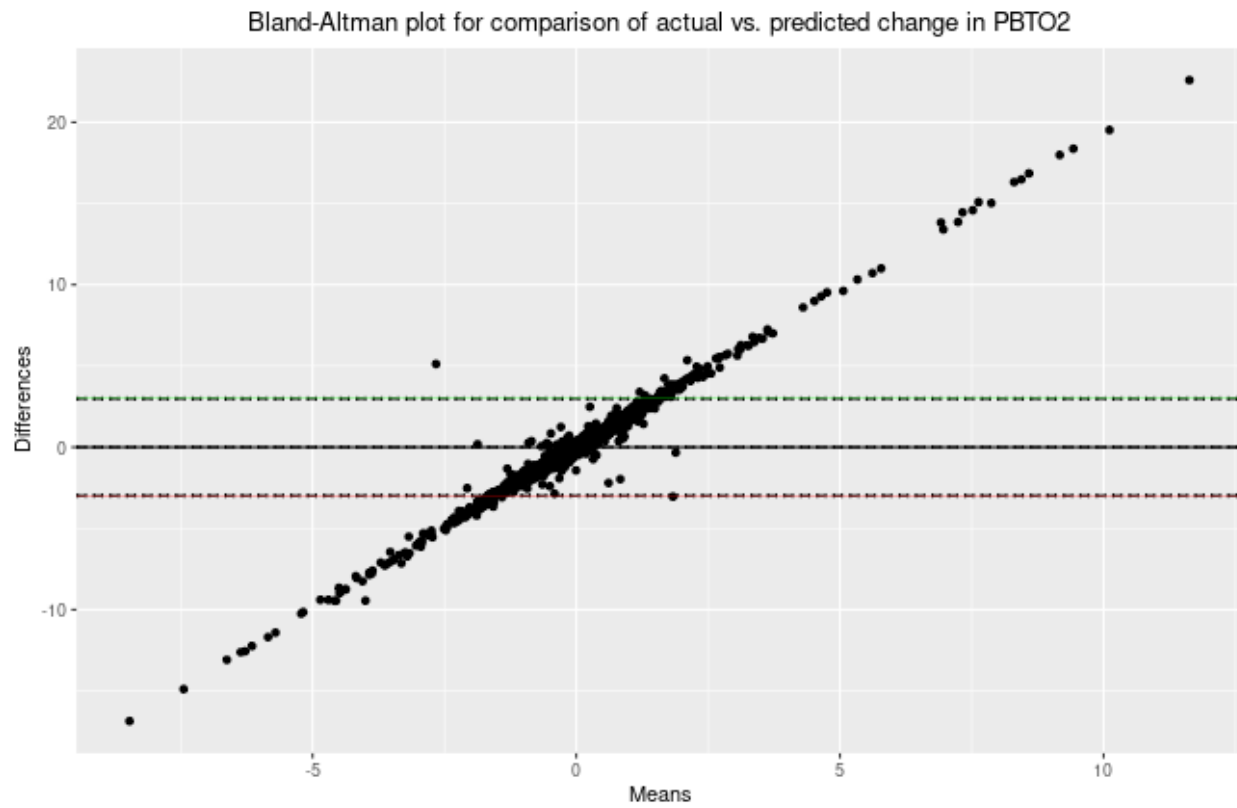
Supplementary File S4 Figure 2: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 2

Subject 3



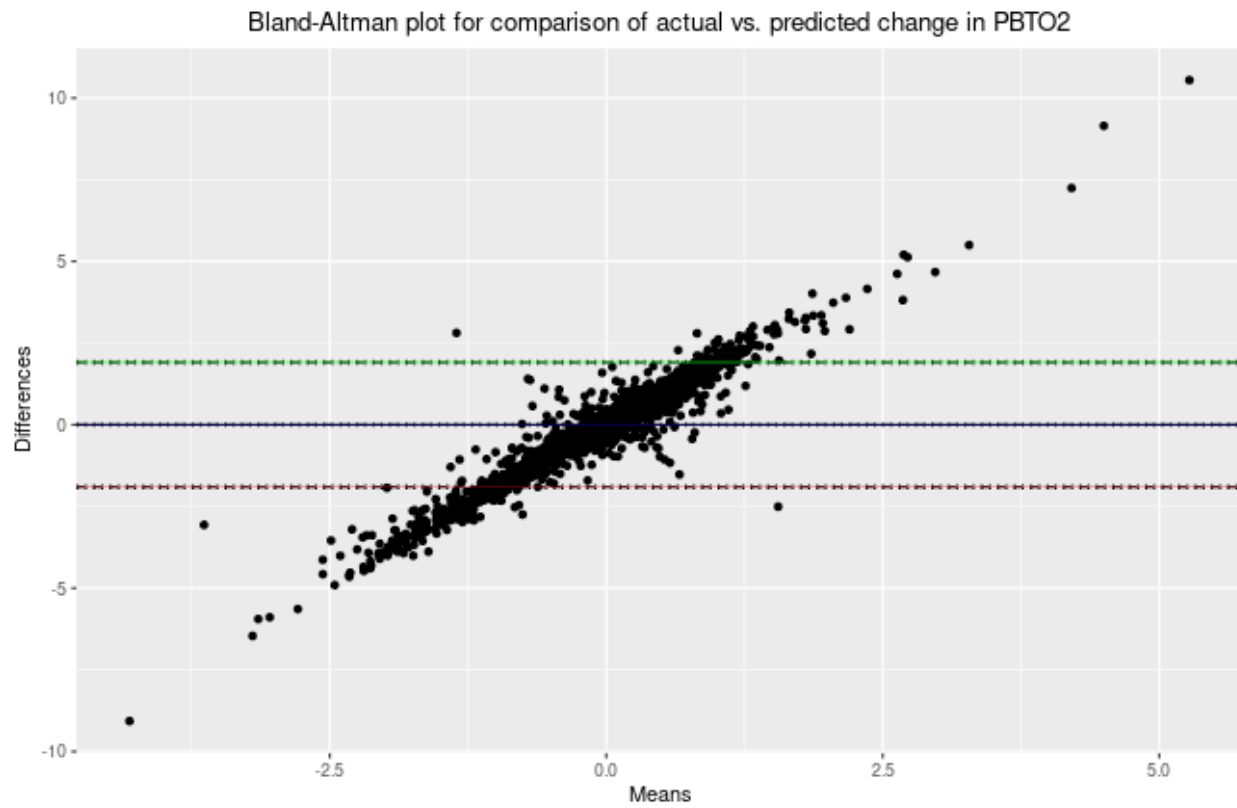
Supplementary File S4 Figure 3: Bland-Altman Plot comparing agreement between predicted values of $\Delta PbtO_2$ and actual values of $\Delta PbtO_2$ for Subject 3

Subject 4



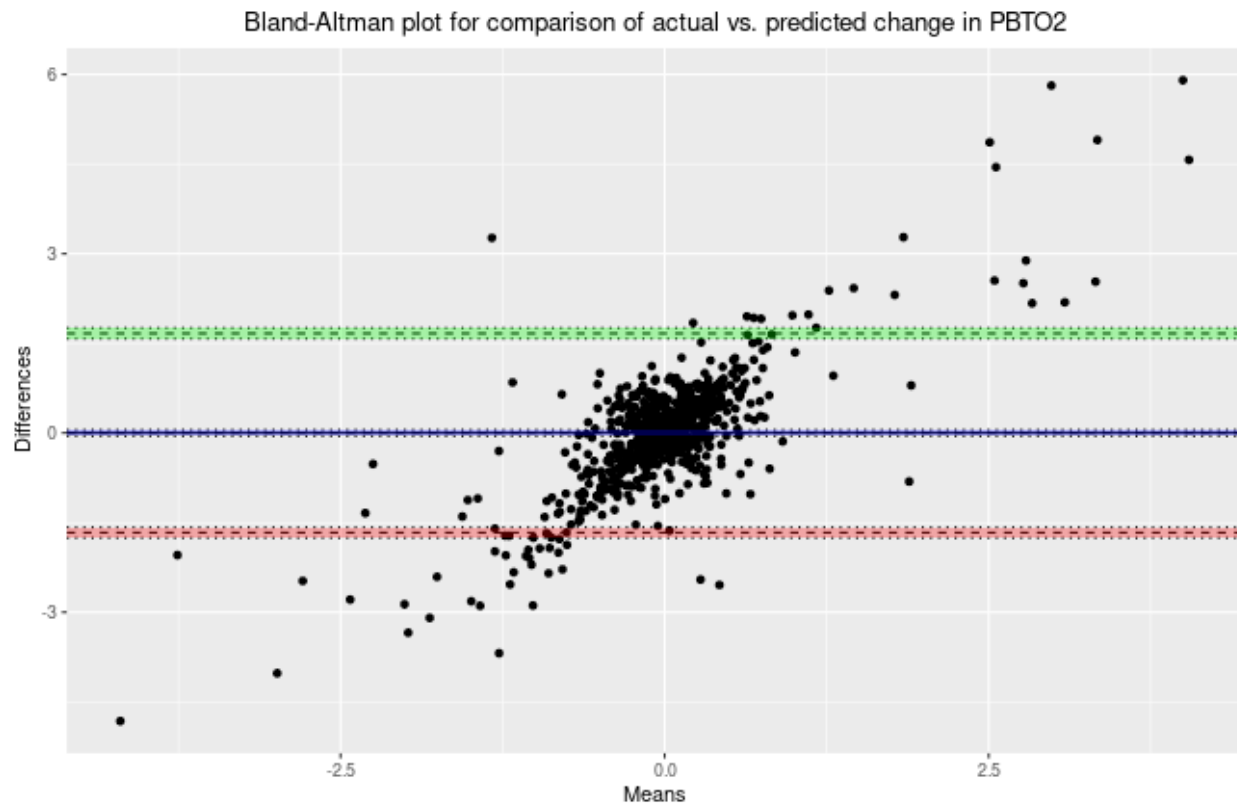
Supplementary File S4 Figure 4: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 4

Subject 5



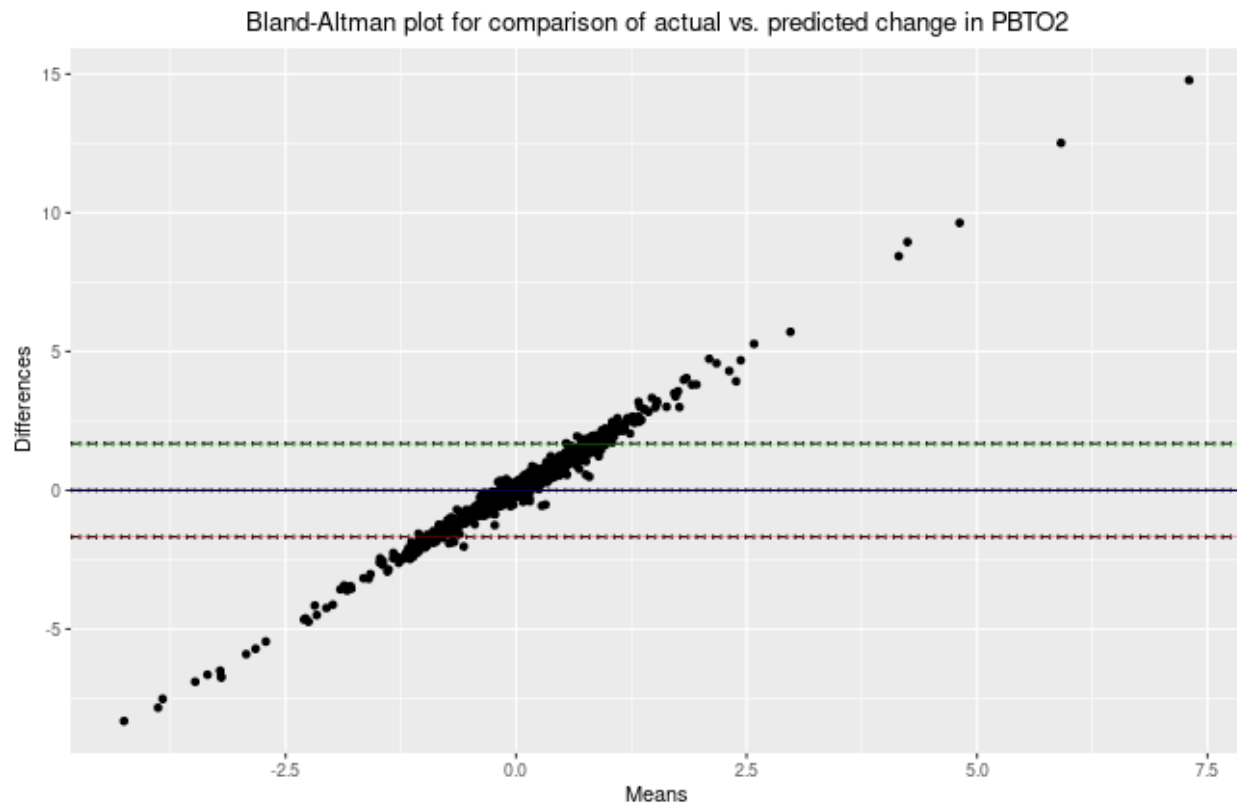
Supplementary File S4 Figure 5: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 5

Subject 6



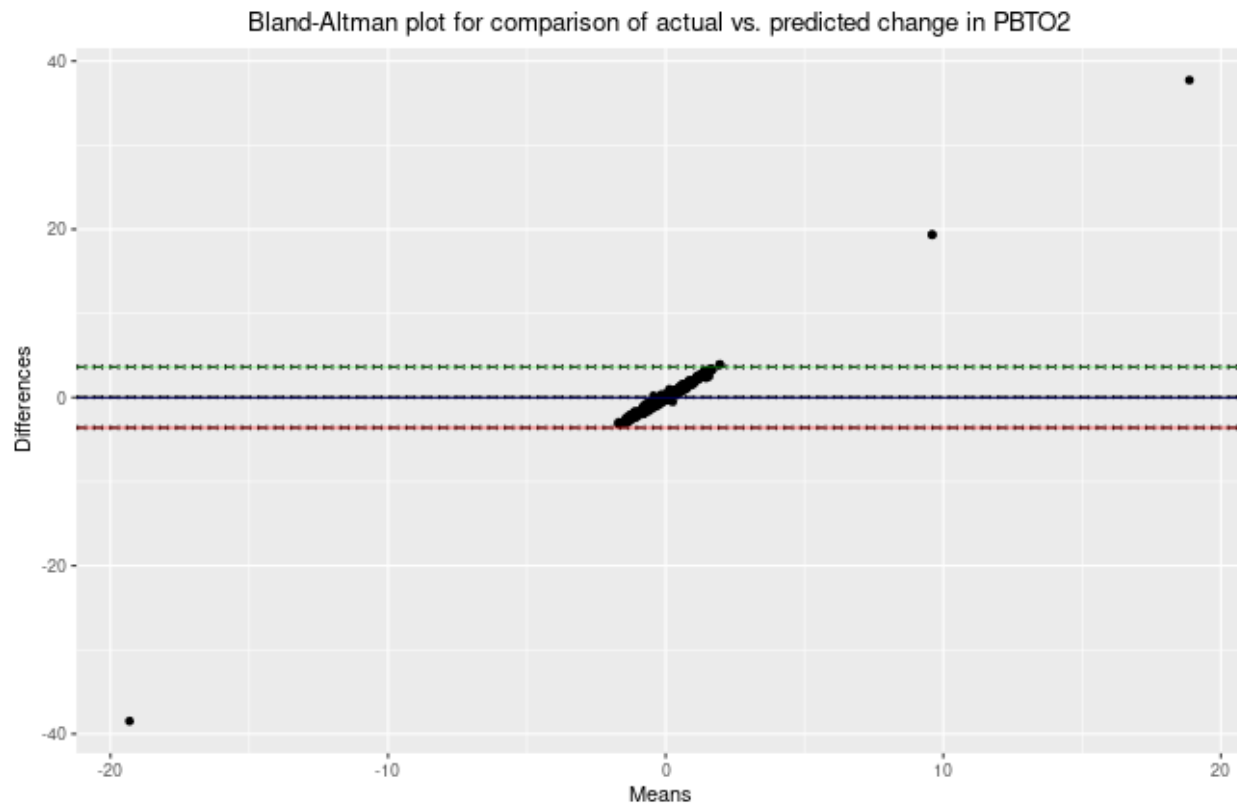
Supplementary File S4 Figure 6: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 6

Subject 7



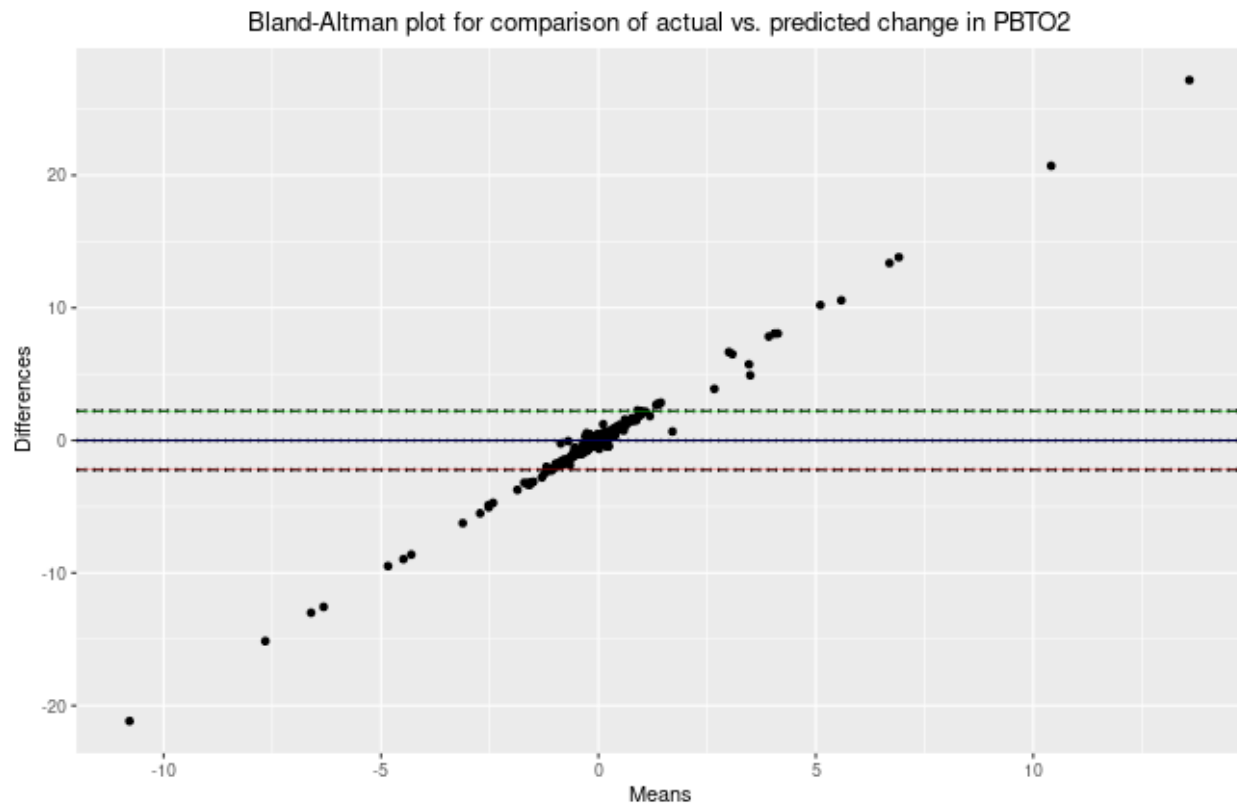
Supplementary File S4 Figure 7: Bland-Altman Plot comparing agreement between predicted values of Δ PbtO₂ and actual values of Δ PbtO₂ for Subject 7

Subject 8

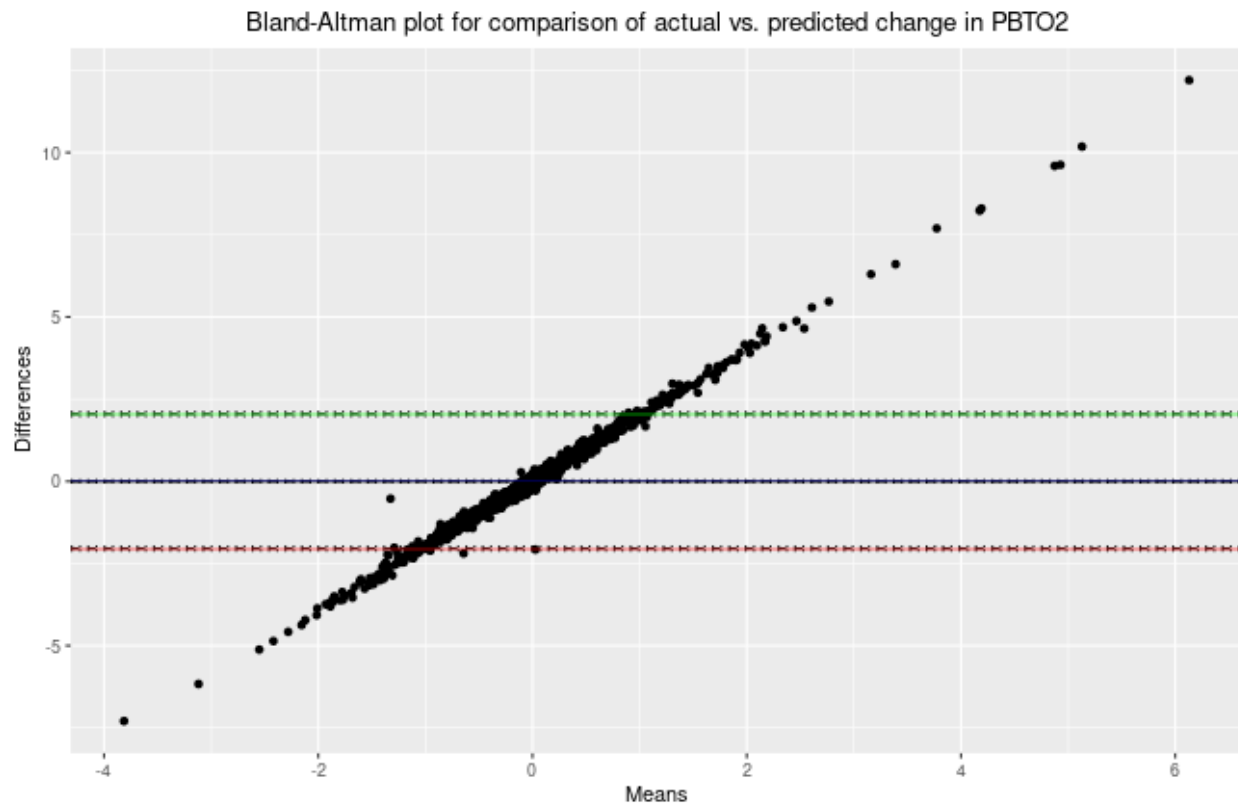


Supplementary File S4 Figure 8: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 8

Subject 9

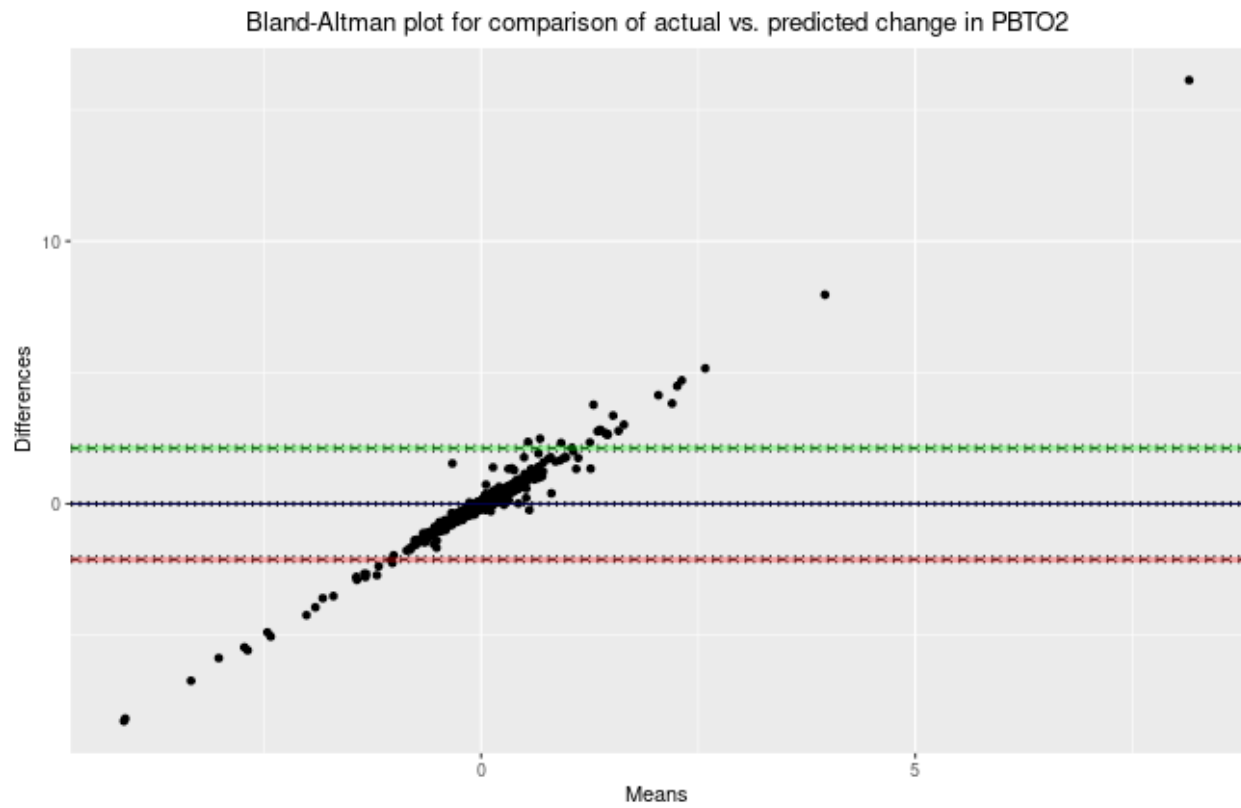


Supplementary File S4 Figure 9: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 9

Subject 10

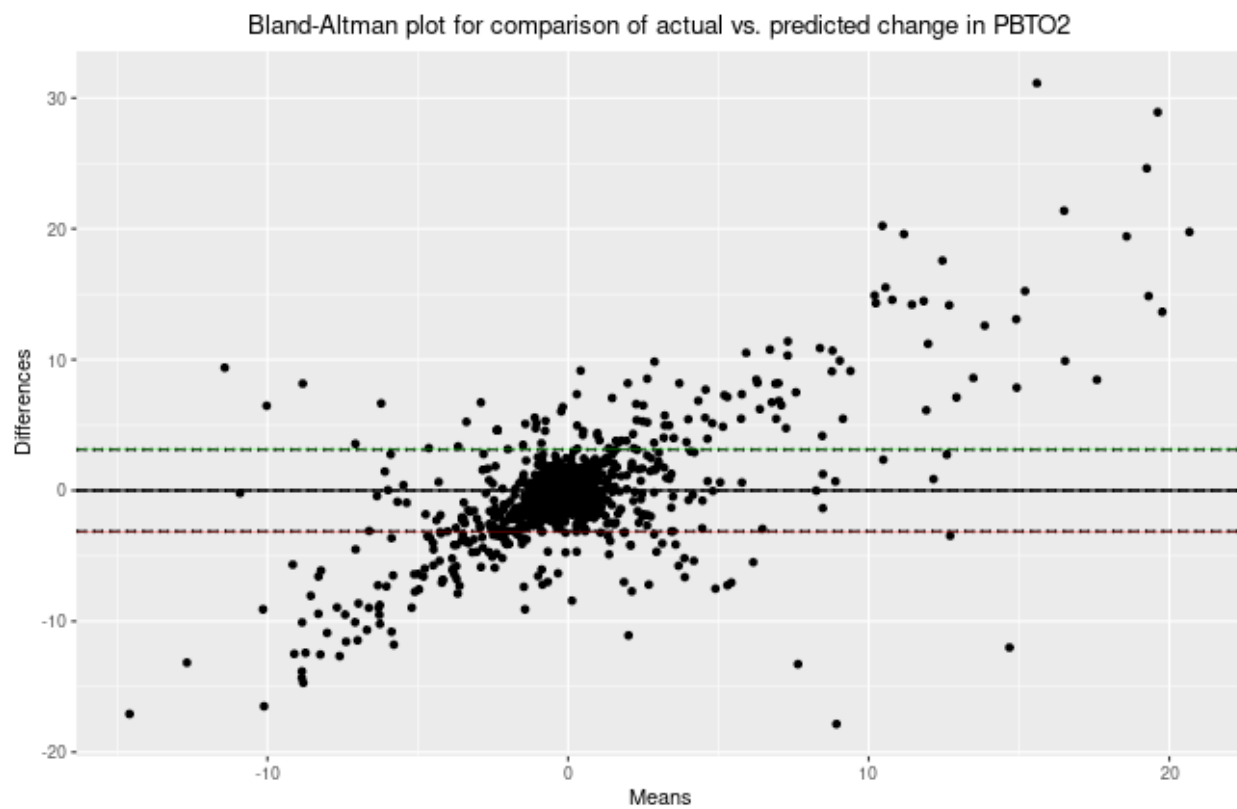
Supplementary File S4 Figure 10: Bland-Altman Plot comparing agreement between predicted values of Δ PbtO₂ and actual values of Δ PbtO₂ for Subject 10

Subject 11



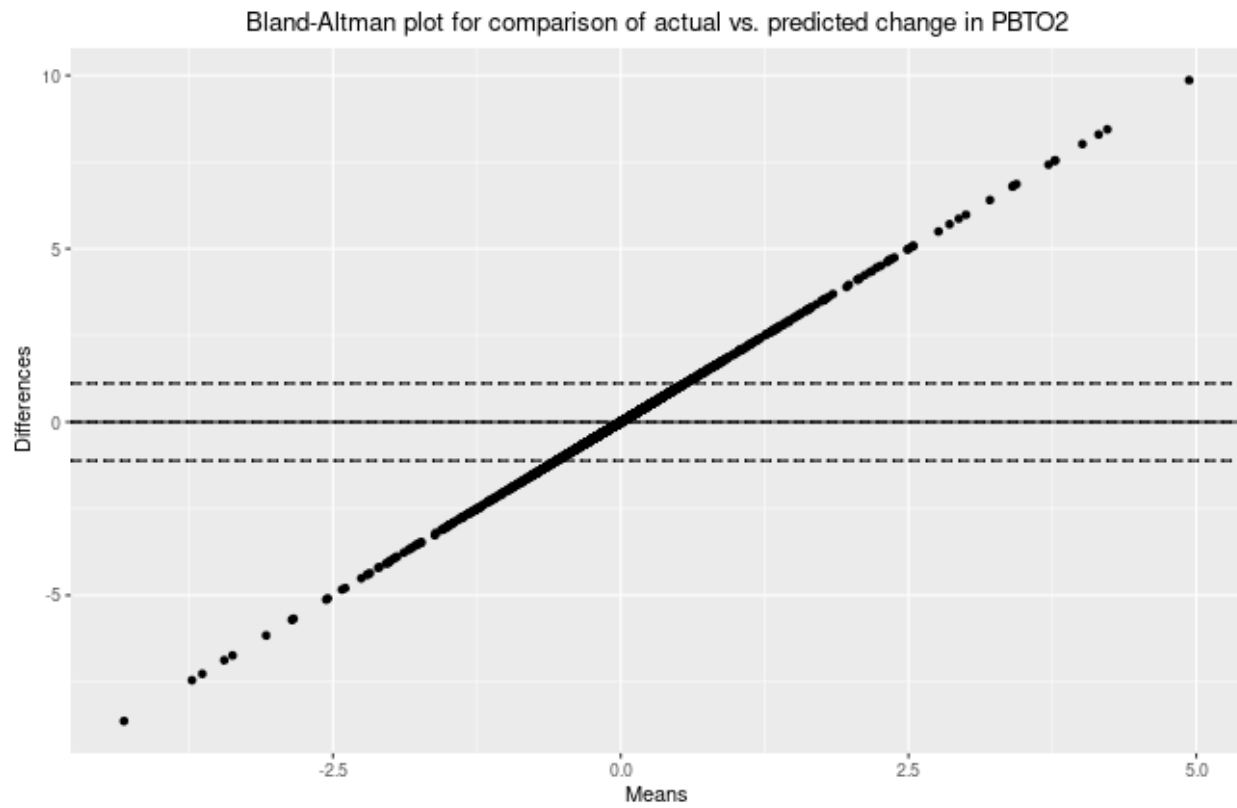
Supplementary File S4 Figure 11: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 11

Subject 12



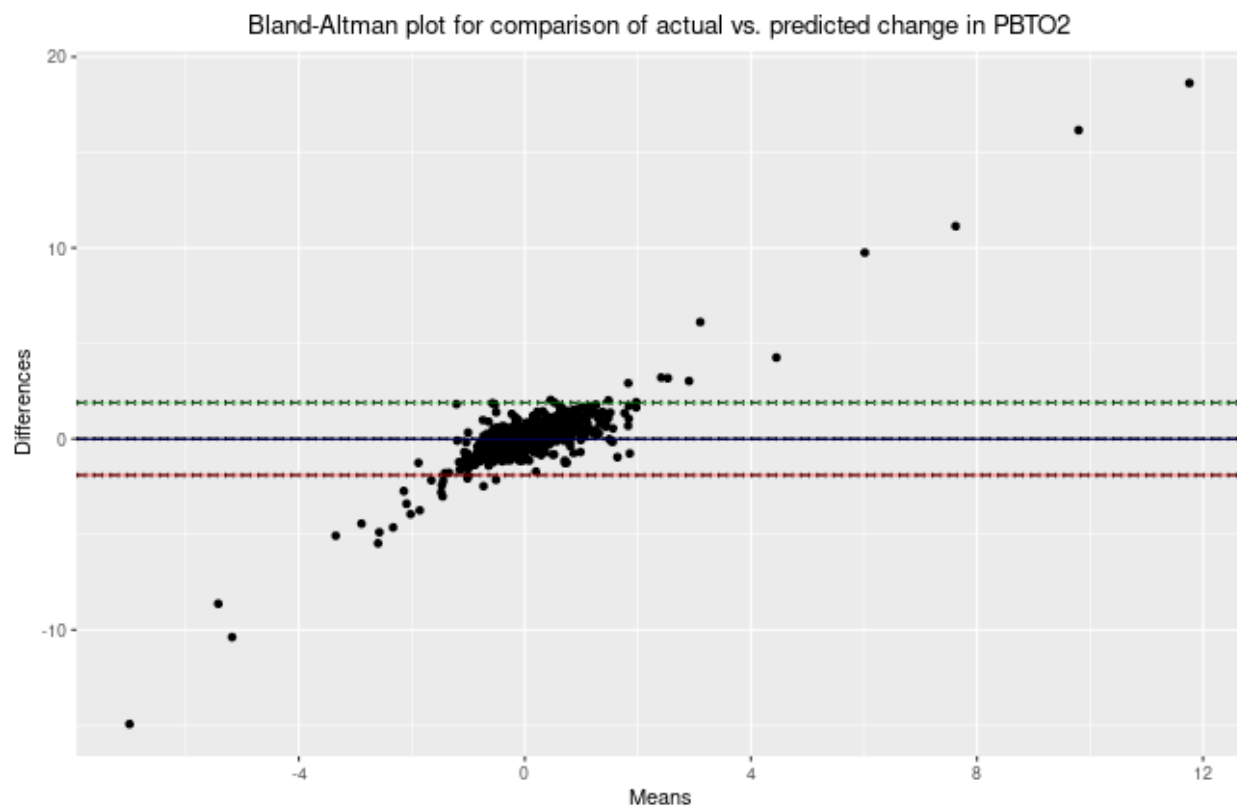
Supplementary File S4 Figure 12: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 12

Subject 13



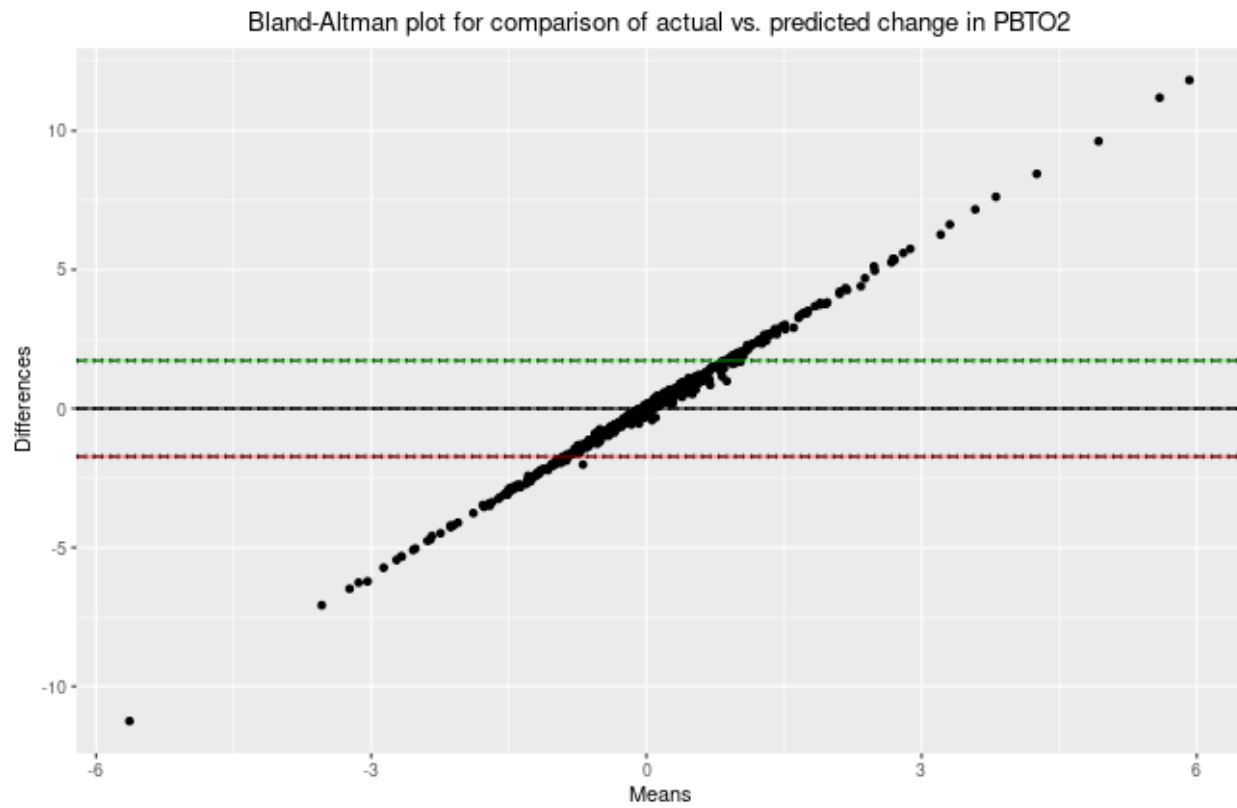
Supplementary File S4 Figure 13: Bland-Altman Plot comparing agreement between predicted values of Δ PbtO₂ and actual values of Δ PbtO₂ for Subject 13

Subject 14

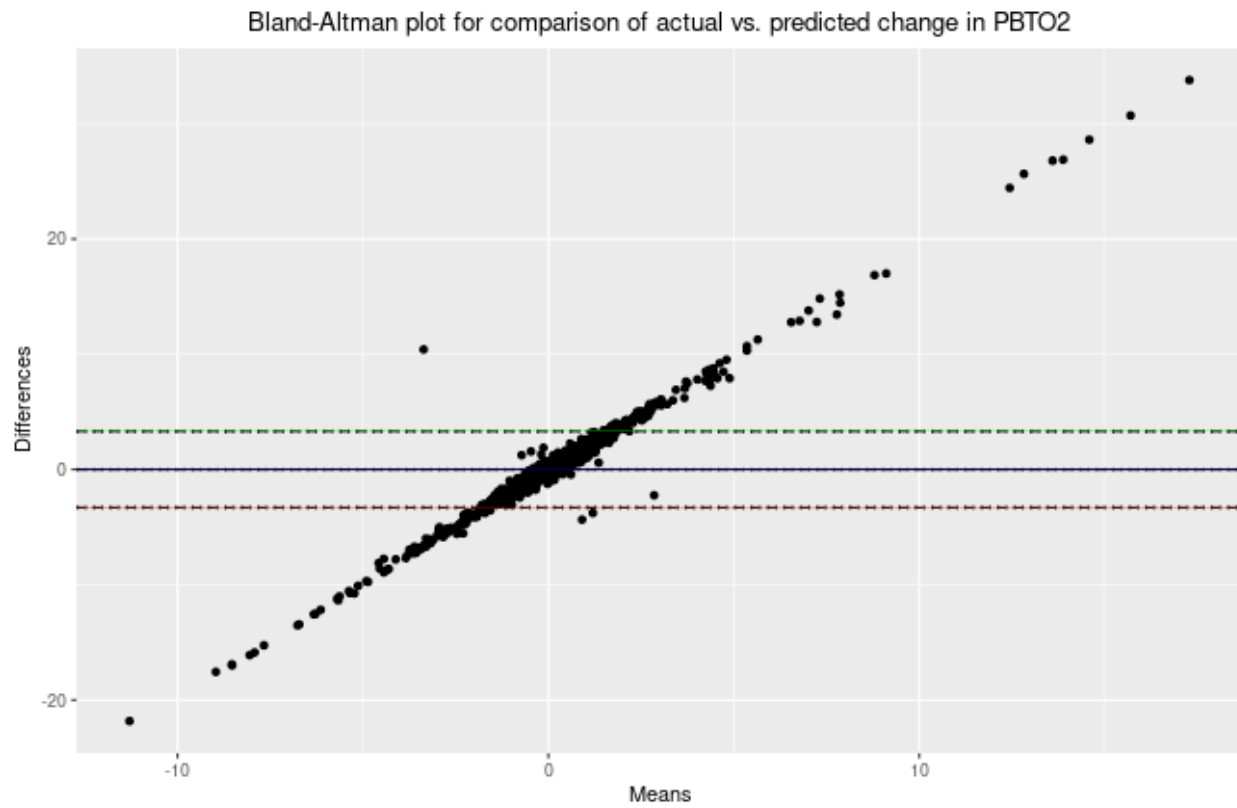


Supplementary File S4 Figure 14: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 14

Subject 15

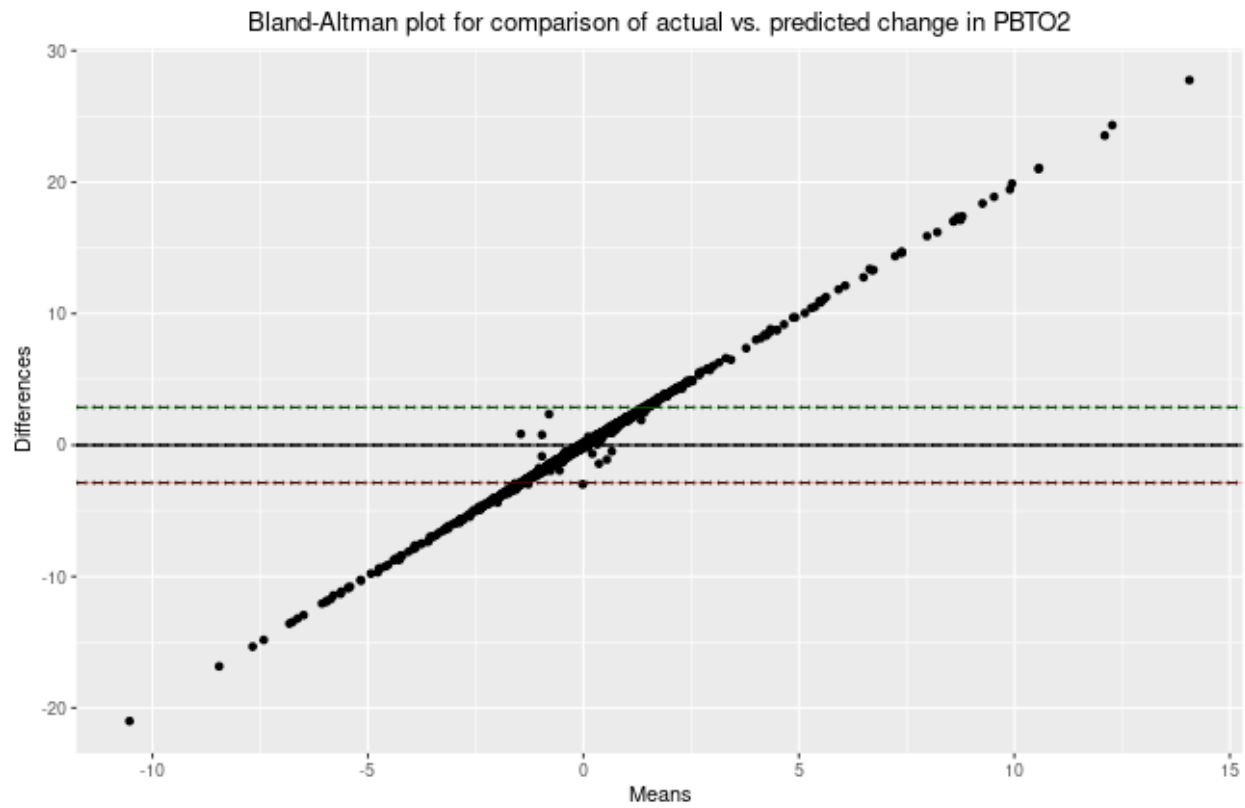


Supplementary File S4 Figure 15: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 15

Subject 16

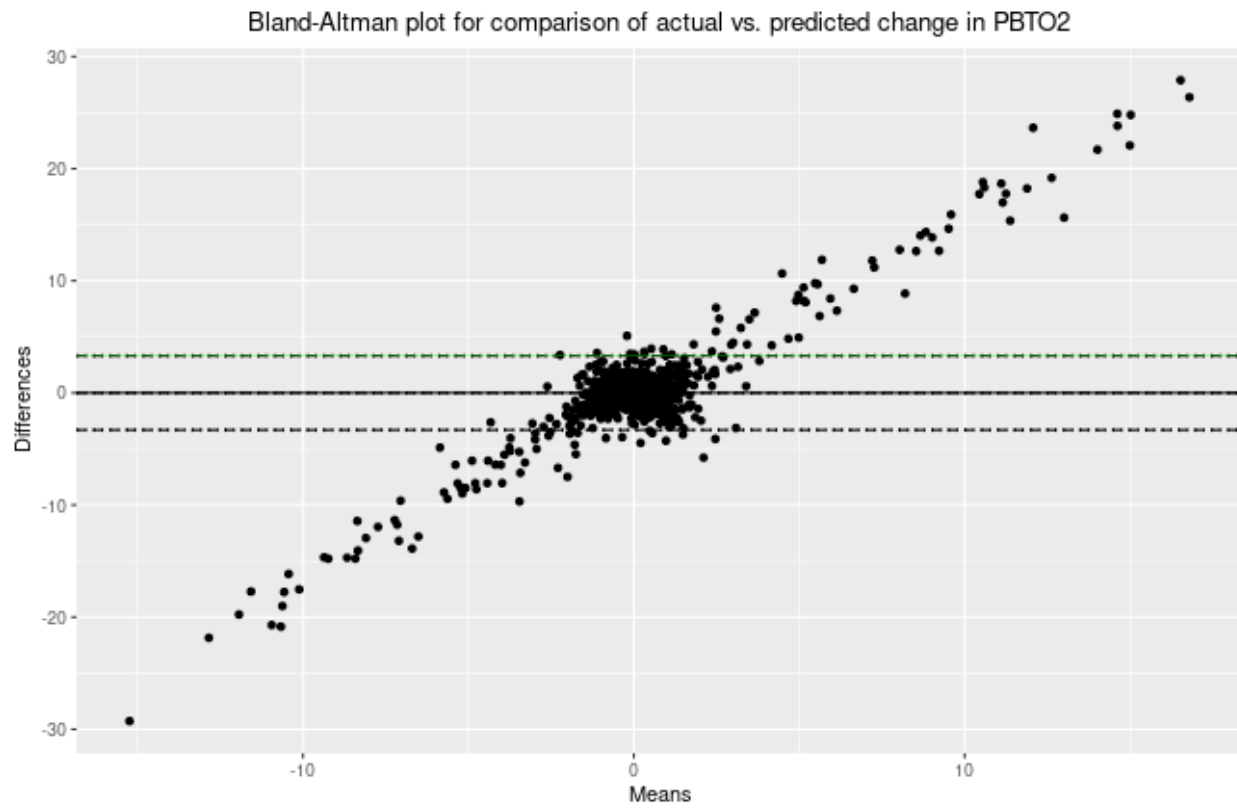
Supplementary File S4 Figure 16: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 16

Subject 17



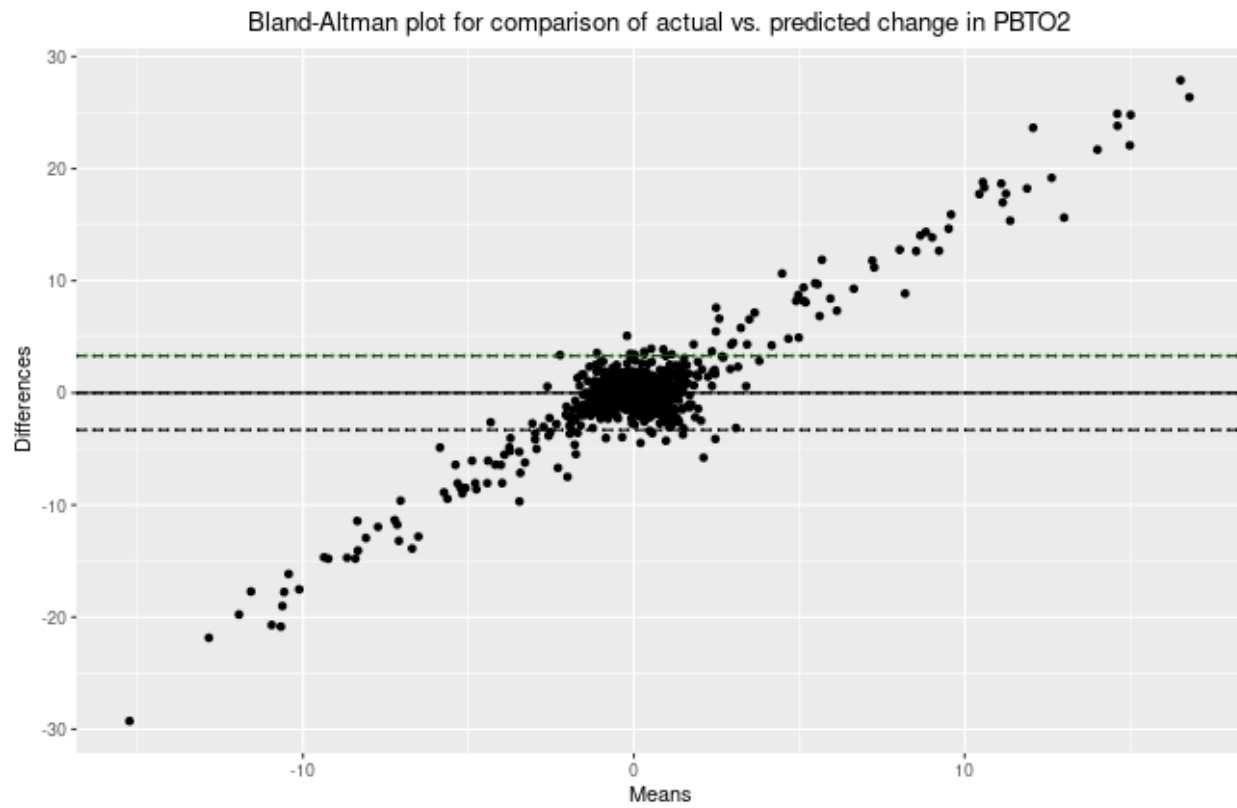
Supplementary File S4 Figure 17: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 17

Subject 18

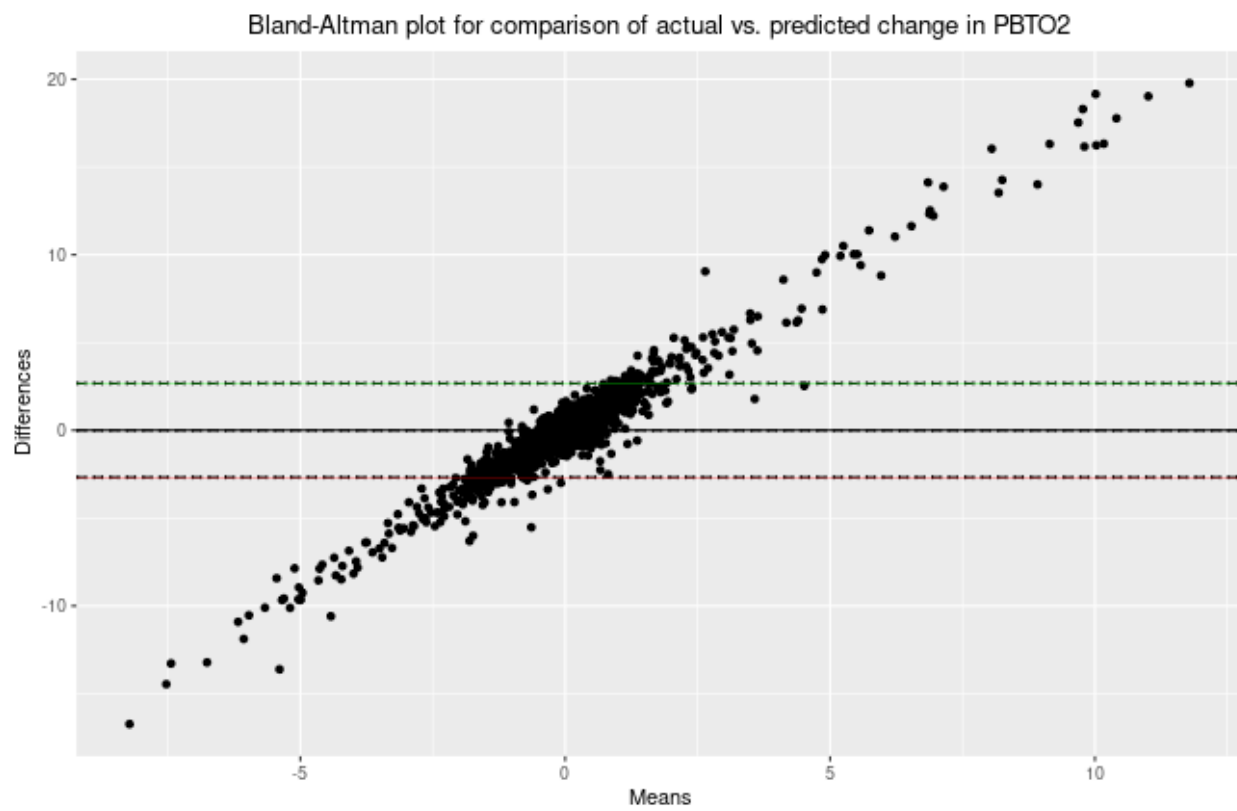


Supplementary File S4 Figure 18: Bland-Altman Plot comparing agreement between predicted values of Δ PbtO₂ and actual values of Δ PbtO₂ for Subject 18

Subject 19



Supplementary File S4 Figure 19: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 19

Subject 20

Supplementary File S4 Figure 20: Bland-Altman Plot comparing agreement between predicted values of ΔPbtO_2 and actual values of ΔPbtO_2 for Subject 20