Model Summaries

NON-Tranformed Models

Summary of Intercept and Slope Parameters

Intercept

Model Number	Estimate	Std. Error	t-Stat	p-value
M0 (lmod0)	1.2970	1.485e-1	8.73	<2e-16
M1 (LMwFEint)	1.8519e1	4.067e-1	4.554e1	<2e-16
M2 (LMwFEslope)	1.8414e1	4.298e-1	4.285e1	<2e-16
M3 (LMMwREint)	2.75	1.37	2.01	6.4e-2
M4 (LMMwREslope)	2.7551	1.3588	2.03	6.2e-2
M5 (GEE)	1.424	3.34e-1	1.819e1**	2e-5**

Note: ** These are Wald test of a single parameter (not t-tests)

Main-Effect Slope

Model Number	Estimate	Std. Error	t-Stat	p-Value
M0 (lmod0)	1.4241	9.22e-2	1.544e1	<2e-16
M1 (LMwFEint)	2.705e-1	6.12e-2	4.42	1.1e-5
M2 (LMwFEslope)	3.051e-1	7.66e-2	3.98	7.3e-5
M3 (LMMwREint)	2.78e-1	6.12e-2	4.54	6.3e-6
M4 (LMMwREslope)	2.775e-1	9.66e-2	2.79	2.12e-1
M5 (GEEmod)	1.297	7.18e-1	3.26**	7.1e-2**

Note: ** These are Wald test of a single parameter (not t-tests)

Model Summaries

M0 (lmod0)

```
summary(lmod0)
```

```
##
## Call:
## lm(formula = fbln ~ cd34, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.266  -1.297  -1.297  -0.297  39.703
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)  1.29700    0.14853   8.732   <2e-16 ***
## cd34         1.42410    0.09221  15.444   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.774 on 1108 degrees of freedom
## Multiple R-squared:  0.1771, Adjusted R-squared:  0.1764
## F-statistic: 238.5 on 1 and 1108 DF,  p-value: < 2.2e-16
```

M1 (LMwFEint)

```
summary(LMwFEint)
```

```
##
## Call:
## lm(formula = fbln ~ subject.no + cd34, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.9540  -0.5592  -0.0157   0.0000  22.4808
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   18.51924    0.40669  45.537  < 2e-16 ***
## subject.no6  -18.51924    0.50340 -36.789  < 2e-16 ***
## subject.no7  -14.81030    0.60924 -24.309  < 2e-16 ***
## subject.no9  -16.77045    0.63245 -26.517  < 2e-16 ***
## subject.no10  -6.74722    0.71571  -9.427  < 2e-16 ***
## subject.no11 -17.33138    0.46261 -37.464  < 2e-16 ***
## subject.no13 -18.50990    0.48594 -38.091  < 2e-16 ***
## subject.no14 -17.96006    0.49008 -36.647  < 2e-16 ***
## subject.no15 -18.47924    0.68422 -27.008  < 2e-16 ***
## subject.no17 -18.49465    0.47690 -38.781  < 2e-16 ***
## subject.no19 -18.50350    0.47433 -39.009  < 2e-16 ***
## subject.no20 -15.98308    0.51203 -31.215  < 2e-16 ***
## subject.no22 -17.62713    0.49469 -35.632  < 2e-16 ***
## subject.no24 -18.14231    0.50484 -35.937  < 2e-16 ***
## subject.no26 -18.51924    0.55516 -33.358  < 2e-16 ***
## cd34           0.27053    0.06121   4.420 1.09e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.751 on 1094 degrees of freedom
## Multiple R-squared:  0.7302, Adjusted R-squared:  0.7265
## F-statistic: 197.4 on 15 and 1094 DF,  p-value: < 2.2e-16
```

M2 (LMwFEslope)

```
summary(LMwFEslope)
```

```
##
```

```
## Call:
## lm(formula = fbln ~ subject.no + cd34:subject.no + cd34, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.1595  -0.5169  -0.0157   0.0000  22.5862
##
## Coefficients: (6 not defined because of singularities)
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        18.41384    0.42975  42.848  < 2e-16 ***
## subject.no6       -18.41384    0.52190 -35.282  < 2e-16 ***
## subject.no7       -14.29786    0.75885 -18.842  < 2e-16 ***
## subject.no9       -16.89689    0.67943 -24.869  < 2e-16 ***
## subject.no10       -7.27738    0.78666  -9.251  < 2e-16 ***
## subject.no11      -16.95607    0.54085 -31.351  < 2e-16 ***
## subject.no13      -18.40450    0.50514 -36.434  < 2e-16 ***
## subject.no14      -17.84093    0.51307 -34.773  < 2e-16 ***
## subject.no15      -18.37384    0.69738 -26.347  < 2e-16 ***
## subject.no17      -18.38925    0.49649 -37.039  < 2e-16 ***
## subject.no19      -18.39810    0.49403 -37.241  < 2e-16 ***
## subject.no20      -15.80032    0.54983 -28.737  < 2e-16 ***
## subject.no22      -17.61978    0.53321 -33.044  < 2e-16 ***
## subject.no24      -17.95597    0.53860 -33.338  < 2e-16 ***
## subject.no26      -18.41384    0.57182 -32.202  < 2e-16 ***
## cd34                0.30507    0.07661   3.982 7.29e-05 ***
## subject.no6:cd34         NA         NA      NA       NA
## subject.no7:cd34   -0.23806    0.21152  -1.125   0.2607
## subject.no9:cd34    0.47883    0.41349   1.158   0.2471
## subject.no10:cd34   0.91881    0.41798   2.198   0.0281 *
## subject.no11:cd34  -0.25842    0.17767  -1.454   0.1461
## subject.no13:cd34        NA         NA      NA       NA
## subject.no14:cd34  -0.37799    1.40349  -0.269   0.7877
## subject.no15:cd34        NA         NA      NA       NA
## subject.no17:cd34        NA         NA      NA       NA
## subject.no19:cd34        NA         NA      NA       NA
## subject.no20:cd34  -0.44892    0.70427  -0.637   0.5240
## subject.no22:cd34   0.24063    0.32840   0.733   0.4639
## subject.no24:cd34  -0.31255    0.35092  -0.891   0.3733
## subject.no26:cd34        NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.746 on 1086 degrees of freedom
## Multiple R-squared:  0.7332, Adjusted R-squared:  0.7275
## F-statistic: 129.7 on 23 and 1086 DF,  p-value: < 2.2e-16
```

M3 (LMMwREint)

```
summary(LMMwREint)
```

```
## Loading required package: lmerTest
```

```
## Loading required package: lme4
## Loading required package: Matrix
##
## Attaching package: 'lmerTest'
## The following object is masked from 'package:lme4':
##
##     lmer
## The following object is masked from 'package:stats':
##
##     step
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: fbln ~ cd34 + (1 | subject.no)
##    Data: dat
##
## REML criterion at convergence: 5478.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.5142 -0.2053 -0.0078 -0.0032  8.2056
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  subject.no (Intercept) 27.831   5.276
##  Residual                7.569   2.751
## Number of obs: 1110, groups:  subject.no, 15
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept) 2.749e+00  1.366e+00 1.396e+01   2.013   0.0639 .
## cd34        2.775e-01  6.117e-02 1.097e+03   4.537 6.34e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr)
## cd34 -0.025
```

M4 (LMMwREslope)

```
summary(LMMwREslope)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: fbln ~ cd34 + (1 | subject.no) + (0 + cd34 | subject.no)
##    Data: dat
##
## REML criterion at convergence: 5477.8
##
```

```
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.5863 -0.2056 -0.0079 -0.0032  8.2483
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  subject.no   (Intercept) 27.53464 5.2473
##  subject.no.1 cd34         0.02232 0.1494
##  Residual                  7.55183 2.7481
## Number of obs: 1110, groups:  subject.no, 15
##
## Fixed effects:
##             Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)  2.75514    1.35885 13.92884   2.028   0.0622 .
## cd34         0.27754    0.09957  1.03771   2.787   0.2119
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr)
## cd34 -0.021
```

M5 (GEEmod)

```
summary(GEEmod)
```

```
##
## Call:
## geeglm(formula = fbln ~ cd34, family = "gaussian", data = dat,
##     id = IDgee, corstr = "independence")
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -11.266   -1.297   -1.297   -0.297   39.703
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.29700    0.14853   8.732   <2e-16 ***
## cd34         1.42410    0.09221  15.444   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 22.79484)
##
##     Null deviance: NULL  on 1108  degrees of freedom
## Residual deviance: NULL  on 1108  degrees of freedom
## AIC: NULL
##
## Number of Fisher Scoring iterations:
```

Nested Model Comparisons

```
# M0 < M1
anova(lmod0, LMwFEint )
```

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1108	25256.685	NA	NA	NA	NA
1094	8280.546	14	16976.14	160.2025	0

```
# M1 < M2
anova(LMwFEint, LMwFEslope)
```

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1094	8280.546	NA	NA	NA	NA
1086	8189.969	8	90.57667	1.501322	0.1522066

```
# M3 < M4
anova(LMMwREint, LMMwREslope)
```

```
## refitting model(s) with ML (instead of REML)
```

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)
LMMwREint	4	5484.759	5504.808	-2738.38	5476.759	NA	NA	NA
LMMwREslope	5	5486.759	5511.820	-2738.38	5476.759	0	1	1

AIC Measurement Statistics

```
AIC(lmod0,LMwFEint, LMwFEslope, LMMwREint, LMMwREslope)
```

	df	AIC
lmod0	3	6624.495
LMwFEint	17	5414.643
LMwFEslope	25	5418.434
LMMwREint	4	5486.084
LMMwREslope	5	5487.766

Tranformed Models

Summary of Intercept and Slope Parameters

Intercept

Model Number	Estimate	Std. Error	t-Stat	p-Value
M0 (loglmod0)	3.510e-1	2.45e-2	1.43e1	< 2e-16
M1 (logLMwFEint)	2.7572	6.52e-2	4.23e1	< 2e-16
M2 (logLMwFEslope)	2.7973	7.68e-2	3.643e1	< 2e-16
M3 (logLMMwREint)	6.53e-1	2.22e-1	2.94	1.1e-2
M4 (logLMMwREslope)	6.491e-1	2.223e-1	2.92	1.1e-2
M5 (logGEEmod)	3.51e-1	1.25e-1	7.85**	5.09e-3**

Note: ** These are Wald test of a single parameter (not t-tests)

Main-Effect Slope

Model Number	Estimate	Std. Error	t-Stat	p-value
M0 (loglmod0)	7.884e-1	4.92e-2	1.6e+1	< 2e-16
M1 (logLMwFEint)	1.306e-1	3.42e-2	3.82	1.4e-4
M2 (logLMwFEslope)	8.38e-2	5.89e-2	1.42	1.5492e-1
M3 (logLMMwREint)	1.35e-1	3.42e-2	3.95	8.4e-5
M4 (logLMMwREslope)	1.705e-1	7.29e-2	2.34	6.7e-2
M5 (logGEEmod)	7.88e-1	2.2e-1	1.281e+1**	3.4e-4**

Note: ** These are Wald test of a single parameter (not t-tests)

Model Summaries

M0 (loglmod0)

```
summary(loglmod0)
```

```
##
## Call:
## lm(formula = logfbln ~ logcd34, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.9906 -0.3510 -0.3510  0.3421  3.3866
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.35105    0.02446   14.36   <2e-16 ***
## logcd34      0.78844    0.04921   16.02   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7662 on 1108 degrees of freedom
## Multiple R-squared:  0.1881, Adjusted R-squared:  0.1874
## F-statistic: 256.7 on 1 and 1108 DF,  p-value: < 2.2e-16
```

M1 (logLMwFEint)

```
summary(logLMwFEint)
```

```
##
## Call:
## lm(formula = logfbln ~ subject.no + logcd34, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.25503 -0.26374 -0.00865  0.00000  1.86771
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.75720    0.06518  42.304  < 2e-16 ***
## subject.no6  -2.75720    0.08082 -34.115  < 2e-16 ***
## subject.no7  -1.45891    0.09763 -14.944  < 2e-16 ***
## subject.no9  -2.00631    0.10107 -19.851  < 2e-16 ***
## subject.no10 -0.50217    0.11460  -4.382 1.29e-05 ***
## subject.no11 -2.14500    0.07295 -29.402  < 2e-16 ***
## subject.no13 -2.75073    0.07800 -35.266  < 2e-16 ***
## subject.no14 -2.43098    0.07847 -30.980  < 2e-16 ***
## subject.no15 -2.72948    0.11003 -24.807  < 2e-16 ***
## subject.no17 -2.74584    0.07654 -35.875  < 2e-16 ***
## subject.no19 -2.74855    0.07612 -36.107  < 2e-16 ***
## subject.no20 -1.68842    0.08149 -20.720  < 2e-16 ***
## subject.no22 -2.32100    0.07862 -29.522  < 2e-16 ***
## subject.no24 -2.49346    0.08040 -31.011  < 2e-16 ***
## subject.no26 -2.75720    0.08919 -30.915  < 2e-16 ***
## logcd34       0.13056    0.03420   3.818 0.000142 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4432 on 1094 degrees of freedom
## Multiple R-squared:  0.7318, Adjusted R-squared:  0.7281
## F-statistic:   199 on 15 and 1094 DF,  p-value: < 2.2e-16
```

M2 (logLMwFEslope)

```
summary(logLMwFEslope)
```

```
##
## Call:
## lm(formula = logfbln ~ subject.no + subject.no:logcd34 + logcd34,
##     data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.21581 -0.26200 -0.00865  0.00000  1.68276
##
## Coefficients: (6 not defined because of singularities)
##                      Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)           2.79731    0.07679  36.427  < 2e-16 ***
## subject.no6          -2.79731    0.09029 -30.980  < 2e-16 ***
## subject.no7          -1.50773    0.13615 -11.074  < 2e-16 ***
## subject.no9          -2.16873    0.11567 -18.749  < 2e-16 ***
## subject.no10         -0.58150    0.13126  -4.430 1.04e-05 ***
## subject.no11         -2.15193    0.09559 -22.512  < 2e-16 ***
## subject.no13         -2.79083    0.08781 -31.783  < 2e-16 ***
## subject.no14         -2.46816    0.08898 -27.737  < 2e-16 ***
## subject.no15         -2.76959    0.11687 -23.699  < 2e-16 ***
## subject.no17         -2.78595    0.08653 -32.196  < 2e-16 ***
## subject.no19         -2.78866    0.08617 -32.363  < 2e-16 ***
## subject.no20         -1.70077    0.09463 -17.973  < 2e-16 ***
## subject.no22         -2.40063    0.09236 -25.991  < 2e-16 ***
## subject.no24         -2.50874    0.09334 -26.878  < 2e-16 ***
## subject.no26         -2.79731    0.09776 -28.613  < 2e-16 ***
## logcd34               0.08381    0.05888   1.423 0.154919
## subject.no6:logcd34        NA         NA      NA       NA
## subject.no7:logcd34   0.05769    0.11757   0.491 0.623779
## subject.no9:logcd34   0.62918    0.17671   3.561 0.000386 ***
## subject.no10:logcd34  0.18667    0.17355   1.076 0.282345
## subject.no11:logcd34 -0.01180    0.08895  -0.133 0.894491
## subject.no13:logcd34       NA         NA      NA       NA
## subject.no14:logcd34 -0.05867    0.32959  -0.178 0.858755
## subject.no15:logcd34       NA         NA      NA       NA
## subject.no17:logcd34       NA         NA      NA       NA
## subject.no19:logcd34       NA         NA      NA       NA
## subject.no20:logcd34 -0.18131    0.18771  -0.966 0.334317
## subject.no22:logcd34  0.26508    0.12565   2.110 0.035111 *
## subject.no24:logcd34 -0.12214    0.14167  -0.862 0.388813
## subject.no26:logcd34       NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4405 on 1086 degrees of freedom
## Multiple R-squared:  0.737,  Adjusted R-squared:  0.7314
## F-statistic: 132.3 on 23 and 1086 DF,  p-value: < 2.2e-16
```

M3 (logLMMwREint)

```
summary(logLMMwREint)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: logfbln ~ logcd34 + (1 | subject.no)
##    Data: logdat
##
## REML criterion at convergence: 1430.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.0395 -0.5966 -0.0226 -0.0046  4.2007
##
```

```
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  subject.no (Intercept) 0.7345   0.8570
##  Residual               0.1965   0.4432
## Number of obs: 1110, groups:  subject.no, 15
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept) 6.527e-01  2.220e-01 1.395e+01   2.941   0.0108 *
## logcd34     1.348e-01  3.416e-02 1.098e+03   3.947 8.43e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr)
## logcd34 -0.033
```

M4 (logLMMwREslope)

```
summary(logLMMwREslope)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## logfbln ~ 1 + logcd34 + (1 | subject.no) + (0 + logcd34 | subject.no)
##    Data: logdat
##
## REML criterion at convergence: 1426.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.0088 -0.6330 -0.0226  0.0108  3.7954
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  subject.no   (Intercept) 0.7368   0.8584
##  subject.no.1 logcd34     0.0298   0.1726
##  Residual                 0.1942   0.4407
## Number of obs: 1110, groups:  subject.no, 15
##
## Fixed effects:
##             Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)  0.64915    0.22231 13.93334   2.920   0.0112 *
## logcd34      0.17047    0.07289  4.98528   2.339   0.0666 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr)
## logcd34 -0.017
```

M5 (logGEEmod)

```
summary(logGEEmod)
```

```
##
## Call:
## geeglm(formula = logfbln ~ logcd34, family = "gaussian", data = logdat,
##     id = IDgee, corstr = "independence")
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.9906  -0.3510  -0.3510   0.3421   3.3866
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.35105    0.02446   14.36   <2e-16 ***
## logcd34      0.78844    0.04921   16.02   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.5871066)
##
##     Null deviance: NULL  on 1108  degrees of freedom
## Residual deviance: NULL  on 1108  degrees of freedom
## AIC: NULL
##
## Number of Fisher Scoring iterations:
```

Nested Model Comparisons

```
# M0 < M1
anova(loglmod0, logLMwFEint )
```

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1108	650.5141	NA	NA	NA	NA
1094	214.9196	14	435.5945	158.3783	0

```
# M1 < M2
anova(logLMwFEint, logLMwFEslope)
```

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1094	214.9196	NA	NA	NA	NA
1086	210.7097	8	4.209848	2.712199	0.0058369

```
# M3 < M4
anova(logLMMwREint, logLMMwREslope)
```

```
## refitting model(s) with ML (instead of REML)
```

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)
logLMMwREint	4	1431.961	1452.010	-711.9807	1423.961	NA	NA	NA
logLMMwREslope	5	1431.439	1456.499	-710.7194	1421.439	2.52256	1	0.1122282

AIC Measurement Statistics

```
AIC(loglmod0, logLMwFEint, logLMwFEslope,
    logLMMwREint, logLMMwREslope)
```

	df	AIC
loglmod0	3	2562.912
logLMwFEint	17	1361.589
logLMwFEslope	25	1355.630
logLMMwREint	4	1438.086
logLMMwREslope	5	1436.145