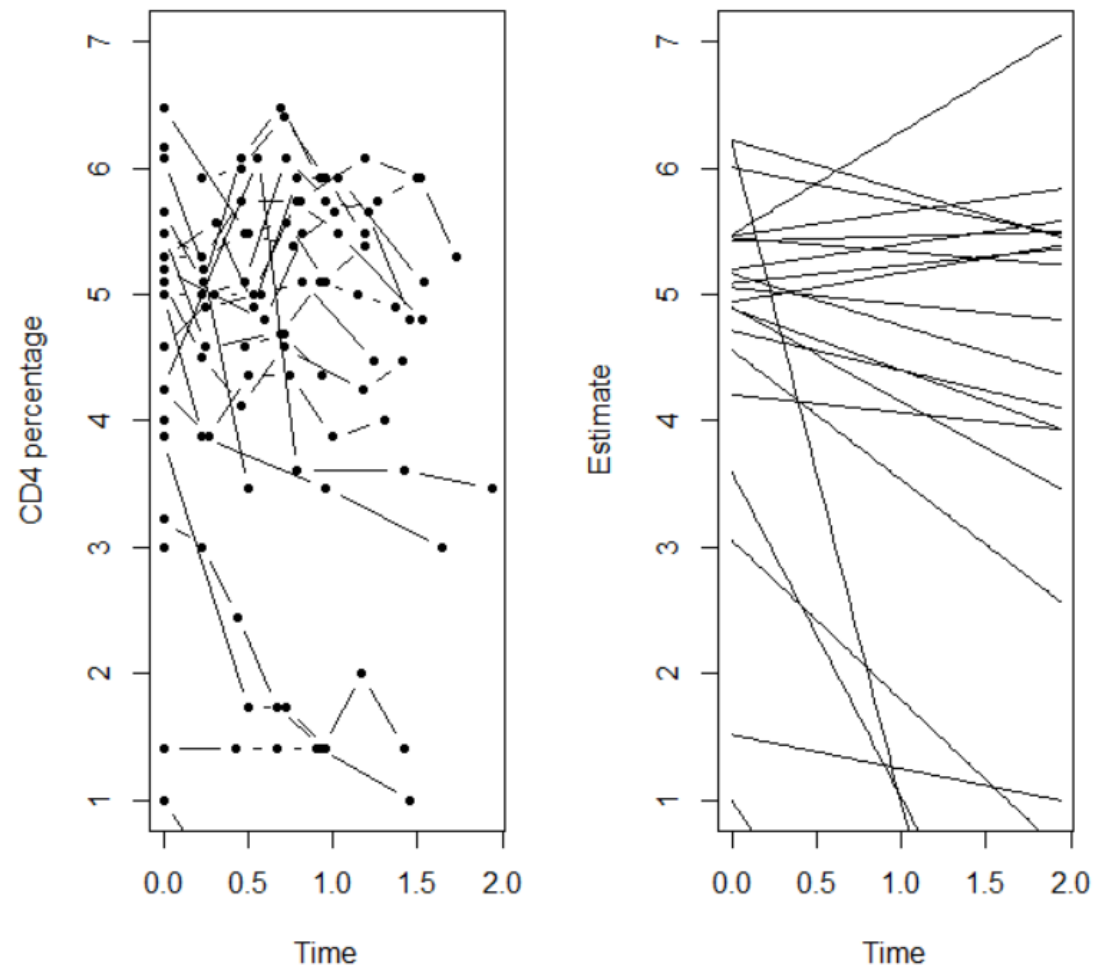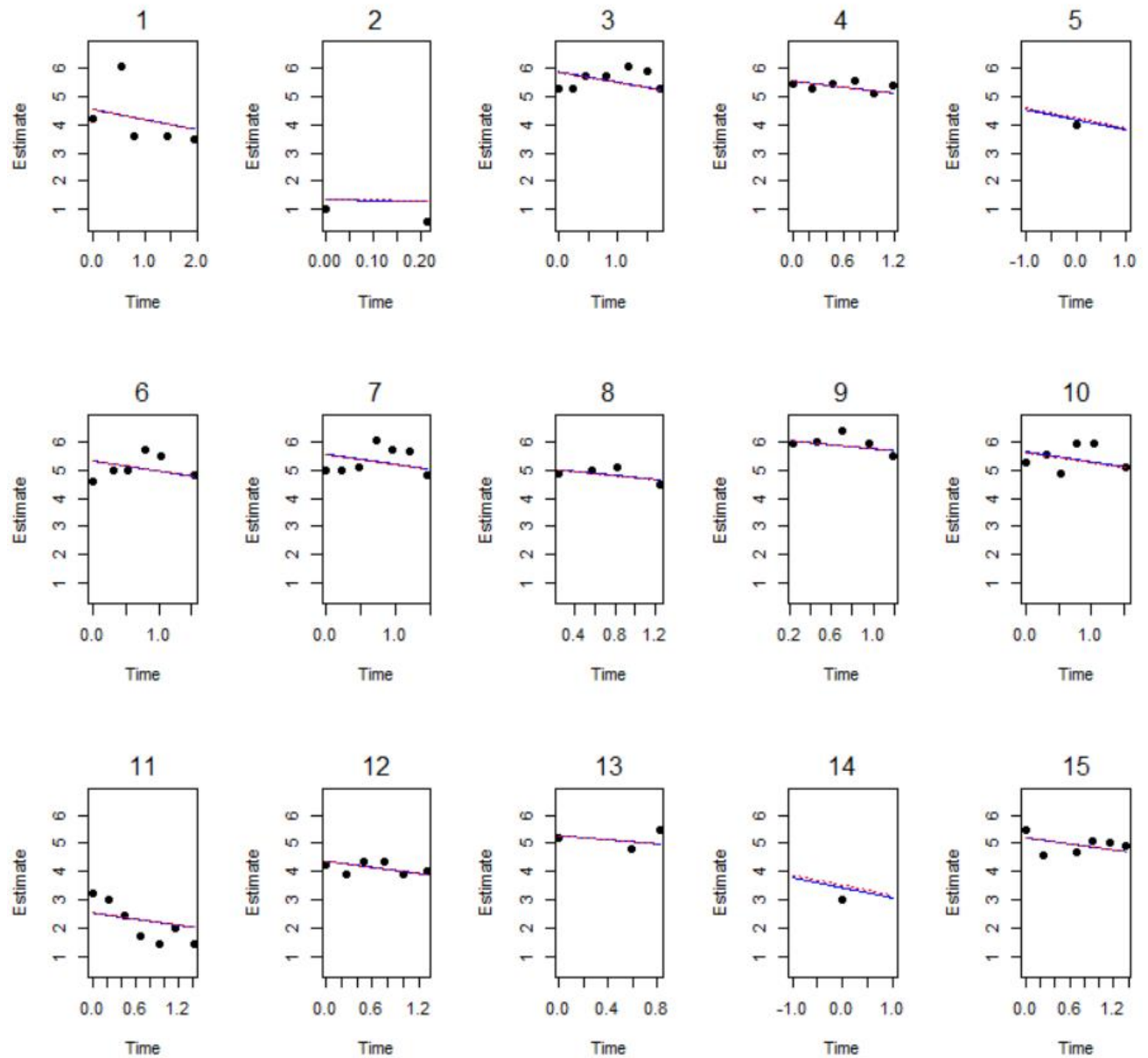11.4.a 與 11.4.b

左上圖為前 25 位小孩的 Time 與開根號後的 CD4 percentage 的關係。Time 是指 visage 減去 baseage。

右上圖為前 25 位小孩估計的 CD4 percentage 與 Time 的關係圖。

兩張圖都顯示，這 25 位小孩估計的 Time 與實際的 Time，與 CD4 percentage 之間的關係各異，有人上升，有人下降。

12.2.c 與 12.2.d

下圖為前 15 小孩前兩個模型中 time 與估計的 CD4 percentage 的關係。紅線為 m5，藍線為 m4，可以看到兩條線近乎重疊。而 m5 的標準誤則稍微下降，意謂著 m5 模型加入兩個變數，有助於對依變數的解釋。

8.1

用 glmer 跑的複層次模型結果如下，此複層次模型與 7.1 非複層次模型的差異
在於，多了一個 random effect，使得截距會隨著 cntryyear 變化。而 fixed effects
的部分，dist_magnitude 與 parliamentary 從顯著變成不顯著。severity、
dist_magnitude 與 enep 等變數的標準誤增加。
此外，沒有任何變數的係數正負號改變。

```
> summary(m81)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) [
glmerMod]
 Family: binomial  ( logit )
Formula: voted ~ (1 | cntryyear) + severity * age + severity * polinfrel +
    severity * income + severity * efficacy + severity * partyID +
    dist_magnitude + enep + vicmarg_dist + parliamentary + development
   Data: st

    AIC       BIC   logLik deviance df.resid
 63235.4   63405.2 -31599.7  63199.4    92723

Scaled residuals:
     Min       1Q   Median       3Q      Max
-27.5751   0.1363   0.2603   0.4078   3.0584

Random effects:
 Groups    Name         Variance Std.Dev.
 cntryyear (Intercept) 0.5671   0.7531
Number of obs: 92741, groups:  cntryyear, 77

Fixed effects:
                   Estimate Std. Error z value Pr(>|z|)
(Intercept)        2.318470   0.088064   26.33  < 2e-16 ***
severity           0.592722   0.105016    5.64 1.66e-08 ***
age                0.348282   0.011559   30.13  < 2e-16 ***
polinfrel          0.348902   0.011374   30.68  < 2e-16 ***
income             0.208132   0.011315   18.39  < 2e-16 ***
efficacy           0.331852   0.009806   33.84  < 2e-16 ***
partyID            0.426377   0.011786   36.18  < 2e-16 ***
dist_magnitude     0.163900   0.102255    1.60  0.10897
enep              -0.180536   0.104865   -1.72  0.08514 .
vicmarg_dist      -0.029745   0.012447   -2.39  0.01686 *
parliamentary      0.119757   0.096278    1.24  0.21355
development        0.284265   0.104353    2.72  0.00645 **
severity:age      -0.087687   0.016523   -5.31 1.11e-07 ***
severity:polinfrel -0.106694   0.013836   -7.71 1.25e-14 ***
severity:income   -0.072336   0.015221   -4.75 2.01e-06 ***
severity:efficacy -0.105280   0.013357   -7.88 3.23e-15 ***
severity:partyID  -0.111704   0.017487   -6.39 1.68e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation matrix not shown by default, as p = 17 > 12.
```

```
> display(m81)
glmer(formula = voted ~ (1 | cntryyear) + severity * age + severity *
    polinfrel + severity * income + severity * efficacy + severity *
    partyID + dist_magnitude + enep + vicmarg_dist + parliamentary +
    development, data = st, family = binomial(link = "logit"))
                     coef.est  coef.se
(Intercept)            2.32      0.09
severity               0.59      0.11
age                    0.35      0.01
polinfrel              0.35      0.01
income                 0.21      0.01
efficacy               0.33      0.01
partyID                0.43      0.01
dist_magnitude         0.16      0.10
enep                  -0.18      0.10
vicmarg_dist          -0.03      0.01
parliamentary          0.12      0.10
development            0.28      0.10
severity:age          -0.09      0.02
severity:polinfrel    -0.11      0.01
severity:income       -0.07      0.02
severity:efficacy     -0.11      0.01
severity:partyID      -0.11      0.02

Error terms:
 Groups    Name         Std.Dev.
 cntryyear (Intercept)  0.75
 Residual               1.00
---
number of obs: 92741, groups: cntryyear, 77
AIC = 63235.4, DIC = 62445.1
deviance = 62822.2
```