# ATCR Lab Repeated Measures 3 – Lab Key

1. The regression and independence analyses give virtually identical results. A minor difference is that the regression uses t-tests, while xtgee uses z-tests. xtcorr gives all zeros for the correlation because we assumed independence.
2. The exchangeable correlation forces all the correlations between various birth orders to be the same.
3. Here is a table of the results with and without the robust option. The first thing to note is the "protection" given you by the robust option. The results hardly vary across the various assumed correlation structures. Without robust, the SEs vary much more. The two analyses without robust that appear to be closest to correct are the exchangeable and unstructured. For this case (small number of times, balanced data), the unstructured isn't estimating too many parameters and is attractive. The exchangeable is supported by the data and works just as well. AR(1), which seems logical, performs much more poorly, suggesting the correlation is induced predominantly by stable-over-time characteristics of the mom. We haven't covered in class how to do the robust SE for regression. The command was "`regress bweight birthord initage, cluster(momid)`". A cluster bootstrap (as in lab 2) would also work to correct the SEs from the `regress` command.

   Coefficients and SEs of Birthord

| | Without Robust | | With Robust | |
|---|---|---|---|---|
| Analysis | Estimate | SE | Estimate | SE |
| Regression | 46.61 | 12.76 | 46.61 | 10.03 |
| XTGEE – indep | 46.61 | 12.74 | 46.61 | 10.02 |
| XTGEE – exch | 46.61 | 9.94 | 46.61 | 10.02 |
| XTGEE – unstr | 44.70 | 9.94 | 44.70 | 9.85 |
| XTGEE – AR(1) | 47.31 | 13.81 | 47.31 | 10.52 |

4. The results using xtgee and logistic are quite similar. How come? Use of the `xtcorr` command shows that the correlation is quite small, only about 0.07, so the data are "almost" independent.

5. The *only* sensible correlation structure is exchangeable. Patients are assumed to be correlated because they share a doctor. No further correlation structure is reasonable. Otherwise, why should patients 1 and 2 (say) be more highly correlated than patients 1 and 3 (say)? It looks as if practice style, age and thoracic are needed in the final model. Education is not statistically significant.
6. Practice style is statistically significant. Don't be fooled by the lack of statistical significance of the printed terms. Testparm gives an overall p-value of 0.015, mainly because low is different than medium (which isn't one of the default comparisons). NB: you can't necessarily depend on the p-values of the displayed comparisons to give an accurate overall test.

7. Interpretation (commands and output below): After adjustment for age and whether the thoracic region is involved: The odds of understanding in the low practice style group are .76 times (95% CI .40 to 1.44) that of the high practice style group. The odds of understanding in the medium group are 1.73 times (95% CI .94 to 3.17) that of the high group and the odds of understanding in the low group are .44 times (95% CI .25 to .78) that of the medium group.

```
. xi: xtgee undrstnd  age i.thor i.prac, i(doctor) corr(exch) family(bi) ef
i.thoraic         _Ithoraic_0-1       (naturally coded; _Ithoraic_0 omitted)
i.pracstyl        _Ipracstyl_0-2      (naturally coded; _Ipracstyl_2 omitted)

GEE population-averaged model                   Number of obs      =      1061
Group variable:                       doctor    Number of groups   =        44
Link:                                  logit    Obs per group: min =        12
Family:                             binomial                   avg =      24.1
Correlation:                    exchangeable                   max =        35
                                                Wald chi2(4)       =     40.06
Scale parameter:                           1    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
    undrstnd | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |    .970742   .0053695    -5.37   0.000     .9602748    .9813234
 _Ithoraic_1 |   1.696967   .3691141     2.43   0.015     1.107962    2.599092
_Ipracstyl_0 |   .7619468    .246626    -0.84   0.401     .4040255    1.436946
_Ipracstyl_1 |    1.73047   .5352377     1.77   0.076     .9438127    3.172797

. lincom  _Ipracstyl_0- _Ipracstyl_1

 ( 1)  _Ipracstyl_0 - _Ipracstyl_1 = 0

------------------------------------------------------------------------------
    undrstnd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |  -.8202716   .2893695    -2.83   0.005    -1.387425   -.2531179
------------------------------------------------------------------------------

. di exp(-.82027)
.44031275

. di exp(-1.387425)
.2497175

. di exp(-.2531179)
.77637634
```

8. A plain logistic regression gives similar estimates of the odds ratios, but falsely small p-values.

9. Poisson might seem like a reasonable choice since activity limitation days is a count variable. But there is then the assumption that the variance is equal to the mean. The Poisson assumption generates a number of very small p-values, while a transformed analysis does not. So one is wrong. Which one? A plot of residuals vs predicted for the transformed data looks fairly good. And use of the robust option for the xtgee command gives answers close to the transformed data (in terms of p-values). So the xtgee command without the robust option is incorrect. NB: depend on tried and true methods if you can; use diagnostic checks (like robust) when you can't.