Lab #3 Discussion

This lab is meant to give you practice using G-computation to calculate a relative risk for a binary effect.

```
tabulate death txtype, col chi2
```

```
     death |         0          1 |     Total
-----------+----------------------+----------
         0 |     4,971      4,339 |     9,310
           |     96.56      93.78 |     95.24
-----------+----------------------+----------
         1 |       177        288 |       465
           |      3.44       6.22 |      4.76
-----------+----------------------+----------
     Total |     5,148      4,627 |     9,775
           |    100.00     100.00 |    100.00

          Pearson chi2(1) =  41.7492   Pr = 0.000
```

Show the proportions. What proportion die in the two txtype groups?

6.2% percent die with a cadaveric organ and 3.4% die with a living organ.

```
glm death i.hlamat c.age_don c.age i.txtype c.year,
 family(binomial) link(log) eform
```

```
glm death i.hlamat c.age_don c.age i.txtype c.year,
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```

What is the relative risk of death associated with the txtype?

```
Generalized linear models                         No. of obs      =      9,775
Optimization     : ML                             Residual df     =      9,764
                                                  Scale parameter =          1
Deviance         =  3537.113445                   (1/df) Deviance =   .3622607
Pearson          =   9467.91809                   (1/df) Pearson  =   .9696762

Variance function: V(u) = u*(1-u)                 [Bernoulli]
Link function    : g(u) = ln(u)                   [Log]

                                                  AIC             =   .3641037
Log likelihood   = -1768.556723                   BIC             =  -86170.45
```

death	Risk Ratio	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
hlamat						
1	.9528767	.1552376	-0.30	0.767	.6924102	1.311324
2	.7703749	.1307864	-1.54	0.124	.5523239	1.07451
3	.6685188	.1174237	-2.29	0.022	.4738077	.9432464
4	.6180188	.1322093	-2.25	0.024	.406358	.9399277
5	.7955451	.2216538	-0.82	0.412	.4607911	1.37349
6	.7558777	.2232885	-0.95	0.343	.4236469	1.348649
age_don	.9929943	.0035475	-1.97	0.049	.9860656	.9999718
age	.9523994	.0078743	-5.90	0.000	.9370905	.9679585
1.txtype	1.382402	.1773821	2.52	0.012	1.075011	1.777689
year	.8783728	.0113742	-10.01	0.000	.8563604	.900951
_cons	2.6e+111	6.6e+112	9.93	0.000	2.62e+89	2.5e+133

The GLM model with a "log" link returns the relative risks of death for each variable. The adjusted relative risk of type of organ (cadaveric relative to living) is 1.38 with 95% conf interval from 1.08 to 1.78.

```
logistic death i.hlamat c.age_don c.age i.txtype c.year
```

What is the odds ratio of death associated with the txtype? Is it similar to the relative risk?

death	Odds Ratio	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
hlamat						
1	.9465672	.170439	-0.30	0.760	.6650955	1.347159
2	.7512613	.1396115	-1.54	0.124	.5219237	1.081372
3	.6475089	.1235607	-2.28	0.023	.4454669	.9411872
4	.592549	.135747	-2.28	0.022	.378201	.9283803
5	.7814941	.234077	-0.82	0.410	.4344798	1.405665
6	.7489237	.2390158	-0.91	0.365	.4006639	1.399893
age_don	.9924912	.00381	-1.96	0.050	.9850516	.9999869
age	.949418	.0084874	-5.81	0.000	.9329278	.9661996
1.txtype	1.412075	.1919952	2.54	0.011	1.08174	1.843287
year	.868867	.0120869	-10.10	0.000	.8454971	.8928828
_cons	7.8e+120	2.2e+122	10.03	0.000	1.81e+97	3.3e+144

The logistic regression model gives the relative odds of death for each variable. The adjusted odds ratio for thetype of organ (cadaveric relative to living) is 1.51 with 95% conf interval from 1.08 to 1.84. Given that death is not frequent, it is not surprising

4. G-COMPUTATION (POTENTIAL OUTCOME ESTIMATION)

We then use each of these models to predict the probability of death if the entire sample received a cadaveric transplant (we will call this “p1”) or if the entire sample received a living transplant (we will call this “p0”). This is done with the margins command.

First, repeat the logistic regression

```
logistic death i.hlamat c.age_don c.age i.txtype c.year
```

You can obtain p1 and p0 with the margins command

```
margins txtype, post
```

```
Predictive margins                              Number of obs     =      9,775
Model VCE    : OIM

Expression   : Pr(death), predict()

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      txtype |
          0  |   .0395061   .0034371    11.49   0.000     .0327695    .0462428
          1  |   .0545477   .0038057    14.33   0.000     .0470886    .0620068
------------------------------------------------------------------------------
```

The estimate probability of death if the entire sample underwent a living transplant is 4.0% and if the entire sample underwent a cadaveric organ is 5.5% based on a logistic regression model.

It is possible to obtain a relative risk (RR) with confidence interval by typing

```
nlcom log(_b[1.txtype])-log(_b[0.txtype])
```

```
       _nl_1:  log(_b[1.txtype])-log(_b[0.txtype])

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3226191   .1276197     2.53   0.011     .0724891    .5727492
------------------------------------------------------------------------------
```

You will have to exponentiate the values to get the RR and it's limits. After exponentiation, with get a RR of 1.38 with 95% CI from 1.08 to 1.77. Note this is extremely close to the adjusted relative risk. The best part about potential outcome estimation is that we have two rigorously motivated numbers which describe the effect of the type of organ. We estimated a RR here but we could have also calculated a risk difference and even the "number needed to treat" or a similar type of number.

The lab then turns to understand how p0 and p1 are calculated. I had you refit the logistic model.

```
logistic death i.hlamat c.age_don c.age i.txtype c.year
```

"p1" was then calculated based on the logistic model using the regression equation but with txtype set to "1" for each person.

```
gen oldtxtype = txtype
replace txtype = 1
predict p1, p
```

This value of p1 is then averaged across the entire sample

```
. summ p1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
          p1 |      9,775    .0545477    .0338222   .0106214   .2529532
```

which give the identical result for margins if everyone had a cadaveric transplant.

If you want, you can attempt the same approach to estimate p0

```
replace txtype = 0
predict p0, p
```

```
. summ p0

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
          p0 |      9,775    .0395061    .0251145   .0075452    .193413
```

which give the identical result for margins if everyone had a living transplant.