For correlated normal random variables , , and with correlation , note that

For another group, we might assume that there’s common variance AND correlation, so that

Note that are independent, so the differences in differences have a normal distribution with variance: , and

Practically, this means that all of the same rules apply for this expanded example. However, we can’t easily compute , which is necessary for , so we have to do something a little different to calculate the terms in the denominator.

Note that we are already estimating within-stratum “pooled” variance for our existing t-tests:

We can plug these in as “sample” variances for our two-sample t-test, and use them to create a new pooled standard deviation:

Then, we have that