Math 150 - Methods in Biostatistics - project Part#2

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Due: Friday, April 19, 2019, in class

```r
library(readr)
AIDSdata <- read_csv("~/Math-150/AIDSdata.csv")
```

```
## Parsed with column specification:
## cols(
##   id = col_double(),
##   time = col_double(),
##   censor = col_double(),
##   time_d = col_double(),
##   censor_d = col_double(),
##   tx = col_double(),
##   txgrp = col_double(),
##   strat2 = col_double(),
##   sex = col_double(),
##   raceth = col_double(),
##   ivdrug = col_double(),
##   hemophil = col_double(),
##   karnof = col_double(),
##   cd4 = col_double(),
##   priorzdv = col_double(),
##   age = col_double()
## )
```

```r
library(survival)
library(simsurv)
library(survminer)
```

```
## Loading required package: ggplot2

## Loading required package: ggpubr

## Loading required package: magrittr
```

```r
library(FDRsampsize)
library(powerSurvEpi)
library(coxed)
```

```
## Loading required package: rms

## Loading required package: Hmisc

## Loading required package: lattice

## Loading required package: Formula

##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':
##
##     format.pval, units

## Loading required package: SparseM
```

```
##
## Attaching package: 'SparseM'
## The following object is masked from 'package:base':
##
##     backsolve
## Loading required package: mgcv
## Loading required package: nlme
## This is mgcv 1.8-28. For overview type 'help("mgcv-package")'.
```

##Power Analysis

(1) What is Power Analysis?

The power of any test of statistical significance is defined as the probability that it will reject a false null hypothesis.

	Do not reject H_0	Reject H_0
H_0 is true	Correct Decision	Incorrect Decision Type I error (α)
H_0 is false	Incorrect Decision Type II error (β)	Correct Decision

α is the Probability when we reject H_0 when is true

β is the probability when we do not reject H_0 when is false

power is inversely related to beta or the probability of making a Type II error: $1-\beta$

75% power means you have an 75% chance of getting a significant result when the effect is real.

(2)How to Calculate the power?

To calculare the power there is a common formula we can used it.

$$1-\beta = 2\Phi(z - z_1 -_\alpha) - 1$$

$$z = (\delta - |ln(\theta)|\sqrt{(}nP_A P_B P_E)$$

,

$$n = \frac{1}{P_A P_B P_E}(\frac{z_1 -_\alpha + z_1 -_{\frac{\beta}{2}}}{\delta - |ln(\theta)|})^2$$

$1-\beta$ is our measure of power. $0 < \beta < 1$

Φ is the standard Normal distribution function.

δ is the testing margin.

θ is the hazard ration

$ln(\theta)$ is the natural logarithm of the hazard ratio, or the log-hazard ratio

n is sample size.

P_E is the overall probability of the event occurring within the study period

P_A and P_B are the proportions of the sample size allotted to the two groups, named 'A' and 'B'. Notice that $P_B = 1 - P_A$.

The assumption of power analysis is that sample random.

A simple random sample is a subset of a statistical population in which each member of the subset has an equal probability of being chosen. A simple random sample is meant to be an unbiased representation of a group.A simple random sample is a subset of a population in which each member of the subset has an equal probability of being chosen. A simple random sample is meant to be an unbiased representation of a group.

(3)What are ingredients of Statistical Power? There are three ingredients of that.

First,strength of the treatment. There is positive relationship between the power and strength of the treatment. That mean, when the strength of your treatment increases, the power of your experiment increases.

Second, background noise. There is opposite relationship between the power and background noise. That mean, when the background noise of your outcome variables increases, the power of your experiment decreases.

Third, experimental Design. Traditional power analysis focuses on one element of experimental design: the number of subjects in each experimental group.

The three ingredients of power connect to the survival analysis model by. Strength of the treatment, how much does the treatment effect how people behave. Backround noise, explaining by example.If we test the drugs there are many diseases kill people then if hard to see when drugs effect. For experimental design, how well the experimental setup or determined and how well good result.

(4)Power analysis for survival analysis

Survival analysis: The survival probability is the probability that an individual survives from the time origin to a specified future time t and is denoted by $S(t)$. Also, called the survivor function.

Hazard Function: Hazard Function is another idea in survival analysis. Also, called instantaneous death rate. It is usually denoted by $h(t)$ ot $\lambda(t)$ and is the probability that an individual who is under observation at a time t has an event at that time. In another word, it represents the instantaneous event rate for an individual who has already survived to time t.

In survival analysis, the power is directly related to the number of events observed in the study. The required sample size is therefore determined by the observed number of events. Survival data are commonly analyzed using the log-rank test or the Cox proportional hazards model.

Time to death is the event of interest

#Null Hypothesis to be Tested

$H_0 : HR = 1$

where $HR = \frac{h_0(t)}{h_1(t)}$ for all t assuming proportional hazards

#Alternative hypothesis

$H_0 : HR \neq 1$

#Test Statistic

HR estimated from Cox model

#Effect Size

HR = 1 implies no difference between treatments

HR > 1 implies "survival" is longer on treatment 2

HR < 1 implies "survival" is longer on treatment 1

#Significance Level

$\alpha = 0.05$, $z_{\frac{\alpha}{2}} = 1.96$

#Power

Typically desire power of at least 80%,90% or 95%. Recall that for means and proportions, power is a function of sample size.However, for survival data, power is entirely driven by number of events

Power	β	z_β
80%	0.20	0.842
90%	0.10	1.282
95%	0.05	1.645

#Required Number of Events

$$events = \frac{(z_{\frac{\alpha}{2}} + z_\beta)^2}{\pi_1 \pi_2 (log HR)^2}$$

where $z_{\frac{\alpha}{2}}$ and z_β are dtandard normal percentiles, $\pi_1 and \pi_2$ are the proportion to be allocated to grpups 1 and 2

(for equal allocation π_1 and π_2=1/2)

#Probability of an Event

$$p(event) = 1 - (\pi_1 s_1(T) + \pi_2 s_2(T)$$

where $S_1(t)$ and $S_2(t)$ are Survival function of groups 1 and 2

Find the best model for AIS data

There are many way to find the best model for the data. We can find the best model by using cox and adding all explanatory variables. Then we see which variables are significant.

#Full Model

```
cop1<-coxph(Surv(time_d,censor_d==1)~cd4+tx+strat2+sex+raceth+ivdrug+hemophil+karnof+priorzdv+age,data=A
cop1
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + strat2 +
##     sex + raceth + ivdrug + hemophil + karnof + priorzdv + age,
##     data = AIDSdata)
##
##                coef exp(coef)  se(coef)      z        p
## cd4       -0.011255  0.988809  0.009008 -1.249 0.211498
## tx        -0.835826  0.433516  0.495609 -1.686 0.091707
## strat2    -0.566918  0.567271  0.803798 -0.705 0.480624
## sex        0.659749  1.934307  0.567115  1.163 0.244690
## raceth     0.197628  1.218509  0.238724  0.828 0.407755
```

```
## ivdrug   -0.039250  0.961510  0.297013 -0.132 0.894865
## hemophil  0.987971  2.685780  1.089686  0.907 0.364588
## karnof   -0.077120  0.925779  0.027610 -2.793 0.005220
## priorzdv -0.005682  0.994335  0.009919 -0.573 0.566774
## age       0.079219  1.082442  0.023888  3.316 0.000912
##
## Likelihood ratio test=39.14  on 10 df, p=2.4e-05
## n= 851, number of events= 20
```

For the first output, it seems the varabiles (cd4,tx,strat2,se,raceth,ivdrug,hemophil and priorzdv) are not significant. We will do a likelihood ratio test to confirm.

```
cop2<-coxph(Surv(time_d,censor_d==1)~cd4+tx+strat2+sex+raceth+hemophil+karnof+priorzdv+age,data=AIDSdat
cop2
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + strat2 +
##     sex + raceth + hemophil + karnof + priorzdv + age, data = AIDSdata)
##
##               coef exp(coef)  se(coef)      z        p
## cd4      -0.011351  0.988713  0.008987 -1.263 0.206571
## tx       -0.832779  0.434839  0.495182 -1.682 0.092615
## strat2   -0.552708  0.575390  0.797232 -0.693 0.488132
## sex       0.659022  1.932900  0.567082  1.162 0.245184
## raceth    0.189698  1.208884  0.231400  0.820 0.412340
## hemophil  0.985072  2.678006  1.091424  0.903 0.366761
## karnof   -0.076797  0.926078  0.027477 -2.795 0.005191
## priorzdv -0.005825  0.994192  0.009901 -0.588 0.556328
## age       0.079400  1.082637  0.023901  3.322 0.000894
##
## Likelihood ratio test=39.12  on 9 df, p=1.095e-05
## n= 851, number of events= 20
```

```
cop=2*(cop1$loglik[2]-cop2$loglik[2])
cop
```

```
## [1] 0.0176964
```

```
1-pchisq(cop,1)
```

```
## [1] 0.8941714
```

There variable we remove was not significaent (comfirem)

```
cop3<-coxph(Surv(time_d,censor_d==1)~cd4+tx+strat2+sex+raceth+hemophil+karnof+age,data=AIDSdata)
cop3
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + strat2 +
##     sex + raceth + hemophil + karnof + age, data = AIDSdata)
##
##               coef exp(coef)  se(coef)      z       p
## cd4      -0.011796  0.988273  0.008907 -1.324 0.18538
## tx       -0.852267  0.426447  0.495033 -1.722 0.08514
## strat2   -0.538686  0.583515  0.801061 -0.672 0.50129
## sex       0.683027  1.979862  0.566272  1.206 0.22775
## raceth    0.196087  1.216632  0.230837  0.849 0.39563
## hemophil  0.848830  2.336910  1.079975  0.786 0.43188
```

```
## karnof   -0.075448  0.927328  0.027221 -2.772 0.00558
## age       0.080127  1.083424  0.024066  3.329 0.00087
##
## Likelihood ratio test=38.74  on 8 df, p=5.487e-06
## n= 851, number of events= 20
```

```
cop4<-coxph(Surv(time_d,censor_d==1)~cd4+tx+sex+raceth+hemophil+karnof+age,data=AIDSdata)
cop4
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + sex +
##     raceth + hemophil + karnof + age, data = AIDSdata)
##
##               coef exp(coef)  se(coef)      z       p
## cd4      -0.016448  0.983686  0.006381 -2.578 0.00994
## tx       -0.822669  0.439258  0.492847 -1.669 0.09507
## sex       0.672284  1.958705  0.565202  1.189 0.23426
## raceth    0.196542  1.217186  0.229554  0.856 0.39189
## hemophil  0.847309  2.333358  1.076279  0.787 0.43113
## karnof   -0.074537  0.928173  0.027012 -2.759 0.00579
## age       0.077046  1.080092  0.023673  3.255 0.00114
##
## Likelihood ratio test=38.27  on 7 df, p=2.689e-06
## n= 851, number of events= 20
```

```
copp=2*(cop3$loglik[2]-cop4$loglik[2])
copp
```

```
## [1] 0.469972
```

```
1-pchisq(copp,1)
```

```
## [1] 0.4930001
```

```
cop5<-coxph(Surv(time_d,censor_d==1)~cd4+tx+sex+raceth+karnof+age,data=AIDSdata)
cop5
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + sex +
##     raceth + karnof + age, data = AIDSdata)
##
##             coef exp(coef)  se(coef)      z       p
## cd4    -0.016310  0.983822  0.006341 -2.572 0.01011
## tx     -0.845455  0.429362  0.490554 -1.723 0.08480
## sex     0.640997  1.898373  0.562596  1.139 0.25455
## raceth  0.229194  1.257586  0.231135  0.992 0.32139
## karnof -0.073793  0.928864  0.026915 -2.742 0.00611
## age     0.075437  1.078355  0.023530  3.206 0.00135
##
## Likelihood ratio test=37.77  on 6 df, p=1.246e-06
## n= 851, number of events= 20
```

```
coppp=2*(cop4$loglik[2]-cop5$loglik[2])
coppp
```

```
## [1] 0.5026622
```

```r
1-pchisq(coppp,1)
```

```
## [1] 0.4783327
```

```r
cop6<-coxph(Surv(time_d,censor_d==1)~cd4+tx+sex+karnof+age,data=AIDSdata)
cop6
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + sex +
##     karnof + age, data = AIDSdata)
##
##             coef exp(coef)  se(coef)      z       p
## cd4    -0.016431  0.983703  0.006357 -2.585 0.00975
## tx     -0.869705  0.419075  0.490311 -1.774 0.07610
## sex     0.636651  1.890139  0.561470  1.134 0.25684
## karnof -0.072203  0.930342  0.026420 -2.733 0.00628
## age     0.075065  1.077954  0.023576  3.184 0.00145
##
## Likelihood ratio test=36.85  on 5 df, p=6.409e-07
## n= 851, number of events= 20
```

```r
coppp1=2*(cop5$loglik[2]-cop6$loglik[2])
coppp1
```

```
## [1] 0.9167282
```

```r
1-pchisq(coppp1,1)
```

```
## [1] 0.3383355
```

```r
cop7<-coxph(Surv(time_d,censor_d==1)~cd4+tx+karnof+age,data=AIDSdata)
cop7
```

```
## Call:
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + tx + karnof +
##     age, data = AIDSdata)
##
##             coef exp(coef)  se(coef)      z       p
## cd4    -0.016659  0.983479  0.006408 -2.600 0.00933
## tx     -0.867409  0.420038  0.490243 -1.769 0.07684
## karnof -0.071620  0.930884  0.025831 -2.773 0.00556
## age     0.073674  1.076456  0.023613  3.120 0.00181
##
## Likelihood ratio test=35.72  on 4 df, p=3.297e-07
## n= 851, number of events= 20
```

```r
coppp2=2*(cop6$loglik[2]-cop7$loglik[2])
coppp2
```

```
## [1] 1.128818
```

```r
1-pchisq(coppp2,1)
```

```
## [1] 0.2880275
```

```r
cop8<-coxph(Surv(time_d,censor_d==1)~cd4+karnof+age,data=AIDSdata)
cop8
```

```
## Call:
```

```
## coxph(formula = Surv(time_d, censor_d == 1) ~ cd4 + karnof +
##     age, data = AIDSdata)
##
##            coef exp(coef) se(coef)      z       p
## cd4    -0.01656   0.98357  0.00628 -2.637 0.00836
## karnof -0.07464   0.92808  0.02599 -2.872 0.00408
## age     0.07042   1.07296  0.02320  3.035 0.00240
##
## Likelihood ratio test=32.31  on 3 df, p=4.51e-07
## n= 851, number of events= 20
```

Because the Chi-square test cop=17.8 and the p-value=0.00002 with one degree of freedom is significant, we reject the null hypothesis.We got the best model.

simulation

```r
simdata <- sim.survdata(N=1000, T=100, num.data.frames=1,beta=c(0.01,0.05,0.08))
head(simdata$data,10)
```

```
##             X1         X2         X3  y failed
## 1   0.54576633  1.4915504  0.9532242 31   TRUE
## 2  -0.45783770  0.7626326 -1.0150790 21   TRUE
## 3   0.24205398  0.9413782  1.6181005 26   TRUE
## 4   0.93415321  0.7641603  0.2790443 85   TRUE
## 5   0.19169313 -0.3257669  2.0121159 32   TRUE
## 6   0.04112496 -0.2583704 -0.3981148 28   TRUE
## 7   0.22888313 -1.8168367 -0.4148365 31   TRUE
## 8   1.00906710  0.7215585 -1.9891162 31   TRUE
## 9   0.27416965  1.4099467  1.5643649 91   TRUE
## 10 -0.29096487  0.2734262  0.4041392 32   TRUE
```

```r
simdata$betas
```

```
##      [,1]
## [1,] 0.01
## [2,] 0.05
## [3,] 0.08
```

```r
head(simdata$baseline,10)
```

```
##    time  failure.PDF  failure.CDF  survivor       hazard
## 1     1 4.069055e-06 4.069055e-06 0.9999959 4.069055e-06
## 2     2 2.848339e-05 3.255244e-05 0.9999674 2.848350e-05
## 3     3 7.731205e-05 1.098645e-04 0.9998901 7.731457e-05
## 4     4 1.505550e-04 2.604195e-04 0.9997396 1.505716e-04
## 5     5 2.482124e-04 5.086319e-04 0.9994914 2.482770e-04
## 6     6 3.702840e-04 8.789160e-04 0.9991211 3.704725e-04
## 7     7 5.167700e-04 1.395686e-03 0.9986043 5.172246e-04
## 8     8 6.876704e-04 2.083356e-03 0.9979166 6.886315e-04
## 9     9 8.829850e-04 2.966341e-03 0.9970337 8.848284e-04
## 10   10 1.102714e-03 4.069055e-03 0.9959309 1.105995e-03
```

```r
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:nlme':
##
##     collapse
## The following objects are masked from 'package:Hmisc':
##
##     src, summarize
## The following objects are masked from 'package:stats':
##
##     filter, lag
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
library(broom)
```

```r
set.seed(1234)
n.reps<-100
a<-c()
for(i in 1:n.reps){
  simdata<-sim.survdata(N=851,num.data.frames=1,xvars=3,beta=c(-0.01656,-0.07464,0.07042))
model<-coxph(Surv(y,failed)~X1+X2+X3,data=simdata$data)
a<-rbind(a,cbind(rep=rep(i,3),model %>% tidy()))
}
a
```

```
##     rep term     estimate  std.error   statistic      p.value
## 1     1   X1 -0.001091115 0.03641440 -0.02996382 9.760959e-01
## 2     1   X2 -0.044468763 0.03840846 -1.15778576 2.469515e-01
## 3     1   X3  0.071231554 0.03490418  2.04077453 4.127324e-02
## 4     2   X1 -0.034537298 0.03762270 -0.91799089 3.586236e-01
## 5     2   X2 -0.097746012 0.03774791 -2.58944159 9.613173e-03
## 6     2   X3 -0.020102203 0.03662637 -0.54884501 5.831118e-01
## 7     3   X1 -0.045698968 0.03857367 -1.18471906 2.361285e-01
## 8     3   X2 -0.087796818 0.03704260 -2.37015824 1.778047e-02
## 9     3   X3  0.023247374 0.03727689  0.62364044 5.328637e-01
## 10    4   X1  0.005741797 0.03851358  0.14908499 8.814866e-01
## 11    4   X2 -0.119241267 0.03609352 -3.30367539 9.542626e-04
## 12    4   X3  0.024358176 0.03612116  0.67434651 5.000910e-01
## 13    5   X1 -0.027040780 0.03489204 -0.77498417 4.383490e-01
## 14    5   X2 -0.140348545 0.03548332 -3.95533902 7.642620e-05
## 15    5   X3  0.085507933 0.03608260  2.36978314 1.779852e-02
## 16    6   X1 -0.031674288 0.03641196 -0.86988687 3.843622e-01
## 17    6   X2 -0.076039307 0.03900018 -1.94971704 5.120985e-02
## 18    6   X3  0.057769160 0.03650382  1.58255093 1.135239e-01
## 19    7   X1 -0.043962804 0.03611997 -1.21713288 2.235537e-01
## 20    7   X2 -0.045774965 0.03707868 -1.23453604 2.170032e-01
## 21    7   X3  0.098460321 0.03566734  2.76051763 5.770984e-03
## 22    8   X1  0.023275900 0.03825992  0.60836242 5.429471e-01
## 23    8   X2 -0.042845551 0.03480445 -1.23103642 2.183092e-01
## 24    8   X3  0.027715894 0.03827756  0.72407684 4.690186e-01
## 25    9   X1  0.112345662 0.03947732  2.84582823 4.429608e-03
## 26    9   X2  0.001913593 0.03618242  0.05288738 9.578216e-01
## 27    9   X3 -0.029203161 0.03739064 -0.78102868 4.347856e-01
## 28   10   X1  0.086038032 0.03948952  2.17875632 2.934978e-02
```

```
## 29   10   X2 -0.044502190 0.03678194 -1.20989253 2.263201e-01
## 30   10   X3  0.042613780 0.03706888  1.14958370 2.503154e-01
## 31   11   X1  0.017311110 0.03431104  0.50453471 6.138857e-01
## 32   11   X2 -0.021360127 0.03391771 -0.62976323 5.288495e-01
## 33   11   X3 -0.005557740 0.03621034 -0.15348488 8.780159e-01
## 34   12   X1 -0.012558671 0.03534340 -0.35533281 7.223403e-01
## 35   12   X2 -0.067839853 0.03721523 -1.82290542 6.831772e-02
## 36   12   X3  0.079245123 0.03709756  2.13612777 3.266900e-02
## 37   13   X1  0.004049296 0.03649918  0.11094213 9.116622e-01
## 38   13   X2 -0.044952127 0.03646544 -1.23273249 2.176756e-01
## 39   13   X3 -0.076222656 0.03670833 -2.07644019 3.785326e-02
## 40   14   X1  0.019656860 0.03492424  0.56284284 5.735419e-01
## 41   14   X2  0.010696105 0.03802166  0.28131609 7.784680e-01
## 42   14   X3  0.054701841 0.03403347  1.60729559 1.079895e-01
## 43   15   X1 -0.057023436 0.03683899 -1.54790982 1.216440e-01
## 44   15   X2 -0.081477517 0.03753194 -2.17088462 2.993989e-02
## 45   15   X3  0.027297960 0.03785093  0.72119662 4.707886e-01
## 46   16   X1  0.013234975 0.03663301  0.36128550 7.178860e-01
## 47   16   X2 -0.018188690 0.03504055 -0.51907551 6.037081e-01
## 48   16   X3  0.086584592 0.03907520  2.21584523 2.670210e-02
## 49   17   X1 -0.034193303 0.03658835 -0.93454061 3.500251e-01
## 50   17   X2 -0.026889800 0.03478426 -0.77304507 4.394957e-01
## 51   17   X3  0.092513255 0.03611571  2.56157896 1.041976e-02
## 52   18   X1 -0.012135717 0.03785413 -0.32059164 7.485199e-01
## 53   18   X2 -0.081720225 0.03709787 -2.20282807 2.760687e-02
## 54   18   X3  0.076490305 0.03561611  2.14763197 3.174300e-02
## 55   19   X1 -0.031422459 0.03662741 -0.85789465 3.909506e-01
## 56   19   X2 -0.024228705 0.03446313 -0.70303260 4.820354e-01
## 57   19   X3  0.021455906 0.03603639  0.59539546 5.515792e-01
## 58   20   X1 -0.027849270 0.03657611 -0.76140612 4.464145e-01
## 59   20   X2 -0.104220407 0.03727993 -2.79561692 5.180076e-03
## 60   20   X3  0.049232567 0.03518671  1.39918057 1.617588e-01
## 61   21   X1 -0.045771941 0.03536455 -1.29428864 1.955657e-01
## 62   21   X2 -0.122230657 0.03930067 -3.11014198 1.869974e-03
## 63   21   X3  0.085157872 0.03661962  2.32547114 2.004678e-02
## 64   22   X1 -0.055340737 0.03519090 -1.57258674 1.158145e-01
## 65   22   X2 -0.147531594 0.03664590 -4.02586944 5.676518e-05
## 66   22   X3  0.127124090 0.03833812  3.31586652 9.135945e-04
## 67   23   X1 -0.037445789 0.03849402 -0.97276910 3.306681e-01
## 68   23   X2 -0.054519104 0.03731046 -1.46122837 1.439528e-01
## 69   23   X3  0.039499344 0.03362480  1.17470868 2.401113e-01
## 70   24   X1 -0.012597032 0.03592997 -0.35059957 7.258888e-01
## 71   24   X2 -0.103234729 0.03528671 -2.92559816 3.437947e-03
## 72   24   X3  0.119241279 0.03721239  3.20434345 1.353709e-03
## 73   25   X1  0.040752153 0.03608569  1.12931622 2.587645e-01
## 74   25   X2 -0.041538779 0.03665007 -1.13338895 2.570510e-01
## 75   25   X3  0.033030428 0.03743967  0.88223079 3.776520e-01
## 76   26   X1 -0.022290600 0.03593697 -0.62026930 5.350805e-01
## 77   26   X2 -0.075547985 0.03808256 -1.98379487 4.727871e-02
## 78   26   X3  0.047358907 0.03564934  1.32846531 1.840244e-01
## 79   27   X1 -0.036718609 0.03402694 -1.07910413 2.805413e-01
## 80   27   X2 -0.121596923 0.03623322 -3.35595117 7.909253e-04
## 81   27   X3  0.103544741 0.03795672  2.72796871 6.372565e-03
## 82   28   X1 -0.038338877 0.03935122 -0.97427409 3.299205e-01
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## 83   28   X2 -0.027214754 0.03644173 -0.74680202 4.551831e-01
## 84   28   X3  0.061174196 0.03605729  1.69658336 8.977546e-02
## 85   29   X1 -0.077895752 0.03725005 -2.09115841 3.651387e-02
## 86   29   X2 -0.024958502 0.03507084 -0.71165968 4.766755e-01
## 87   29   X3  0.155739705 0.03482698  4.47181237 7.755947e-06
## 88   30   X1  0.070494160 0.03652770  1.92988249 5.362140e-02
## 89   30   X2 -0.015283015 0.03633976 -0.42055906 6.740771e-01
## 90   30   X3  0.087715112 0.03614707  2.42661749 1.524031e-02
## 91   31   X1 -0.003094473 0.03402595 -0.09094452 9.275367e-01
## 92   31   X2 -0.065507237 0.03727113 -1.75758644 7.881790e-02
## 93   31   X3  0.056822661 0.03594458  1.58084073 1.139145e-01
## 94   32   X1 -0.006341605 0.03642000 -0.17412426 8.617678e-01
## 95   32   X2  0.013032362 0.03692154  0.35297444 7.241076e-01
## 96   32   X3  0.117263645 0.03494150  3.35599902 7.907885e-04
## 97   33   X1  0.023284365 0.03658497  0.63644617 5.244857e-01
## 98   33   X2 -0.102431659 0.03628793 -2.82274718 4.761410e-03
## 99   33   X3  0.089761677 0.03617697  2.48118257 1.309473e-02
## 100  34   X1  0.050729387 0.03699380  1.37129443 1.702832e-01
## 101  34   X2  0.010471454 0.03592777  0.29145849 7.707007e-01
## 102  34   X3  0.029537116 0.03766456  0.78421503 4.329139e-01
## 103  35   X1 -0.039008538 0.03581263 -1.08923966 2.760482e-01
## 104  35   X2 -0.055652978 0.03684557 -1.51043871 1.309315e-01
## 105  35   X3  0.085605868 0.03625781  2.36103226 1.822415e-02
## 106  36   X1  0.033254944 0.03644424  0.91248832 3.615117e-01
## 107  36   X2 -0.019409531 0.03678386 -0.52766434 5.977323e-01
## 108  36   X3  0.001413734 0.03563729  0.03967007 9.683562e-01
## 109  37   X1 -0.022368913 0.03419093 -0.65423527 5.129602e-01
## 110  37   X2 -0.074011717 0.03757083 -1.96992489 4.884698e-02
## 111  37   X3  0.037337122 0.03727450  1.00167991 3.164982e-01
## 112  38   X1 -0.037705734 0.03553664 -1.06103833 2.886725e-01
## 113  38   X2 -0.046040848 0.03881855 -1.18605280 2.356014e-01
## 114  38   X3  0.040300189 0.03653055  1.10319150 2.699440e-01
## 115  39   X1 -0.004909202 0.03651963 -0.13442638 8.930654e-01
## 116  39   X2 -0.136272938 0.03697485 -3.68555727 2.282028e-04
## 117  39   X3  0.121113932 0.03598676  3.36551353 7.640132e-04
## 118  40   X1 -0.022735644 0.03394317 -0.66981498 5.029757e-01
## 119  40   X2 -0.004941253 0.03830615 -0.12899373 8.973626e-01
## 120  40   X3  0.070839312 0.03809896  1.85935042 6.297748e-02
## 121  41   X1  0.041972950 0.03649721  1.15003174 2.501308e-01
## 122  41   X2 -0.005140053 0.03490992 -0.14723761 8.829445e-01
## 123  41   X3  0.103658285 0.03474880  2.98307496 2.853681e-03
## 124  42   X1 -0.023178832 0.03478036 -0.66643453 5.051334e-01
## 125  42   X2 -0.076058108 0.03653384 -2.08185345 3.735586e-02
## 126  42   X3 -0.013592040 0.03579881 -0.37967851 7.041841e-01
## 127  43   X1 -0.056439374 0.03699893 -1.52543280 1.271512e-01
## 128  43   X2 -0.065433988 0.03549568 -1.84343509 6.526551e-02
## 129  43   X3  0.066100011 0.03667977  1.80208372 7.153223e-02
## 130  44   X1 -0.057519444 0.03841862 -1.49717618 1.343474e-01
## 131  44   X2 -0.091846119 0.03580986 -2.56482784 1.032270e-02
## 132  44   X3  0.045495151 0.03742294  1.21570231 2.240983e-01
## 133  45   X1 -0.022834797 0.03847113 -0.59355672 5.528086e-01
## 134  45   X2 -0.079515218 0.03738508 -2.12692358 3.342643e-02
## 135  45   X3  0.063265535 0.03637706  1.73916031 8.200657e-02
## 136  46   X1 -0.002317948 0.03574138 -0.06485332 9.482908e-01
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## 137  46   X2 -0.041389286 0.03771363 -1.09746240 2.724393e-01
## 138  46   X3  0.092943992 0.03706700  2.50745912 1.216026e-02
## 139  47   X1 -0.005858587 0.03872332 -0.15129352 8.797442e-01
## 140  47   X2 -0.021363596 0.03506442 -0.60926702 5.423475e-01
## 141  47   X3  0.085945742 0.03753062  2.29001667 2.202035e-02
## 142  48   X1  0.035998504 0.03773082  0.95408752 3.400393e-01
## 143  48   X2 -0.066394893 0.03940180 -1.68507248 9.197459e-02
## 144  48   X3  0.081704246 0.03905962  2.09178279 3.645795e-02
## 145  49   X1 -0.022759120 0.03848083 -0.59144050 5.542253e-01
## 146  49   X2 -0.043596156 0.03606426 -1.20884658 2.267218e-01
## 147  49   X3  0.050092978 0.03433747  1.45884319 1.446083e-01
## 148  50   X1 -0.021717399 0.03669762 -0.59179316 5.539891e-01
## 149  50   X2 -0.091300358 0.03705165 -2.46413775 1.373433e-02
## 150  50   X3  0.070091501 0.03521606  1.99032765 4.655485e-02
## 151  51   X1  0.075540929 0.03814952  1.98012777 4.768917e-02
## 152  51   X2 -0.113789596 0.03493007 -3.25764042 1.123427e-03
## 153  51   X3  0.059322068 0.03484106  1.70264801 8.863396e-02
## 154  52   X1  0.039948549 0.03533235  1.13065081 2.582021e-01
## 155  52   X2 -0.043234401 0.03622581 -1.19346955 2.326855e-01
## 156  52   X3 -0.046670843 0.03789514 -1.23157865 2.181065e-01
## 157  53   X1 -0.035721364 0.03651954 -0.97814384 3.280032e-01
## 158  53   X2 -0.049771388 0.03619536 -1.37507639 1.691078e-01
## 159  53   X3  0.054326272 0.03511639  1.54703486 1.218548e-01
## 160  54   X1  0.022644110 0.03559293  0.63619684 5.246481e-01
## 161  54   X2 -0.130371212 0.03531657 -3.69150217 2.229335e-04
## 162  54   X3  0.022300097 0.03652989  0.61046167 5.415560e-01
## 163  55   X1  0.006497719 0.03646152  0.17820759 8.585600e-01
## 164  55   X2 -0.056943705 0.03764003 -1.51284977 1.303178e-01
## 165  55   X3  0.043254116 0.03574442  1.21009429 2.262427e-01
## 166  56   X1 -0.006683520 0.03833663 -0.17433769 8.616001e-01
## 167  56   X2 -0.040595083 0.03408089 -1.19113904 2.335990e-01
## 168  56   X3  0.052131674 0.03773320  1.38158650 1.670987e-01
## 169  57   X1 -0.021846433 0.03671605 -0.59501038 5.518365e-01
## 170  57   X2 -0.051063415 0.03527760 -1.44747427 1.477641e-01
## 171  57   X3  0.073992038 0.03678442  2.01150474 4.427217e-02
## 172  58   X1 -0.028693798 0.03699227 -0.77567015 4.379438e-01
## 173  58   X2 -0.107361464 0.03575880 -3.00237871 2.678787e-03
## 174  58   X3  0.055114497 0.03648234  1.51071698 1.308606e-01
## 175  59   X1  0.016291967 0.03660774  0.44504156 6.562897e-01
## 176  59   X2 -0.056382020 0.03666758 -1.53765309 1.241335e-01
## 177  59   X3  0.181344268 0.03654408  4.96234298 6.964787e-07
## 178  60   X1 -0.011665782 0.03832742 -0.30437170 7.608447e-01
## 179  60   X2 -0.089508918 0.03582050 -2.49881843 1.246081e-02
## 180  60   X3  0.051822087 0.03692044  1.40361504 1.604335e-01
## 181  61   X1 -0.031361746 0.03547779 -0.88398246 3.767057e-01
## 182  61   X2 -0.034262848 0.03744099 -0.91511605 3.601307e-01
## 183  61   X3  0.030190595 0.03592840  0.84029889 4.007408e-01
## 184  62   X1  0.004026282 0.03541614  0.11368493 9.094876e-01
## 185  62   X2 -0.042640693 0.03494759 -1.22013261 2.224146e-01
## 186  62   X3  0.049194299 0.03702171  1.32879587 1.839153e-01
## 187  63   X1  0.018893582 0.03899957  0.48445616 6.280622e-01
## 188  63   X2 -0.033707596 0.03496711 -0.96397997 3.350560e-01
## 189  63   X3  0.084621099 0.03641991  2.32348450 2.015314e-02
## 190  64   X1  0.037700548 0.03855096  0.97794069 3.281037e-01
```

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## 191  64   X2 -0.011939255 0.03535020 -0.33774218 7.355575e-01
## 192  64   X3 -0.037729841 0.03637491 -1.03724915 2.996198e-01
## 193  65   X1 -0.029189072 0.03781698 -0.77185100 4.402027e-01
## 194  65   X2 -0.038666099 0.03595693 -1.07534490 2.822203e-01
## 195  65   X3  0.050044890 0.03654707  1.36932699 1.708971e-01
## 196  66   X1  0.021253934 0.03488346  0.60928406 5.423362e-01
## 197  66   X2 -0.027226641 0.03539686 -0.76918243 4.417850e-01
## 198  66   X3  0.054702129 0.03646352  1.50018787 1.335657e-01
## 199  67   X1  0.052542317 0.03804884  1.38091755 1.673043e-01
## 200  67   X2 -0.056466297 0.03697169 -1.52728478 1.266902e-01
## 201  67   X3  0.004869878 0.03586321  0.13579034 8.919870e-01
## 202  68   X1 -0.033046206 0.03453218 -0.95696831 3.385833e-01
## 203  68   X2 -0.038816462 0.03653513 -1.06244229 2.880349e-01
## 204  68   X3  0.068524641 0.03430375  1.99758476 4.576170e-02
## 205  69   X1 -0.043843800 0.03658350 -1.19845844 2.307386e-01
## 206  69   X2 -0.021407868 0.03560838 -0.60120305 5.477048e-01
## 207  69   X3  0.078315131 0.03811728  2.05458323 3.991928e-02
## 208  70   X1 -0.018590004 0.03663655 -0.50741683 6.118624e-01
## 209  70   X2 -0.017405560 0.03551545 -0.49008417 6.240743e-01
## 210  70   X3  0.066201027 0.03947693  1.67695487 9.355131e-02
## 211  71   X1  0.056110330 0.03553559  1.57898970 1.143384e-01
## 212  71   X2 -0.086412091 0.03642363 -2.37241828 1.767207e-02
## 213  71   X3  0.079791927 0.03532488  2.25880279 2.389565e-02
## 214  72   X1 -0.009751404 0.03619307 -0.26942740 7.876008e-01
## 215  72   X2 -0.070662732 0.03842083 -1.83917745 6.588909e-02
## 216  72   X3  0.058997834 0.03552145  1.66090746 9.673203e-02
## 217  73   X1 -0.073451496 0.03712530 -1.97847522 4.787512e-02
## 218  73   X2 -0.054139738 0.03733433 -1.45013283 1.470215e-01
## 219  73   X3  0.013695270 0.03778749  0.36242868 7.170317e-01
## 220  74   X1  0.007098792 0.03785528  0.18752448 8.512494e-01
## 221  74   X2 -0.025034706 0.03563981 -0.70243655 4.824070e-01
## 222  74   X3  0.048681345 0.03558705  1.36795126 1.713273e-01
## 223  75   X1 -0.056856469 0.03688467 -1.54146629 1.232033e-01
## 224  75   X2 -0.044010607 0.03421244 -1.28639185 1.983063e-01
## 225  75   X3  0.057658587 0.03766886  1.53066982 1.258510e-01
## 226  76   X1 -0.030045717 0.03660218 -0.82087235 4.117190e-01
## 227  76   X2 -0.033018454 0.03921575 -0.84196925 3.998052e-01
## 228  76   X3  0.010636687 0.03742516  0.28421221 7.762478e-01
## 229  77   X1  0.015314304 0.03634398  0.42137110 6.734841e-01
## 230  77   X2 -0.037690116 0.03490667 -1.07973972 2.802581e-01
## 231  77   X3  0.047834105 0.03700535  1.29262675 1.961402e-01
## 232  78   X1 -0.020323259 0.03555187 -0.57165091 5.675585e-01
## 233  78   X2 -0.012269287 0.03632521 -0.33776228 7.355423e-01
## 234  78   X3 -0.016535380 0.03700507 -0.44684090 6.549899e-01
## 235  79   X1  0.058126063 0.03728917  1.55879189 1.190456e-01
## 236  79   X2 -0.038345824 0.03794671 -1.01051781 3.122473e-01
## 237  79   X3  0.040572757 0.03669921  1.10554838 2.689220e-01
## 238  80   X1  0.014868190 0.03555220  0.41820726 6.757956e-01
## 239  80   X2 -0.070717474 0.03774616 -1.87350109 6.099922e-02
## 240  80   X3  0.057825340 0.03651242  1.58371697 1.132581e-01
## 241  81   X1  0.001245536 0.03628842  0.03432324 9.726194e-01
## 242  81   X2 -0.107190376 0.03667549 -2.92267097 3.470430e-03
## 243  81   X3  0.078700323 0.03878479  2.02915428 4.244258e-02
## 244  82   X1 -0.050174556 0.03612670 -1.38884951 1.648785e-01
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## 245  82   X2 -0.062232895 0.03868843 -1.60856608 1.077113e-01
## 246  82   X3  0.096741032 0.03411026  2.83612702 4.566428e-03
## 247  83   X1  0.030188071 0.03552712  0.84971896 3.954814e-01
## 248  83   X2 -0.057469155 0.03675917 -1.56339646 1.179594e-01
## 249  83   X3  0.026005570 0.03533400  0.73599288 4.617350e-01
## 250  84   X1 -0.049344183 0.03831913 -1.28771665 1.978446e-01
## 251  84   X2 -0.058447956 0.03552841 -1.64510493 9.994817e-02
## 252  84   X3  0.111381471 0.03426739  3.25036351 1.152576e-03
## 253  85   X1 -0.034564507 0.03534318 -0.97796817 3.280901e-01
## 254  85   X2 -0.022068206 0.03371018 -0.65464525 5.126962e-01
## 255  85   X3  0.041320181 0.03660768  1.12872992 2.590118e-01
## 256  86   X1  0.100611122 0.03612911  2.78476610 5.356635e-03
## 257  86   X2 -0.130120757 0.03876194 -3.35692045 7.881579e-04
## 258  86   X3  0.075195631 0.03624498  2.07464981 3.801900e-02
## 259  87   X1 -0.050504720 0.03590969 -1.40643689 1.595944e-01
## 260  87   X2 -0.131538556 0.03685426 -3.56915499 3.581345e-04
## 261  87   X3  0.089718951 0.03787758  2.36865602 1.785285e-02
## 262  88   X1  0.052348741 0.03492781  1.49876951 1.339334e-01
## 263  88   X2  0.003680489 0.03556941  0.10347343 9.175872e-01
## 264  88   X3 -0.033291337 0.03680207 -0.90460501 3.656747e-01
## 265  89   X1  0.034452640 0.03478241  0.99051906 3.219205e-01
## 266  89   X2 -0.042563472 0.03480483 -1.22291863 2.213604e-01
## 267  89   X3  0.031543369 0.03398643  0.92811657 3.533471e-01
## 268  90   X1  0.009466915 0.03677326  0.25744020 7.968390e-01
## 269  90   X2  0.040321116 0.03440153  1.17207323 2.411677e-01
## 270  90   X3  0.064567885 0.03676693  1.75614014 7.906448e-02
## 271  91   X1 -0.015959334 0.03556621 -0.44872179 6.536324e-01
## 272  91   X2  0.008675240 0.03646318  0.23791781 8.119448e-01
## 273  91   X3  0.053336336 0.03695258  1.44337256 1.489156e-01
## 274  92   X1  0.002967780 0.03587004  0.08273702 9.340606e-01
## 275  92   X2 -0.068744046 0.03525143 -1.95010675 5.116340e-02
## 276  92   X3  0.080501420 0.03411321  2.35983099 1.828326e-02
## 277  93   X1  0.039628485 0.03273674  1.21052030 2.260793e-01
## 278  93   X2 -0.067891789 0.03678490 -1.84564310 6.494404e-02
## 279  93   X3  0.071706134 0.03494416  2.05202025 4.016769e-02
## 280  94   X1  0.043038461 0.03532730  1.21827777 2.231184e-01
## 281  94   X2 -0.082323265 0.03583893 -2.29703496 2.161678e-02
## 282  94   X3  0.067370439 0.03674050  1.83368319 6.670103e-02
## 283  95   X1  0.008670989 0.03706638  0.23393138 8.150383e-01
## 284  95   X2 -0.067728269 0.03730779 -1.81539229 6.946365e-02
## 285  95   X3  0.070735230 0.03634488  1.94622285 5.162798e-02
## 286  96   X1 -0.032292814 0.03768676 -0.85687427 3.915144e-01
## 287  96   X2 -0.043239541 0.03514621 -1.23027596 2.185938e-01
## 288  96   X3  0.030307479 0.03569713  0.84901726 3.958717e-01
## 289  97   X1  0.005803628 0.03493371  0.16613260 8.680526e-01
## 290  97   X2 -0.023410189 0.03718796 -0.62950991 5.290153e-01
## 291  97   X3  0.048502402 0.03597459  1.34824050 1.775810e-01
## 292  98   X1  0.023396674 0.03788507  0.61756984 5.368589e-01
## 293  98   X2 -0.063056986 0.03468690 -1.81789067 6.908084e-02
## 294  98   X3  0.055906359 0.03937149  1.41997057 1.556162e-01
## 295  99   X1 -0.055893640 0.03557771 -1.57102974 1.161757e-01
## 296  99   X2 -0.023182513 0.03619569 -0.64047722 5.218624e-01
## 297  99   X3  0.084547898 0.03496914  2.41778604 1.561526e-02
## 298 100   X1 -0.024033511 0.03640318 -0.66020369 5.091231e-01
```

```
## 299 100   X2 -0.013592243 0.03678002 -0.36955511 7.117140e-01
## 300 100   X3  0.035516677 0.03500435  1.01463602 3.102794e-01
##          conf.low     conf.high
## 1   -0.0724620287  0.0702797993
## 2   -0.1197479529  0.0308104268
## 3    0.0028206256  0.1396424822
## 4   -0.1082764392  0.0392018436
## 5   -0.1717305587 -0.0237614649
## 6   -0.0918885785  0.0516841724
## 7   -0.1213019818  0.0299040456
## 8   -0.1603989745 -0.0151946606
## 9   -0.0498139822  0.0963087312
## 10  -0.0697434401  0.0812270346
## 11  -0.1899832630 -0.0484992719
## 12  -0.0464379904  0.0951543424
## 13  -0.0954279250  0.0413463652
## 14  -0.2098945661 -0.0708025230
## 15   0.0147873399  0.1562285269
## 16  -0.1030404219  0.0396918466
## 17  -0.1524782459  0.0003996327
## 18  -0.0137770198  0.1293153405
## 19  -0.1147566462  0.0268310379
## 20  -0.1184478400  0.0268979097
## 21   0.0285536191  0.1683670234
## 22  -0.0517121725  0.0982639719
## 23  -0.1110610287  0.0253699264
## 24  -0.0473067443  0.1027385331
## 25   0.0349715434  0.1897197811
## 26  -0.0690026378  0.0728298238
## 27  -0.1024874674  0.0440811445
## 28   0.0086400033  0.1634360612
## 29  -0.1165934614  0.0275890809
## 30  -0.0300398893  0.1152674493
## 31  -0.0499372913  0.0845595122
## 32  -0.0878376197  0.0451173648
## 33  -0.0765287005  0.0654132212
## 34  -0.0818304710  0.0567131288
## 35  -0.1407803725  0.0051006665
## 36   0.0065352463  0.1519549990
## 37  -0.0674877791  0.0755863720
## 38  -0.1164230674  0.0265188131
## 39  -0.1481696652 -0.0042756474
## 40  -0.0487933978  0.0881071175
## 41  -0.0638249796  0.0852171892
## 42  -0.0120025280  0.1214062109
## 43  -0.1292265315  0.0151796595
## 44  -0.1550387721 -0.0079162613
## 45  -0.0468884914  0.1014844108
## 46  -0.0585644018  0.0850343514
## 47  -0.0868668997  0.0504895203
## 48   0.0099986103  0.1631705738
## 49  -0.1059051599  0.0375185540
## 50  -0.0950656941  0.0412860946
## 51   0.0217277549  0.1632987557
```

```
## 52  -0.0863284450  0.0620570110
## 53  -0.1544307105 -0.0090097399
## 54   0.0066840043  0.1462966048
## 55  -0.1032108646  0.0403659457
## 56  -0.0917752014  0.0433177916
## 57  -0.0491741298  0.0920859415
## 58  -0.0995371196  0.0438385788
## 59  -0.1772877303 -0.0311530841
## 60  -0.0197321257  0.1181972592
## 61  -0.1150851943  0.0235413122
## 62  -0.1992585506 -0.0452027633
## 63   0.0133847335  0.1569310101
## 64  -0.1243136265  0.0136321524
## 65  -0.2193562314 -0.0757069571
## 66   0.0519827546  0.2022654254
## 67  -0.1128926745  0.0380010958
## 68  -0.1276462641  0.0186080558
## 69  -0.0264040525  0.1054027405
## 70  -0.0830184793  0.0578244152
## 71  -0.1723954068 -0.0340740515
## 72   0.0463063341  0.1921762234
## 73  -0.0299744966  0.1114788032
## 74  -0.1133715881  0.0302940295
## 75  -0.0403499727  0.1064108282
## 76  -0.0927257686  0.0481445689
## 77  -0.1501884284 -0.0009075410
## 78  -0.0225125086  0.1172303220
## 79  -0.1034101828  0.0299729638
## 80  -0.1926127327 -0.0505811134
## 81   0.0291509393  0.1779385427
## 82  -0.1154658562  0.0387881028
## 83  -0.0986392246  0.0442097159
## 84  -0.0094967911  0.1318451835
## 85  -0.1509045060 -0.0048869987
## 86  -0.0936960825  0.0437790787
## 87   0.0874800847  0.2239993243
## 88  -0.0010988076  0.1420871267
## 89  -0.0865076360  0.0559416055
## 90   0.0168681569  0.1585620674
## 91  -0.0697841070  0.0635951600
## 92  -0.1385573137  0.0075428402
## 93  -0.0136274276  0.1272727504
## 94  -0.0777234886  0.0650402785
## 95  -0.0593325363  0.0853972598
## 96   0.0487795602  0.1857477294
## 97  -0.0484208615  0.0949895915
## 98  -0.1735547002 -0.0313086184
## 99   0.0188561112  0.1606672421
## 100 -0.0217771218  0.1232358965
## 101 -0.0599456830  0.0808885910
## 102 -0.0442840700  0.1033583022
## 103 -0.1092000052  0.0311829291
## 104 -0.1278689730  0.0165630160
## 105  0.0145418587  0.1566698770
```

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## 106 -0.0381744550  0.1046843427
## 107 -0.0915045728  0.0526855101
## 108 -0.0684340724  0.0712615402
## 109 -0.0893819062  0.0446440805
## 110 -0.1476491956 -0.0003742393
## 111 -0.0357195640  0.1103938088
## 112 -0.1073562614  0.0319447941
## 113 -0.1221238049  0.0300421087
## 114 -0.0312983672  0.1118987448
## 115 -0.0764863716  0.0666679670
## 116 -0.2087423174 -0.0638035578
## 117  0.0505811760  0.1916466886
## 118 -0.0892630340  0.0437917467
## 119 -0.0800199330  0.0701374261
## 120 -0.0038332720  0.1455118962
## 121 -0.0295602668  0.1135061659
## 122 -0.0735622414  0.0632821346
## 123  0.0355518819  0.1717646872
## 124 -0.0913470811  0.0449894178
## 125 -0.1476631261 -0.0044530907
## 126 -0.0837564256  0.0565723454
## 127 -0.1289559361  0.0160771871
## 128 -0.1350042481  0.0041362725
## 129 -0.0057910112  0.1379910329
## 130 -0.1328185583  0.0177796695
## 131 -0.1620321490 -0.0216600883
## 132 -0.0278524579  0.1188427597
## 133 -0.0982368232  0.0525672296
## 134 -0.1527886371 -0.0062417987
## 135 -0.0080321879  0.1345632584
## 136 -0.0723697739  0.0677338787
## 137 -0.1153066349  0.0325280620
## 138  0.0202940031  0.1655939800
## 139 -0.0817548934  0.0700377199
## 140 -0.0900886012  0.0473614087
## 141  0.0123870815  0.1595044021
## 142 -0.0379525426  0.1099495499
## 143 -0.1436210063  0.0108312206
## 144  0.0051487928  0.1582596985
## 145 -0.0981801544  0.0526619154
## 146 -0.1142808050  0.0270884929
## 147 -0.0172072183  0.1173931742
## 148 -0.0936434058  0.0502086086
## 149 -0.1639202482 -0.0186804674
## 150  0.0010692887  0.1391137136
## 151  0.0007692387  0.1503126194
## 152 -0.1822512673 -0.0453279238
## 153 -0.0089651624  0.1276092984
## 154 -0.0293015825  0.1091986799
## 155 -0.1142356843  0.0277668820
## 156 -0.1209439501  0.0276022632
## 157 -0.1072983482  0.0358556209
## 158 -0.1207129952  0.0211702184
## 159 -0.0145005784  0.1231531225
```

```
## 160 -0.0471167518  0.0924049713
## 161 -0.1995904265 -0.0611519976
## 162 -0.0492971701  0.0938973641
## 163 -0.0649655378  0.0779609751
## 164 -0.1307167996  0.0168293905
## 165 -0.0268036554  0.1133118870
## 166 -0.0818219354  0.0684548961
## 167 -0.1073924072  0.0262022414
## 168 -0.0218240308  0.1260873781
## 169 -0.0938085748  0.0501157094
## 170 -0.1202062357  0.0180794058
## 171  0.0018958968  0.1460881799
## 172 -0.1011973087  0.0438097137
## 173 -0.1774474268 -0.0372755011
## 174 -0.0163895841  0.1266185787
## 175 -0.0554578903  0.0880418241
## 176 -0.1282491594  0.0154851191
## 177  0.1097191836  0.2529693519
## 178 -0.0867861432  0.0634545795
## 179 -0.1597158015 -0.0193020341
## 180 -0.0205406487  0.1241848234
## 181 -0.1008969410  0.0381734489
## 182 -0.1076458343  0.0391201380
## 183 -0.0402277761  0.1006089664
## 184 -0.0653880810  0.0734406445
## 185 -0.1111367084  0.0258553227
## 186 -0.0233669244  0.1217555215
## 187 -0.0575441705  0.0953313337
## 188 -0.1022418765  0.0348266850
## 189  0.0132393848  0.1560028141
## 190 -0.0378579361  0.1132590321
## 191 -0.0812243821  0.0573458720
## 192 -0.1090233467  0.0335636657
## 193 -0.1033089855  0.0449308420
## 194 -0.1091403812  0.0318081840
## 195 -0.0215860519  0.1216758324
## 196 -0.0471163851  0.0896242539
## 197 -0.0966032070  0.0421499249
## 198 -0.0167650549  0.1261693130
## 199 -0.0220320478  0.1271166814
## 200 -0.1289294744  0.0159968806
## 201 -0.0654207288  0.0751604847
## 202 -0.1007280453  0.0346356323
## 203 -0.1104239911  0.0327910675
## 204  0.0012905335  0.1357587485
## 205 -0.1155461355  0.0278585356
## 206 -0.0911990126  0.0483832775
## 207  0.0036066284  0.1530236341
## 208 -0.0903963303  0.0532163224
## 209 -0.0870145616  0.0522034426
## 210 -0.0111723305  0.1435743839
## 211 -0.0135381457  0.1257588056
## 212 -0.1578010982 -0.0150230835
## 213  0.0105564435  0.1490274096
```

```
## 214 -0.0806885126  0.0611857042
## 215 -0.1459661829  0.0046407196
## 216 -0.0106229201  0.1286185889
## 217 -0.1462157566 -0.0006872352
## 218 -0.1273136796  0.0190342044
## 219 -0.0603668496  0.0877573901
## 220 -0.0670961936  0.0812937772
## 221 -0.0948874518  0.0448180398
## 222 -0.0210679848  0.1184306757
## 223 -0.1291490863  0.0154361477
## 224 -0.1110657624  0.0230445481
## 225 -0.0161710216  0.1314881962
## 226 -0.1017846694  0.0416932358
## 227 -0.1098799094  0.0438430004
## 228 -0.0627152768  0.0839886512
## 229 -0.0559185951  0.0865472040
## 230 -0.1061059295  0.0307256968
## 231 -0.0246950476  0.1203632574
## 232 -0.0900036456  0.0493571272
## 233 -0.0834653952  0.0589268217
## 234 -0.0890639904  0.0559932304
## 235 -0.0149593762  0.1312115030
## 236 -0.1127200034  0.0360283561
## 237 -0.0313563810  0.1125018942
## 238 -0.0548128486  0.0845492279
## 239 -0.1446985898  0.0032636425
## 240 -0.0137376892  0.1293883695
## 241 -0.0698784659  0.0723695383
## 242 -0.1790730063 -0.0353077458
## 243  0.0026835310  0.1547171147
## 244 -0.1209815957  0.0206324840
## 245 -0.1380608220  0.0135950328
## 246  0.0298861497  0.1635959148
## 247 -0.0394438133  0.0998199555
## 248 -0.1295158019  0.0145774927
## 249 -0.0432477904  0.0952589297
## 250 -0.1244482990  0.0257599335
## 251 -0.1280823534  0.0111864404
## 252  0.0442186226  0.1785443192
## 253 -0.1038358712  0.0347068571
## 254 -0.0881389353  0.0440025229
## 255 -0.0304295488  0.1130699117
## 256  0.0297993667  0.1714228765
## 257 -0.2060927676 -0.0541487458
## 258  0.0041567849  0.1462344770
## 259 -0.1208864281  0.0198769890
## 260 -0.2037715735 -0.0593055394
## 261  0.0154802642  0.1639576384
## 262 -0.0161085143  0.1208059960
## 263 -0.0660342757  0.0733952535
## 264 -0.1054220703  0.0388393956
## 265 -0.0337196314  0.1026249120
## 266 -0.1107796810  0.0256527365
## 267 -0.0350688102  0.0981555477
```

```
## 268 -0.0626073485  0.0815411786
## 269 -0.0271046499  0.1077468816
## 270 -0.0074939775  0.1366297475
## 271 -0.0856678276  0.0537491597
## 272 -0.0627912824  0.0801417634
## 273 -0.0190893848  0.1257620573
## 274 -0.0673362089  0.0732717698
## 275 -0.1378355740  0.0003474817
## 276  0.0136407488  0.1473620912
## 277 -0.0245343409  0.1037913114
## 278 -0.1399888589  0.0042052818
## 279  0.0032168293  0.1401954386
## 280 -0.0262017694  0.1122786908
## 281 -0.1525662685 -0.0120802617
## 282 -0.0046396195  0.1393804985
## 283 -0.0639777761  0.0813197540
## 284 -0.1408501882  0.0053936501
## 285 -0.0004994199  0.1419698797
## 286 -0.1061575028  0.0415718755
## 287 -0.1121248537  0.0256457712
## 288 -0.0396576089  0.1002725668
## 289 -0.0626651828  0.0742724382
## 290 -0.0962972511  0.0494768727
## 291 -0.0220065030  0.1190113065
## 292 -0.0508566899  0.0976500372
## 293 -0.1310420548  0.0049280825
## 294 -0.0212603463  0.1330730648
## 295 -0.1256246698  0.0138373898
## 296 -0.0941247560  0.0477597298
## 297  0.0160096433  0.1530861521
## 298 -0.0953824245  0.0473154025
## 299 -0.0856797486  0.0584952632
## 300 -0.0330905934  0.1041239472
```

```r
x1pvalue<-a%>% filter(term=="X1") %>%
  summarize(sum(p.value<0.05))
x2pvalue<-a%>% filter(term=="X2") %>%
  summarize(sum(p.value<0.05))
x3pvalue<-a%>% filter(term=="X3") %>%
  summarize(sum(p.value<0.05))
c(x1pvalue,x2pvalue,x3pvalue)
```

```
## $`sum(p.value < 0.05)`
## [1] 6
##
## $`sum(p.value < 0.05)`
## [1] 28
##
## $`sum(p.value < 0.05)`
## [1] 37
```

```r
X1<-a%>% filter(term=="X1")
X11<-X1$p.value
X2<-a%>%filter(term=="X2")
X22<-X2$p.value
```

```r
powerEpi(X1=X11,X2=X22,failureFlag = 1,n=51,theta=2,alpha=0.05)
```

```
## $power
## [1] 0.025
##
## $p
## [1] 0
##
## $rho2
## [1] 0.002661758
##
## $psi
## [1] 1
```

References:

http://egap.org/methods-guides/10-things-you-need-know-about-statistical-power https://www.investopedia.com/terms/s/simple-random-sample.asp Yulia Marchenko, 2007. "Power analysis and sample-size determination in survival models with the new stpower command