Designing on Precision

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We Appreciate Power....

However power isn't everything. As some researchers are advocating the moving away from straight hypothesis testing and toward more effect estimation, e.g dropping p-values for confidence intervals.

To plan on precision a common technique is estimate the width of a confidence interval and see how that varies with sample size

The framework of Monte Carlo simulation can easily be adapted to designing studies based on precision. Simply the steps with the only difference being that your test is that you run is a confidence interval

Collect all your confidence intervals and the mean width is your studies precision.

Here is a quick example

Design Your Model

```
sims <-1000
N <- 50

x1 <- rnorm(N, 2, 3)
x2 <- runif(N,5,95)
x3 <- rbinom(N,1,.5)

b0 <- 20
b1 <- 0.5
b2 <- 0.037
b3 <- -5.2
sigma <- 1.4
```

Simulate Your Model, and Record Your Result

In this instance create a confidence interval for your estimated effect and take the mean width of all simulations

```
  ci.widths <- replicate(sims,{

    eps <- rnorm(x1,0,sigma)
    y <- b0 + b1*x1  + b2*x2  + b3*x3 + eps

    data <- data.frame(y, x1, x2, x3)
    model <-lm(y~ x1 + x2 + x3 , data = data)
    #Only part of the code that needs to change
    ci.width <- abs(confint(model)[2,1] -confint(model)[2,2])
  })
```

The mean width of your confidence interval widths

```r
  study_precision <-mean(ci.widths)
  study_precision
```

```
## [1] 0.2691649
```