PUBH 501 Biostatistics

STATA: POWER AND SAMPLE SIZE

Stata Tips: Splitting Columns

momweight	race	smokepreg
182	black	0
155	other	0
105	white	1
108	white	1
107	white	1
124	other	0
118	white	0
103	other	0
123	white	1
113	white	1
95	other	0
150	other	0

race1	race2	race3
black		
	other	
		white
		white
		white
	other	
		white
	other	
		white
		white
	other	
	other	

Stata Tips: Splitting Columns

. tab race

race	Freq.	Percent	Cum.
black	26	13.76	13.76
other	67	35.45	49.21
white	96	50.79	100.00
Total	189	100.00	

. tab race1

Black	Freq.	Percent	Cum.
black	26	100.00	100.00
Total	26	100.00	

. tab race2

Other	Freq.	Percent	Cum.
other	67	100.00	100.00
Total	67	100.00	

. tab race3

White	Freq.	Percent	Cum.
white	96	100.00	100.00
Total	96	100.00	

Stata Tips: Splitting Columns

- Command: *separate*
  - separate race, by(race)
  - *Will automatically separate a column into new columns by unique values.*
  - lab var race1 "Black"
- Label

race1	race, race == black
race2	race, race == other
race3	race, race == white

```
lab var race1 "Black"

label var race2 "Other"

lab var race3 "White"
```

race1	Black
race2	Other
race3	White

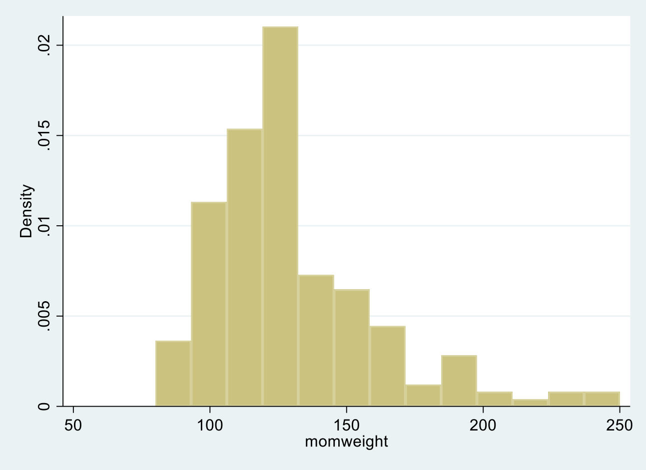
Stata Tips: New Variables

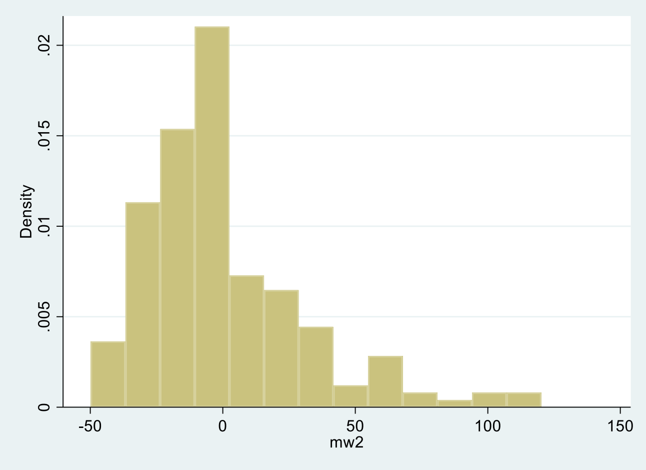
- What do you want your code to do? If you don't remember the language, think about the end result and logic then google your way there. Datasets come in different formats!
- The *generate* command is your friend. You may want to create a new variable to find a solution.
- Let's say you want to create a new variable based on another.
- Let's look at momweight: Perhaps you want to subtract each observation by the average:

```
. summm momweigh

    Variable |        Obs        Mean
-------------+------------------------
   momweight |        189    129.8201
```

gen mw2 = momweight - 129.8201

```
.  summ mw2

    Variable |        Obs        Mean
-------------+------------------------
         mw2 |        189    5.89e-06
```





Overview

- Power command
- Calculating power and sample size for tests we've used
  - Two-sample t-test
  - Paired t-test
  - Test of proportions (chi-squared test)

The -power- command

- Helpful in study planning
- Can be used for three main calculations
  - Sample size
  - Power
  - Minimum detectable effect size
- Default calculation of alpha=0.05, power=0.8, two-sided
  - -alpha()- and -power()- options can change these defaults
  - -beta()- option specifies the probability of a type II error

Power and sample size: paired t-test

•Power is the probability of rejecting the null hypothesis when, in fact, it is false.

•Power is the probability of avoiding a Type II error.

Example

- Interested in the change in hours slept by college freshman before the start of the semester (0 days) and at the end of the semester (180 days).
- Paired. Same participants measured at two different times. Before and after the semester.
- Null: There is no difference in mean hours slept before and after the semester
- Alt: There is no difference in mean hours slept before and after the semester
- We need more data from our power calculations…
  - What is the expected mean and sd at 1 and 180 days (any prior research from a similar population?)

Sleep problems in university students – an intervention

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Abstract

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Introduction

Up to 60% of all college students
insomnia disorder. Sleep problem
grade point average. Due to irreg
periods, they need specialized tr
(studying in your sleep)) is a mu
Therapy for Insomnia and Hypno
symptoms and nightmares. The a
and the first effects of SWIS.

Table 11

Descriptive statistics of and comparisons between pre- and post-measurement of the diagnostic sleep log
Regeneration scores are displayed on a six-point Likert scale (N=13)

	t1, M (SD)	t2, M (SD)	*t*	*Z*	*P*-value	Effect s
Time in bed (hours)	8.44 (1.26)	8.45 (1.30)	−0.08	–	0.94	–
Sleep duration (hours)	6.94 (1.45)	6.83 (1.18)	0.57	–	0.58	–
Duration of night waking (minutes)	89.96 (49.86)	97.43 (53.91)	−0.59	–	0.563	–
Sleep-onset latency (minutes)	52.71 (54.06)	45.15 (35.13)	–	−1.06	0.289	–
Sleep efficiency (%)	83.77 (9.69)	81.49 (9.28)	–	−0.035	0.972	–

Methods

Twenty-seven students (mean =24.24, standard deviation =3.57) participated in a study of pre–post design. The acceptance and feasibility were measured with questionnaires. In addition, the Pittsburgh Sleep Quality Index (PSQI), sleep logs and actigraphy were implemented. Further variables encompassed daytime sleepiness, sleep-related personality traits and cognitions about sleep.

Results

Power inputs

- Expected mean hours slept start of semester: 6.94
- Expected mean hours slept end of semester: 6.83
- SD of the difference: 1.3
- Expected mean difference under null: 0
- Default alpha: 0.05
- Default power: 0.8

```
power pairedmeans 6.94 6.83, sddiff(1.3)
```

```
. power pairedmeans 6.94 6.83, sddiff(1.3)

Performing iteration ...

Estimated sample size for a two-sample paired-means test
Paired t test
H0: d = d0  versus  Ha: d != d0

Study parameters:

        alpha =    0.0500          ma1 =    6.9400
        power =    0.8000          ma2 =    6.8300
        delta =   -0.0846
           d0 =    0.0000
           da =   -0.1100
         sd_d =    1.3000

Estimated sample size:

            N =     1,099
```

Power options

- Can change the power and alpha

```
power pairedmeans 111 106.7, sddiff(16) alpha(0.01)
power(0.9)
```

- Can run if we don't know means but do know the difference in means

```
power pairedmeans, altdiff(-4.3) sddiff(16)
```

- Can computer power for a known sample size

```
power pairedmeans 111 106.7, n(100) sddiff(16)
```

- Graph power at different sample sizes

```
power pairedmeans 111 106.7, n(80 (10) 130) sddiff(16) graph
```

```
. power pairedmeans 6.94 6.83, n(400) sddiff(1.3)

Estimated power for a two-sample paired-means test
Paired t test
H0: d = d0  versus  Ha: d != d0

Study parameters:

        alpha =    0.0500           ma1 =    6.9400
            N =       400           ma2 =    6.8300
        delta =   -0.0846
           d0 =    0.0000
           da =   -0.1100
         sd_d =    1.3000

Estimated power:

        power =    0.3930
```

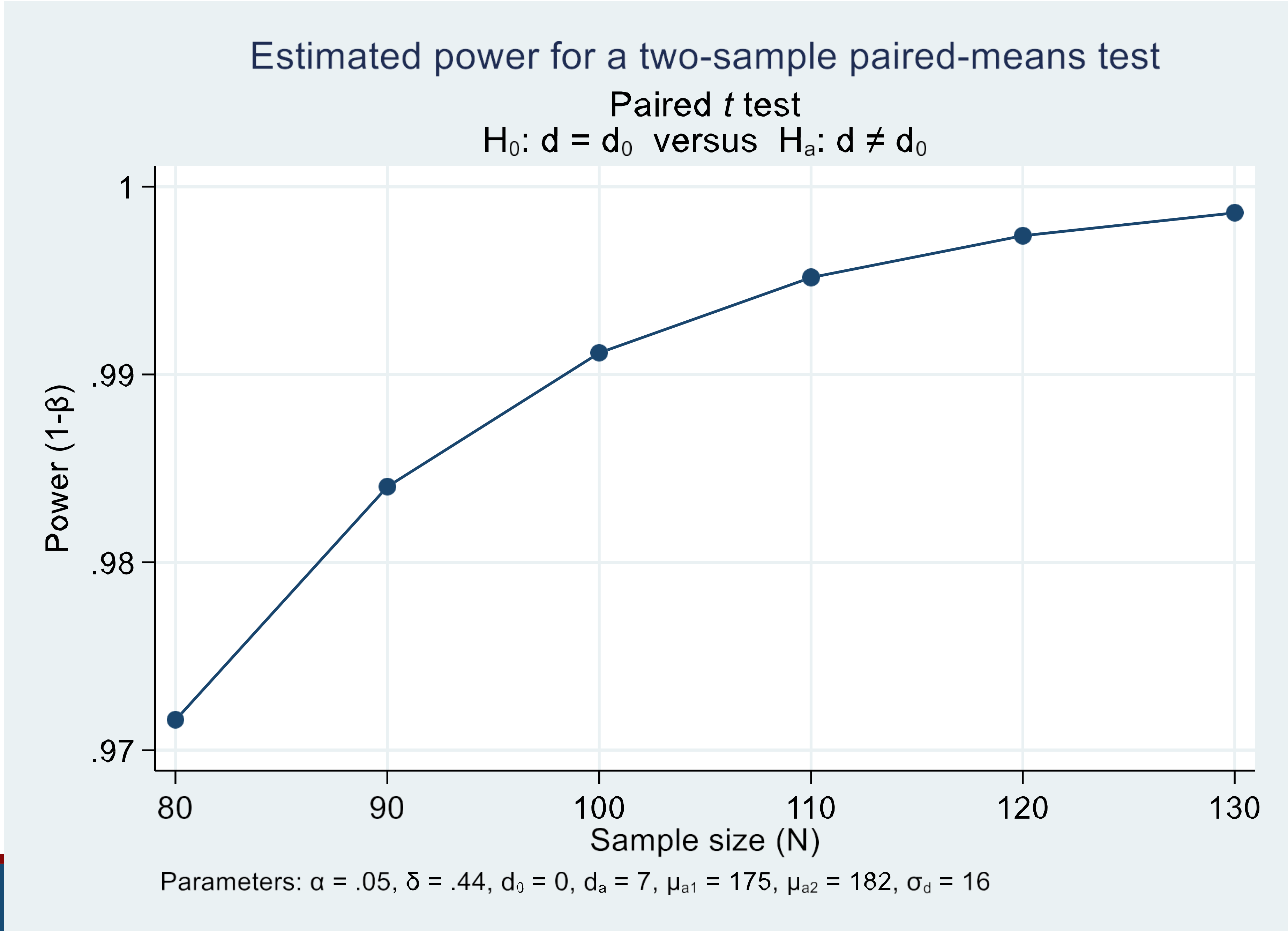
```
. power pairedmeans 175 182, sddiff(16) alpha(0.1 0.05 0.01) power(0.7 0.8 0.9)
Estimated sample size for a two-sample paired-means test
Paired t test
Ho: d = d0  versus  Ha: d != d0

  +-------------------------------------------------------------------------+
  |   alpha   power       N   delta        d0        da       ma1       ma2      sd_d |
  |-------------------------------------------------------------------------|
  |      .1      .7      26   .4375         0         7       175       182        16 |
  |      .1      .8      34   .4375         0         7       175       182        16 |
  |      .1      .9      47   .4375         0         7       175       182        16 |
  |     .05      .7      35   .4375         0         7       175       182        16 |
  |     .05      .8      43   .4375         0         7       175       182        16 |
  |     .05      .9      57   .4375         0         7       175       182        16 |
  |     .01      .7      54   .4375         0         7       175       182        16 |
  |     .01      .8      65   .4375         0         7       175       182        16 |
  |     .01      .9      82   .4375         0         7       175       182        16 |
  +-------------------------------------------------------------------------+
```

```
> power pairedmeans 175 182, n(100) sddiff(16)
Estimated power for a two-sample paired-means test
Paired t test
Ho: d = d0  versus  Ha: d != d0

Study parameters:

        alpha =    0.0500            ma1 =  175.0000
            N =       100            ma2 =  182.0000
        delta =    0.4375
           d0 =    0.0000
           da =    7.0000
         sd_d =   16.0000

Estimated power:

        power =    0.9912
```

```
> power pairedmeans, altdiff(7) sddiff(16)
Estimated sample size for a two-sample paired-means test
Paired t test
Ho: d = d0  versus  Ha: d != d0

Study parameters:

        alpha =    0.0500
        power =    0.8000
        delta =    0.4375
           d0 =    0.0000
           da =    7.0000
         sd_d =   16.0000

Estimated sample size:

            N =        43
```

No means in this table because we didn't input them

```
. power pairedmeans 175 182, n(80 (10) 130) sddiff(16) graph
```



Power and sample size: two-sample t-test

Example

- We are creating a study to assess the relationship between antipsychotic medication use and depression score in adolescents with autism.
- Little is known about this in this population, but pilot data suggests depression score may be higher in adolescents who use antipsychotics
- This data is not paired, two-sample t-test would be used
- Our null hypothesis would be… no mean difference in score between groups
- What we need for our power calculations
  - Expected mean of each group
  - Standard deviation of each group mean

Power inputs

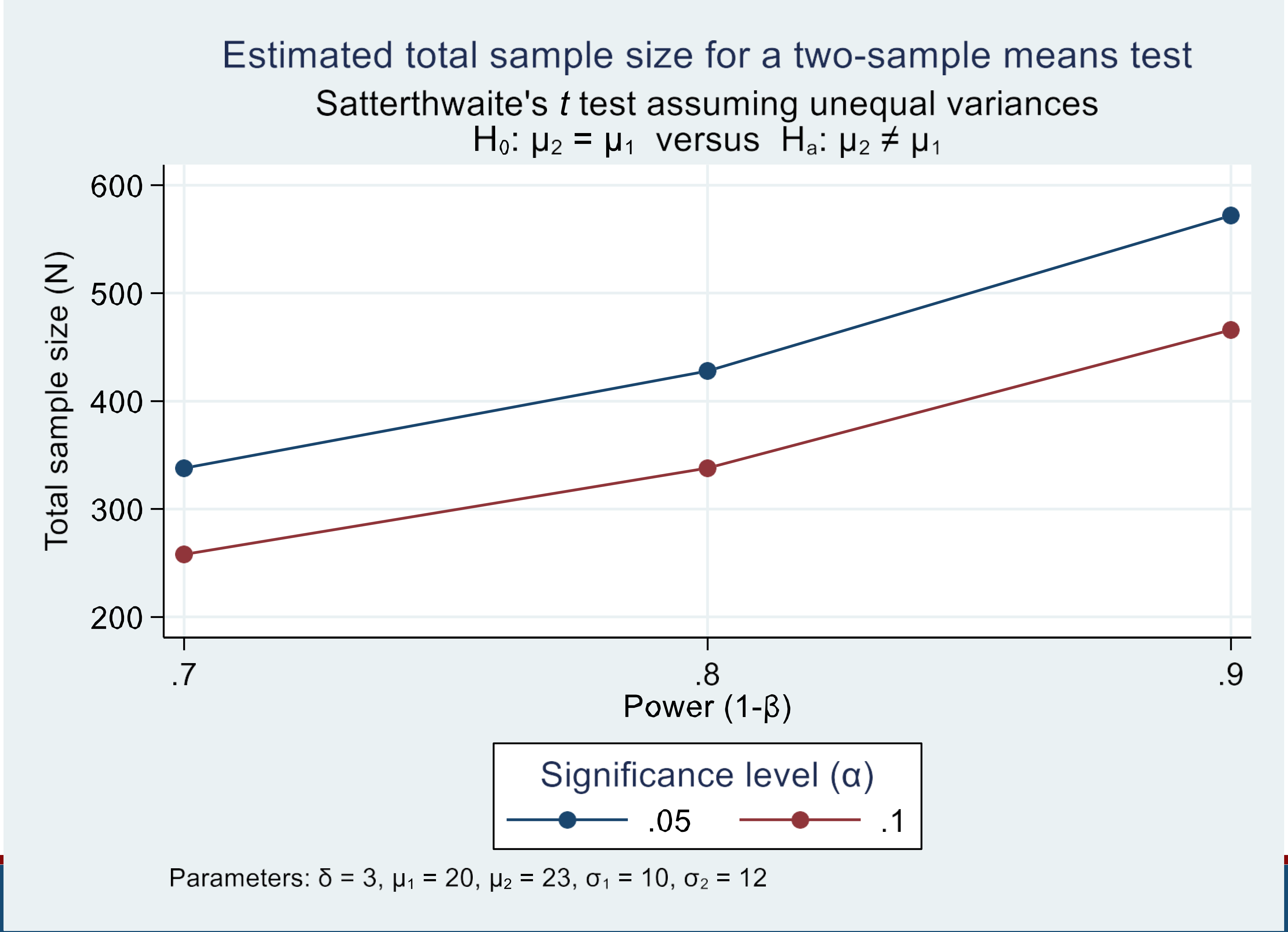
- Expected mean non medication group: 20, sd 10
- Expected mean medication group: 23, sd 12
- Expected mean difference under null: 0
- Default alpha: 0.05
- Default power: 0.8

```
power twomeans 20 23, sd1(10) sd2(12)
```

```
. power twomeans 20 23, sd1(10) sd2(12)
Estimated sample sizes for a two-sample means test
Satterthwaite's t test assuming unequal variances
Ho: m2 = m1  versus  Ha: m2 != m1

Study parameters:
        alpha =    0.0500
        power =    0.8000
        delta =    3.0000
           m1 =   20.0000
           m2 =   23.0000
          sd1 =   10.0000
          sd2 =   12.0000

Estimated sample sizes:
            N =       428
  N per group =       214
```

```
. power twomeans 20 23, sd1(10) sd2(12) alpha (0.1 0.05) power (0.7 0.8 0.9)

Estimated sample sizes for a two-sample means test
Satterthwaite's t test assuming unequal variances
Ho: m2 = m1  versus  Ha: m2 != m1

  +---------------------------------------------------------------------+
  |   alpha   power       N      N1      N2   delta      m1      m2      sd1      sd2 |
  |---------------------------------------------------------------------|
  |      .1      .7     258     129     129       3      20      23       10       12 |
  |      .1      .8     338     169     169       3      20      23       10       12 |
  |      .1      .9     466     233     233       3      20      23       10       12 |
  |     .05      .7     338     169     169       3      20      23       10       12 |
  |     .05      .8     428     214     214       3      20      23       10       12 |
  |     .05      .9     572     286     286       3      20      23       10       12 |
  +---------------------------------------------------------------------+
```

```
. power twomeans 20 23, sd1(10) sd2(12) alpha (0.1 0.05)  power(.7 (.1) .9)
graph
```



```
. power twomeans 20 23, sd1(10) sd2(12) alpha (0.1 0.05)  n1(100 150) n2(150 200)

Estimated power for a two-sample means test
Satterthwaite's t test assuming unequal variances
Ho: m2 = m1  versus  Ha: m2 != m1
```

alpha	power	N	N1	N2	delta	m1	m2	sd1	sd2
.1	.6887	250	100	150	3	20	23	10	12
.1	.7376	300	100	200	3	20	23	10	12
.1	.7586	300	150	150	3	20	23	10	12
.1	.8154	350	150	200	3	20	23	10	12
.05	.5692	250	100	150	3	20	23	10	12
.05	.6248	300	100	200	3	20	23	10	12
.05	.6497	300	150	150	3	20	23	10	12
.05	.7192	350	150	200	3	20	23	10	12

Power and sample size: independent proportions

Example

- We are interested in the employment rates of newly graduated young adults with autism who participate in a vocational rehabilitation (VR) service versus those who don't
- We don't know for our group, but we know for young adults with intellectual disabilities, 60% who participate in VR get a job within a year, and 50% who do not participate get a job within a year
- Our null hypothesis would be… no difference in proportion of employment rates between these groups

Power inputs

- Expected proportion employed in VR group: 0.6
- Expected proportion employed in non-VR group: 0.5
- Expected mean difference under null: 0
- Default alpha: 0.05 two-sided
- Default power: 0.8

```
power twoproportions 0.6 0.5
```

```
. power twoproportions 0.6 0.5, power(0.8)
Estimated sample sizes for a two-sample proportions test
Pearson's chi-squared test
Ho: p2 = p1  versus  Ha: p2 != p1

Study parameters:

        alpha =    0.0500
        power =    0.8000
        delta =   -0.1000  (difference)
           p1 =    0.6000
           p2 =    0.5000

Estimated sample sizes:

            N =       776
  N per group =       388
```

```
. power twoproportions 0.6 0.5, n(500 (50) 1000)

Estimated power for a two-sample proportions test
Pearson's chi-squared test
Ho: p2 = p1  versus  Ha: p2 != p1

  +-------------------------------------------------------------------------+
  |   alpha   power       N      N1      N2   delta      p1      p2 |
  |-------------------------------------------------------------------------|
  |     .05   .6137     500     250     250     -.1      .6      .5 |
  |     .05   .6551     550     275     275     -.1      .6      .5 |
  |     .05    .693     600     300     300     -.1      .6      .5 |
  |     .05   .7276     650     325     325     -.1      .6      .5 |
  |     .05   .7589     700     350     350     -.1      .6      .5 |
  |     .05   .7871     750     375     375     -.1      .6      .5 |
  |     .05   .8125     800     400     400     -.1      .6      .5 |
  |     .05   .8353     850     425     425     -.1      .6      .5 |
  |     .05   .8555     900     450     450     -.1      .6      .5 |
  |     .05   .8736     950     475     475     -.1      .6      .5 |
  |     .05   .8896   1,000     500     500     -.1      .6      .5 |
  +-------------------------------------------------------------------------+
```