

# Group sequential designs

Why wait until you finish collecting data to analyze the results of your clinical trial?

Stata's **gsbounds** and **gsdesign** commands calculate efficacy- and futility-stopping boundaries, compute sample sizes for interim and final analyses, graph the stopping boundaries for your trial, and more.

- Hypothesis tests

- One-sample mean
- Two-sample means
- One-sample proportion
- Two-sample proportions
- Log-rank test of survivor functions

- Add your own methods

- Automatic and customizable tables and graphs

- Stopping boundaries

- Classical O'Brien–Fleming
- Classical Pocock
- Classical Wang–Tsiatis
- Error-spending O'Brien–Fleming-style
- Error-spending Pocock-style
- Error-spending Kim–DeMets
- Error-spending Hwang–Shih–de Cani

## Stopping boundaries

**gsbounds** calculates efficacy and futility bounds based on the number of looks, the desired overall type I error, and the desired power.

For instance, calculate O'Brien–Fleming efficacy and futility bounds for a study with 5 looks, the default power of 0.9, and a type I error of 0.05.

• **gsbounds, nlooks(5) efficacy(errobfleming) futility(errobfleming)**

```

Group sequential boundaries

Efficacy: Error-spending O'Brien-Fleming style
Futility: Error-spending O'Brien-Fleming style, nonbinding

Study parameters:
alpha = 0.0500 (two-sided)
power = 0.8000

Info. ratio = 1.1618

Fixed-study crit. values = ±1.9600

Critical values and p-values for a group sequential design
    
```

Look	Info. frac.	Lower	Efficacy Upper	p-value	Lower	Futility Upper	p-value
1	0.20	-4.8769	4.8769	0.0000	-0.0130	0.0130	0.9896
2	0.40	-3.3570	3.3570	0.0008	-0.2929	0.2929	0.7696
3	0.60	-2.6803	2.6803	0.0074	-0.9245	0.9245	0.3552
4	0.80	-2.2898	2.2898	0.0220	-1.5186	1.5186	0.1289
5	1.00	-2.0310	2.0310	0.0423	-2.0310	2.0310	0.0423

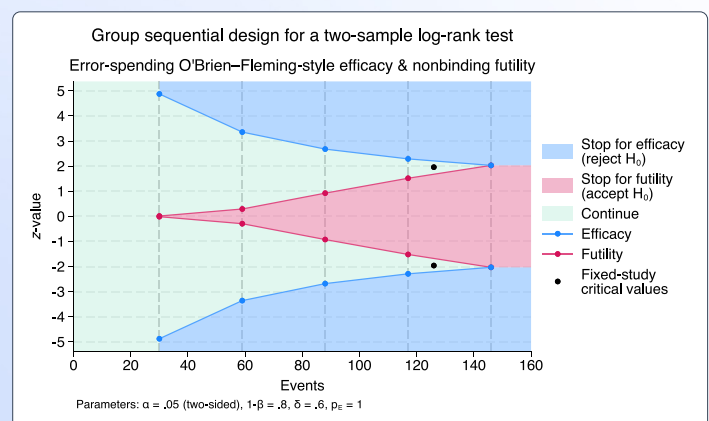
Note: Critical values are for z statistics; otherwise, use p-value boundaries.

## Sample-size determination

**gsdesign** computes efficacy and futility boundaries and provides sample sizes at each look for a variety of tests.

Compute the required number of events for each look, and graph the O'Brien–Fleming efficacy and futility bounds for the log-rank test comparing the survivor functions of two groups and assuming the hazard ratio (effect size) of 0.6.

• **gsdesign logrank, hratio(0.6) nlooks(5) efficacy(errobfleming) futility(errobfleming) graphbounds**



## Add your own methods

In addition to **gsdesign**'s built-in methods, you can add your own methods to compute the required sample size such as when you use the **simulate** command to compute the sample size by simulation. All you need to do is write a program that computes sample size, and **gsdesign** will do the rest for you.

```

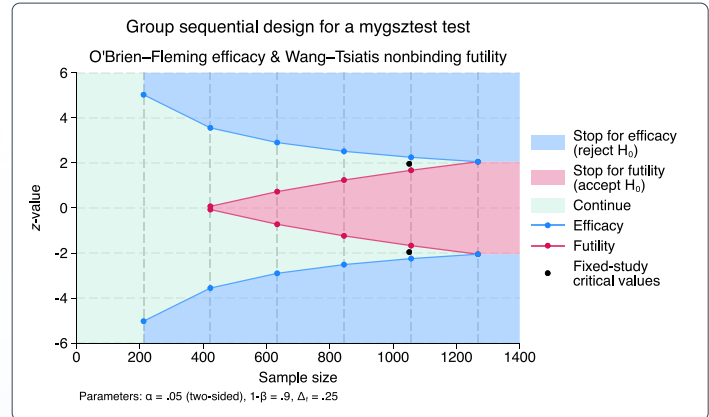
program power_cmd_mygsztest, rclass
    version 18
    // parse options
    syntax, STDDiff(real) /// standardized diff.
    [ Alpha(real 0.05) /// significance level
      Power(real 0.8) /// power
      NFRACTIONAL /// fractional sample size
    ]

    // compute sample size
    tempname N
    scalar `N' = ((invnormal(`power') + ///
                  invnormal(1 - `alpha'/2))/`stddiff')^2
    if ("`nfractional'" == "") {
        scalar `N' = ceil(`N')
    }

    // return results
    return scalar N = `N'
    return scalar alpha = `alpha'
    return scalar power = `power'
    return scalar stddiff = `stddiff'
end
    
```

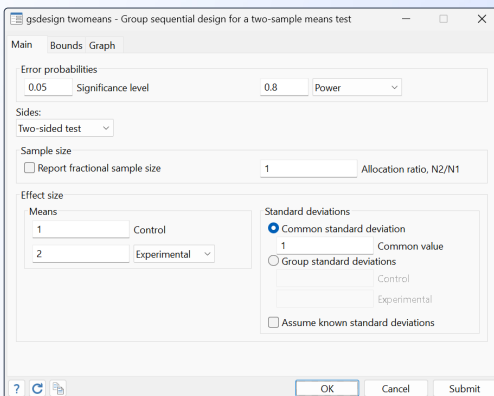
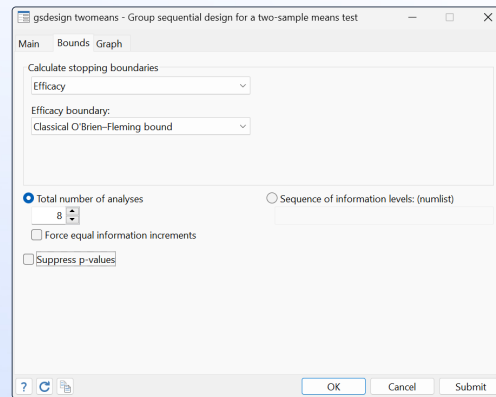
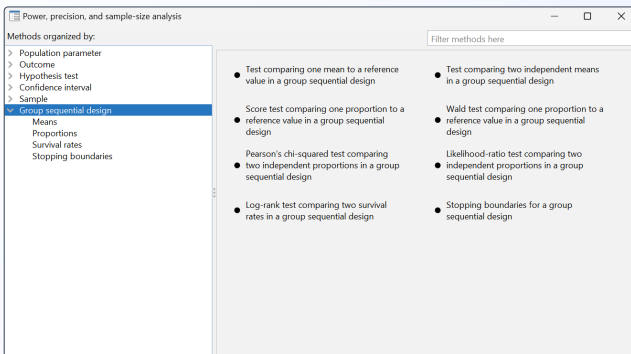
```

. gsdesign mygsztest, stddiff(0.1) alpha(0.05)
  power(0.9) nlooks(6) efficacy(obfleming)
  futility(wtsiatis(0.25)) graphbounds
    
```



## Perform analyses using point and click

You can perform your analyses interactively by typing the commands or by using a point-and-click GUI available via the PSS Control Panel.



```

. gsdesign twomeans 1 2, nlooks(6) graphbounds
    
```

