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Description

`strate` tabulates rates by one or more categorical variables declared in *varlist*. You can also save an optional summary dataset, which includes event counts and rate denominators, for further analysis or display. The combination of the commands `stsplit` and `strate` implements most of, if not all, the functions of the special-purpose person-years programs in widespread use in epidemiology; see [\[ST\] stsplit](#).

Quick start

Table of failure rates using `stset` data

```
strate
```

Same as above, but calculate failure rates at each level of categorical variable `catvar`

```
strate catvar
```

Graph rates against `catvar`

```
strate catvar, graph
```

Table of SMRs per 1,000 with reference rates stored in variable `rvar`

```
strate catvar, per(1000) smr(rvar)
```

Menu

Statistics > Survival analysis > Summary statistics, tests, and tables > Tabulate failure rates and rate ratios

Syntax

strate [<i>varlist</i>] [<i>if</i>] [<i>in</i>] [, <i>options</i>]	
<i>options</i>	Description
Main	
<code>per (#)</code>	units to be used in reported rates
<code>smr (<i>varname</i>)</code>	use <i>varname</i> as reference-rate variable to calculate SMRs
<code>cluster (<i>varname</i>)</code>	cluster variable to be used by the jackknife
<code>jackknife</code>	report jackknife confidence intervals
<code>missing</code>	include missing values as extra categories
<code>graph</code>	graph rates against exposure category
<code>nowhisker</code>	omit confidence intervals from the graph
<code>level (#)</code>	set confidence level; default is level(95)
<code>output (<i>filename</i> [, replace])</code>	save summary dataset as <i>filename</i> ; use replace to overwrite existing <i>filename</i>
<code>nolist</code>	suppress listed output
Plot	
<code>marker_options</code>	change look of markers (color, size, etc.)
<code>marker_label_options</code>	add marker labels; change look or position
<code>cline_options</code>	affect rendition of the plotted points
CI plot	
<code>ciopts (<i>rspike_options</i>)</code>	affect rendition of the confidence intervals (whiskers)
Add plots	
<code>addplot (<i>plot</i>)</code>	add other plots to the generated graph
Y axis, X axis, Titles, Legend, Overall	
<code>twoway_options</code>	any options other than by() documented in [G-3] <i>twoway_options</i>
You must stset your data before using strate; see [ST] stset.	
fweights, iweights, and pweights may be specified using stset; see [ST] stset.	

Options

Main
<code>per (#)</code> specifies the units to be used in reported rates. For example, if the analysis time is in years, specifying <code>per(1000)</code> results in rates per 1,000 person-years.
<code>smr (<i>varname</i>)</code> specifies a reference-rate variable. <code>strate</code> then calculates SMRs rather than rates. This option will usually follow <code>stsplit</code> to separate the follow-up records by age bands and possibly calendar periods.
<code>cluster (<i>varname</i>)</code> defines a categorical variable that indicates clusters of data to be used by the jackknife. If the <code>jackknife</code> option is selected and this option is not specified, the cluster variable is taken as the <code>id</code> variable defined in the <code>st</code> data. Specifying <code>cluster()</code> implies <code>jackknife</code> .
<code>jackknife</code> specifies that jackknife confidence intervals be produced. This is the default if weights were specified when the dataset was <code>stset</code> .

missing specifies that missing values of the explanatory variables be treated as extra categories. The default is to exclude such observations.

graph produces a graph of the rate against the numerical code used for the categories of *varname*.

nowhisker omits the confidence intervals from the graph.

level(#) specifies the confidence level, as a percentage, for confidence intervals. The default is level(95) or as set by set level; see [U] 20.8 Specifying the width of confidence intervals.

output(*filename* [, replace]) saves a summary dataset in *filename*. The file contains counts of failures and person-time, rates (or SMRs), confidence limits, and all the categorical variables in the *varlist*. This dataset could be used for further calculations or simply as input to the table command; see [R] table.

replace specifies that *filename* be overwritten if it exists. This option is not shown in the dialog box.

nolist suppresses the output. This is used only when saving results to a file specified by output().

Plot

marker_options affect the rendition of markers drawn at the plotted points, including their shape, size, color, and outline; see [G-3] marker_options.

marker_label_options specify if and how the markers are to be labeled; see [G-3] marker_label_options.

cline_options affect whether lines connect the plotted points and the rendition of those lines; see [G-3] cline_options.

CI plot

ciopts(*rspike_options*) affects the rendition of the confidence intervals (whiskers); see [G-3] rspike_options.

Add plots

addplot(*plot*) provides a way to add other plots to the generated graph; see [G-3] addplot_option.

Y axis, X axis, Titles, Legend, Overall

twoway_options are any of the options documented in [G-3] twoway_options, excluding by(). These include options for titling the graph (see [G-3] title_options) and for saving the graph to disk (see [G-3] saving_option).

Remarks and examples

strate tabulates the rate, formed from the number of failures divided by the person-time, by different levels of one or more categorical explanatory variables specified by *varlist*. Confidence intervals for the rate are also given. By default, the confidence intervals are calculated using the quadratic approximation to the Poisson log likelihood for the log-rate parameter. However, whenever the Poisson assumption is questionable, jackknife confidence intervals can also be calculated. The jackknife option also allows for multiple records for the same cluster (usually subject).

strate can also calculate and report SMRs if the data have been merged with a suitable file of reference rates.

The summary dataset can be saved to a file specified with the output() option for further analysis or more elaborate graphical display.

If weights were specified when the dataset was `stset`, `strate` calculates jackknife confidence intervals by default.

► Example 1: Tabulation of failure rates

Using the diet data (Clayton and Hills 1993) described in [example 1](#) of [\[ST\] stsplot](#), we will use `strate` to tabulate age-specific coronary heart disease (CHD). In this dataset, CHD has been coded as `fail = 1, 3, or 13`.

We first `stset` the data: failure codes for CHD are specified; origin is set to date of birth, making age the analysis time; and the scale is set to 365.25, so analysis time is measured in years.

```
. use https://www.stata-press.com/data/r19/diet
(Diet data with dates)

. stset dox, origin(time dob) enter(time doe) id(id) scale(365.25)
> fail(fail==1 3 13)

Survival-time data settings
      ID variable: id
      Failure event: fail==1 3 13
Observed time interval: (dox[_n-1], dox]
      Enter on or after: time doe
      Exit on or before: failure
      Time for analysis: (time-origin)/365.25
      Origin: time dob
```

```
      337 total observations
       0 exclusions
```

```
      337 observations remaining, representing
      337 subjects
       46 failures in single-failure-per-subject data
4,603.669 total analysis time at risk and under observation
                                     At risk from t =          0
                        Earliest observed entry t =  30.07529
                        Last observed exit t =  69.99863
```

Now we `stsplot` the data into 10-year age bands.

```
. stsplot ageband, at(40(10)70) after(time=dob) trim
(26 observations trimmed because of lower bound)
(418 observations (episodes) created)
```

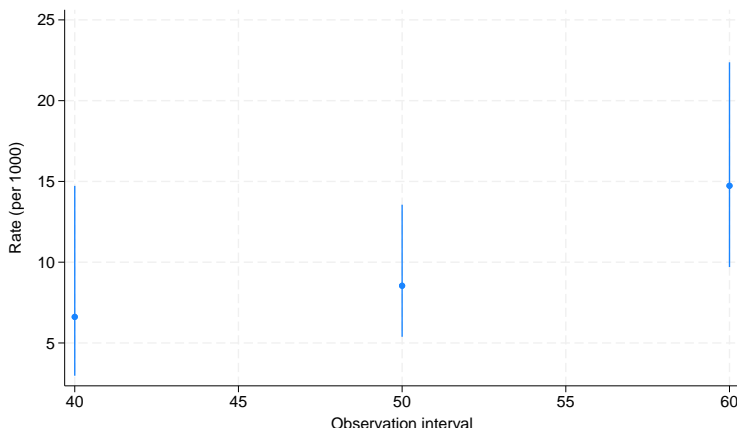
`stsplot` added 418 observations to the dataset in memory and generated a new variable, `ageband`, that identifies each observation's age group.

The CHD rate per 1,000 person-years can now be tabulated for categories of ageband:

```
. strate ageband, per(1000) graph
      Failure _d: fail==1 3 13
      Analysis time _t: (dox-origin)/365.25
      Origin: time dob
      Enter on or after: time doe
      ID variable: id
      Note: ageband<=40 trimmed
Estimated failure rates
Number of records = 729
```

ageband	D	Y	Rate	Lower	Upper
40	6	0.9070	6.6152	2.9719	14.7246
50	18	2.1070	8.5428	5.3823	13.5591
60	22	1.4933	14.7325	9.7007	22.3746

Notes: Rate = D/Y = failures/person-time (per 1000).
Lower and Upper are bounds of 95% confidence intervals.



Because we specified the `graph` option, `strate` also generated a plot of the estimated rates and confidence intervals.

◀

The SMR for a cohort is the ratio of the total number of observed deaths to the number expected from age-specific reference rates. This expected number can be found by first expanding on age, using `stsplit`, and then multiplying the person-years in each age band by the reference rate for that band. `merge` (see [\[D\] merge](#)) can be used to add the reference rates to the dataset. Using the `smr` option to define the variable containing the reference rates, `strate` calculates SMRs and confidence intervals. You must specify the `per()` option. For example, if the reference rates were per 100,000 person-years, you would specify `per(100000)`. When reference rates are available by age and calendar period, you must call `stsplit` twice to expand on both time scales before merging the data with the reference-rate file.

► Example 2: Tabulation of SMRs

In `smrchd.dta`, we have age-specific CHD rates per 1,000 person-years for a reference population. We can merge these data with our current data and use `strate` to obtain SMRs and confidence intervals.

```
. sort ageband
. merge m:1 ageband using https://www.stata-press.com/data/r19/smrchd
(variable ageband was byte, now float to accommodate using data's values)
```

Result	Number of obs	
Not matched	26	
from master	26	(_merge ==1)
from using	0	(_merge ==2)
Matched	729	(_merge ==3)

```
. strate ageband, per(1000) smr(rate)
    Failure _d: fail==1 3 13
    Analysis time _t: (dox-origin)/365.25
    Origin: time dob
    Enter on or after: time doe
    ID variable: id
    Note: ageband<=40 trimmed
```

Estimated standardized mortality rates
Reference-rate variable: rate
Number of records = 729

ageband	D	E	SMR	Lower	Upper
40	6	5.62	1.0670	0.4793	2.3749
50	18	18.75	0.9599	0.6048	1.5235
60	22	22.85	0.9629	0.6340	1.4624

Notes: SMR = D/E = failures/expected failures (per 1000).
Lower and Upper are bounds of 95% confidence intervals.



Acknowledgments

The original version of `strate` was written by David Clayton (retired) of the Cambridge Institute for Medical Research and Michael Hills (1934–2021) of the London School of Hygiene and Tropical Medicine.

Reference

Clayton, D. G., and M. Hills. 1993. *Statistical Models in Epidemiology*. Oxford: Oxford University Press.

Also see

- [ST] [stci](#) — Confidence intervals for means and percentiles of survival time
- [ST] [stir](#) — Report incidence-rate comparison
- [ST] [stmcc](#) — Calculate rate ratios with the Mantel–Cox method
- [ST] [stmh](#) — Calculate rate ratios with the Mantel–Haenszel method
- [ST] [stptime](#) — Calculate person-time, incidence rates, and SMR
- [ST] [stset](#) — Declare data to be survival-time data

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