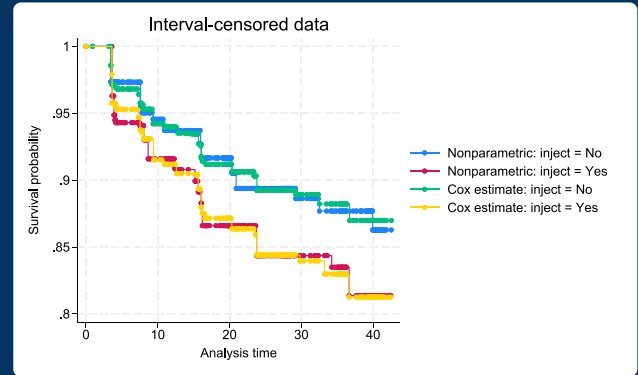


# Interval-censored Cox model

- Genuine semiparametric modeling
- Left-censoring, right-censoring, interval-censoring
- Current-status and general interval-censored data
- Single- or multiple-record data *New*
- Stratified estimation
- Time-varying covariates *New*
- Two estimators for baseline hazard
- Robust and cluster—robust standard errors *New*
- Graphs of survivor, cumulative hazard, and hazard functions
- Residual diagnostics
- Graphical checks of proportional-hazards assumption
- Graphical checks of goodness of fit *New*



Do you know the exact failure times or event times?

You can fit the Cox proportional hazards model in Stata even if you don't.

## Fit the model

The Cox proportional hazards model is widely used with right-censored event-time data because it does not require parameterization of the baseline hazard function and, under the proportional-hazards assumption, the hazard ratios are constant over time.

If we know the exact failure times, we can fit a Cox proportional hazards model using the `stcox` command. For instance, we can type

```
. stcox age_mean i.inject
```

to study the effect of mean age and injection status on failure times.

It is just as easy to fit a Cox proportional hazards model with interval-censored data, where we know only that the failure occurred sometime between two time points. With a single-record-per-subject data, we specify the variables containing the upper and lower endpoints for the failure time in `stintcox`'s `interval()` option.

```
. stintcox age_mean i.inject, interval(ltime rtime)
```

```
Viewer - view stintcox1.smcl
view stintcox1.smcl x
+
Dialog | Also see | Jump to |
. stintcox age_mean i.inject, interval(ltime rtime)
note: using adaptive step size to compute derivatives.

Performing EM optimization (showing every 100 iterations):
Iteration 0:  Log likelihood = -1086.2564
Iteration 100: Log likelihood = -601.62673
Iteration 200: Log likelihood = -601.54523
Iteration 299: Log likelihood = -601.53336

Computing standard errors: ..... done

Interval-censored Cox regression          Number of obs   = 1,124
Baseline hazard: Reduced intervals        Uncensored      = 0
                                           Left-censored   = 41
Event-time interval:                     Right-censored  = 991
  Lower endpoint: ltime                   Interval-cens. = 92
  Upper endpoint: rtime

Log likelihood = -601.53336                Wald chi2(2)    = 11.18
                                           Prob > chi2     = 0.0037

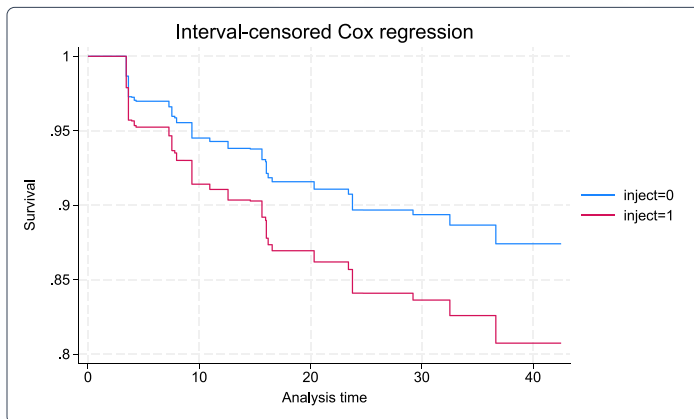
+-----+-----+-----+-----+-----+-----+
|           |           | OPG          |           |           |           |
|           | Haz. ratio | std. err.    | z         | P>|z|     | [95% conf. interval] |
+-----+-----+-----+-----+-----+-----+
| age_mean | .9657816   | .0124711     | -2.70     | 0.007     | .9416454   .9905365 | |
| inject   |           |           |           |           |           |           |
| Yes      | 1.590116   | .2847623     | 2.59     | 0.010     | 1.11942    2.25873   |
+-----+-----+-----+-----+-----+

Note: Standard error estimates may be more variable for small datasets and
      datasets with low proportions of interval-censored observations.
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```

## Graph the results

Use **stcurve** to plot the survivor, hazard, or cumulative hazard function.

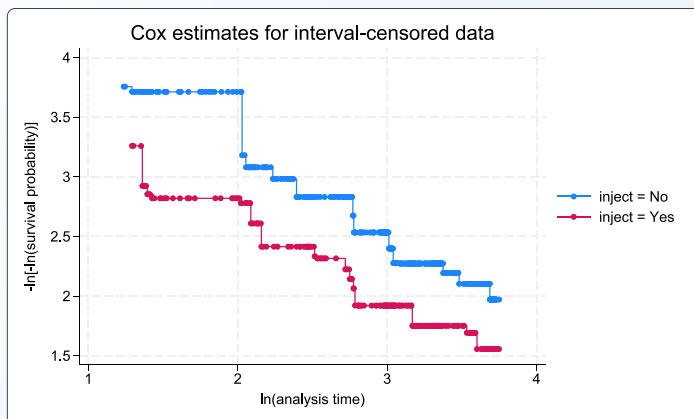
```
. stcurve, survival at(inject = (0 1))
```



## Check the proportional-hazards assumption

We can assess the proportional-hazards assumption graphically using the **stintphplot** command.

```
. stintphplot, interval(ltime rtime) by(inject) adjustfor(age_mean)
```

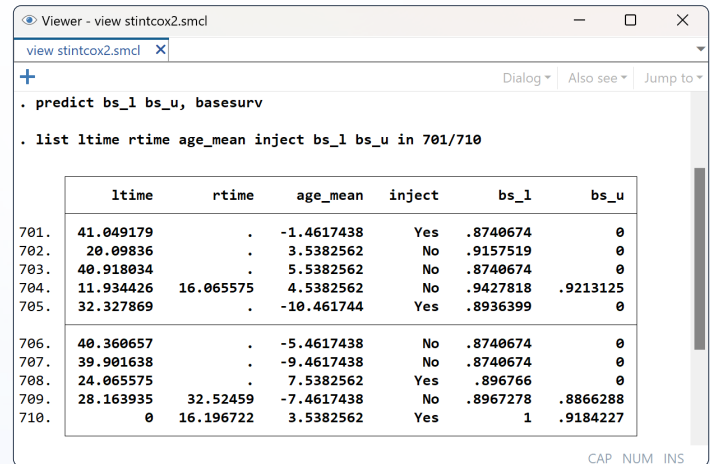


Or we can test this assumption when fitting the model. Specify the **tvco** option to interact covariates with time, and test for coefficients of time-interacted covariates equal to zero.

```
. stintcox age_mean i.inject, interval(ltime rtime) tvco(age_mean i.inject)
```

## Predict baseline survivor function

For each individual, we can predict the baseline survivor functions corresponding to the lower and upper endpoints of our interval.



## Type or point and click

