Applied Epidemiology I: Summary Statistics and Graphs

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Acknowledgements

This course material is based on my learning from Anastasia Lam's teachings in last year's Applied Epidemiology I lab sessions, and readings from *Epidemiology* by Gordis [**?**], *A First Course in Probability and Statistics* by Goldsman and Goldsman [**?**], *Principles of Biostatistics* by Pagano and Gauvreau [**?**], and *Biostatistics I* by Gabriel and Frumento [**?**].

I especially want to thank Marlene Stratmann for reviewing the slides and Prof. Paul Dickman for providing me with suggestions to improving the teaching.

Outline

Summary statistics: Bad example

What is the problem here?

Table 5

Simulation results for using full data, CRs only, and proposed method under four missing mechanisms

	Bias[a]		Variance[b]		95% CI[c]	
Method	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$
(M.1) $P(R=1)=0.66$						
Full	0.01346	0.02229	0.04008	0.03685	0.955	0.950
Comp	0.03062	−0.003561	0.1149	0.06732	0.960	0.955
Impu	0.01431	0.021	0.04088	0.05169	0.980	0.975
(M.2) logit $P(R=1)=2Y$						
Full	0.007908	−0.02116	0.03838	0.03624	0.975	0.925
Comp	0.01945	0.07096	0.107	0.06581	0.960	0.950
Impu	0.006966	0.01597	0.04227	0.05226	0.975	0.985
(M.3) logit $P(R=1)=2X$						
Full	0.007908	−0.02116	0.03838	0.03624	0.975	0.925
Comp	0.01225	0.0589	0.08856	0.06818	0.980	0.975
Impu	0.009563	−0.04699	0.03865	0.04923	0.985	0.970
(M.4) logit $P(R=1)=X+Y$						
Full	0.01346	0.02229	0.04008	0.03685	0.955	0.950
Comp	0.02404	1.613	0.1102	0.08202	0.955	0.580
Impu	0.01814	0.08289	0.0578	0.06075	0.955	0.970

[a]Bias $= (\hat{\beta} - \beta_0)/\beta_0$.

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```
. tabstat age // will only give you mean

    variable |      mean
-------------+----------
         age |  56.41176
----------------------

. tabstat age, s(count mean median) // s stands for statistics
    variable |         N      mean       p50
-------------+------------------------------
         age |        34  56.41176        56
--------------------------------------------
```

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$$s^2 = \widehat{Var}(x) = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

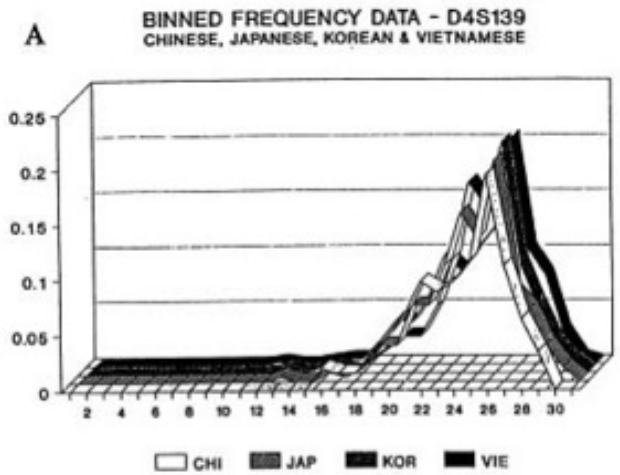
```
. tabstat age, s(count range min max iqr var sd)

    variable |         N     range       min       max
-------------+--------------------------------------------
         age |        34        20        47        67
----------------------------------------------------------

    variable |       iqr  variance        sd
-------------+------------------------------
         age |        10  36.12834  6.010686
-----------------------------------------
```

Graphs: Bad examples

Graphs can say more than texts! But it depends.....
Sometimes less is more.



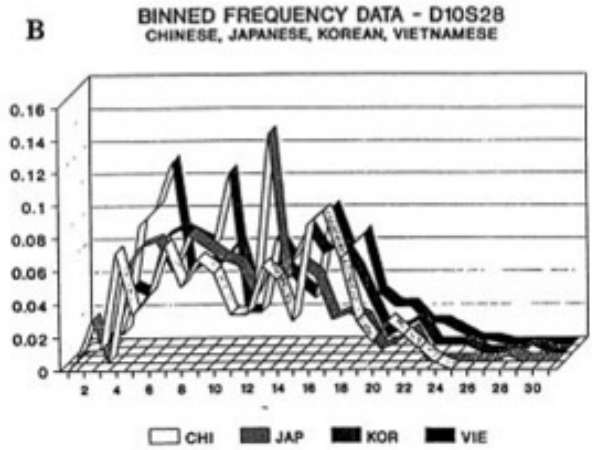
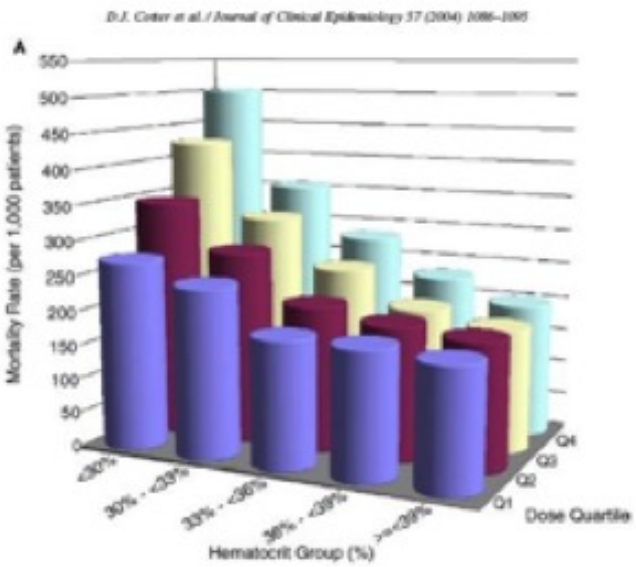
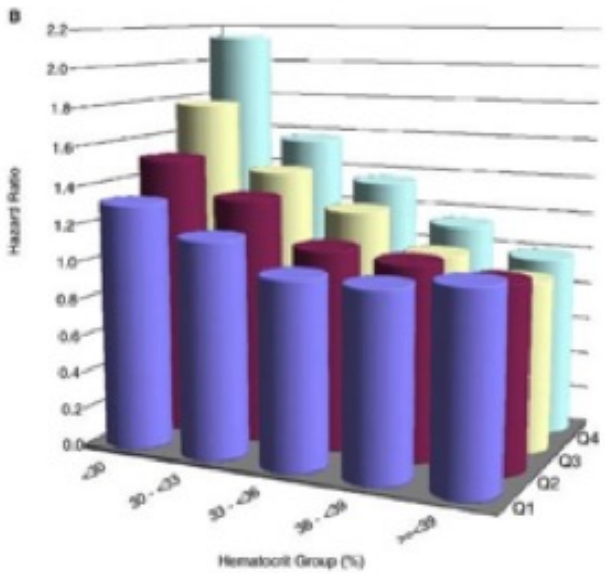


FIG. 4. *Fixed bin distribution (histogram) for two loci and four Asian subpopulations (used with permission from John Hartmann): the boundaries of the* 30 *bins (vertical axis) are determined by the FBI; these bins are not of equal length. Sample sizes (numbers of individuals) for Chinese, Japanese, Korean and Vietnamese are* 103, 125, 93 *and* 215 *for* D4S139 *and* 120, 137, 100 *and* 193 *for* D10S28. *The horizontal axis is the bin number; bins are not of equal length.*

Graphs: Bad examples

Too fancy?





Graphs: Bad examples

Insufficient info?

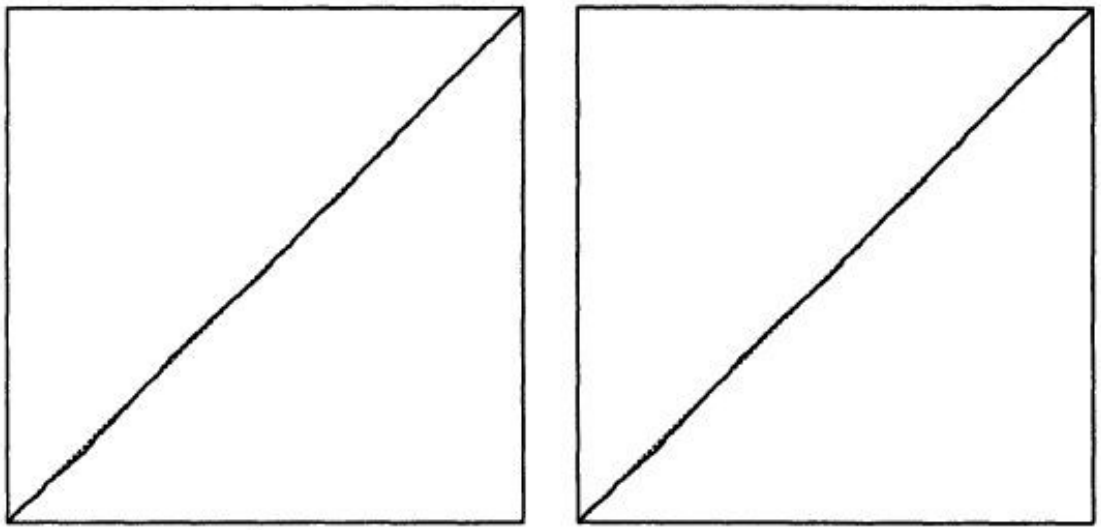
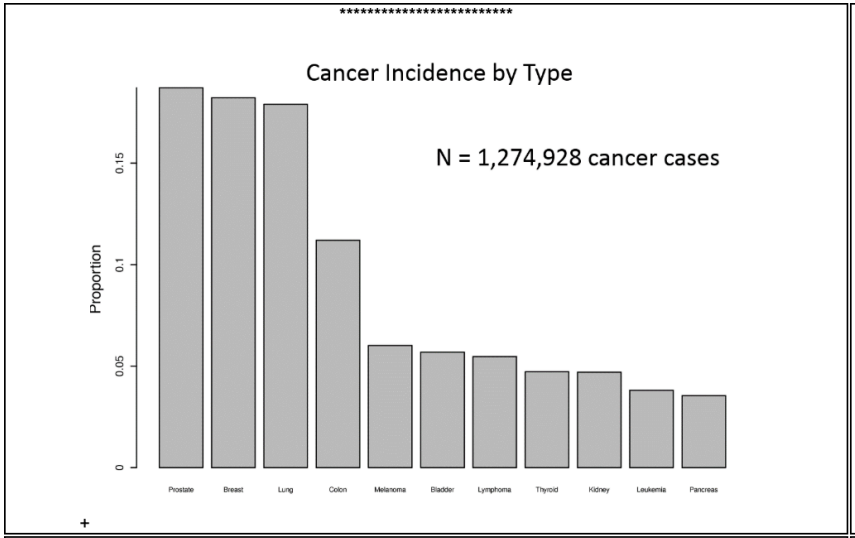
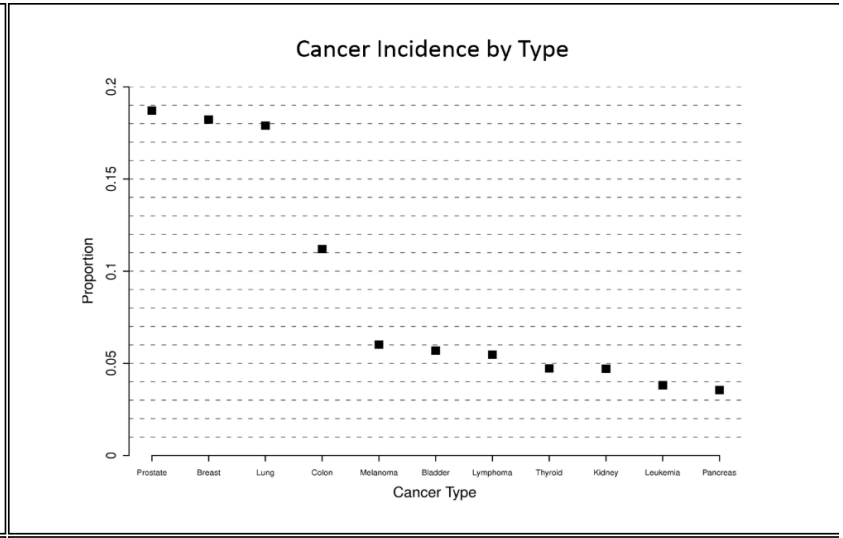


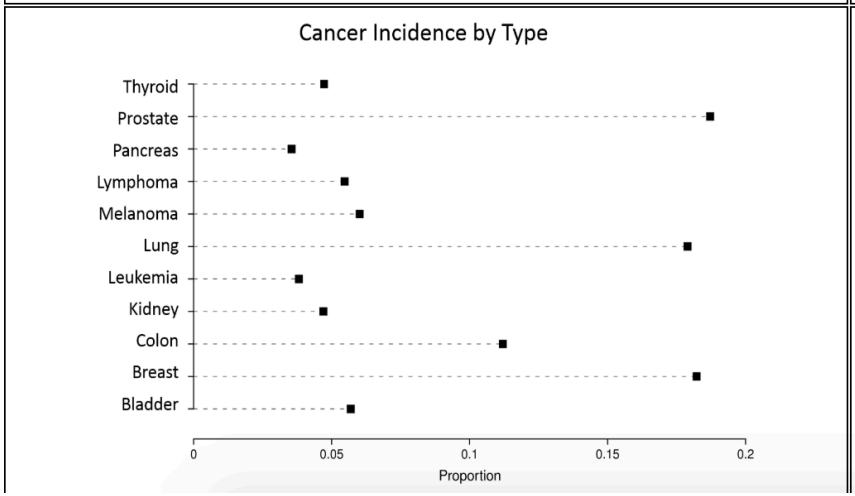
Figure 1. SRQ Plots of T_i/T_n (Vertical Axes) Against i/n (Horizontal Axes) for the Gibbs Sampler (a) and an Alternating Gibbs/Independence Sampler (b) for the Pump Failure Data Based on Runs of Length 5,000. Lines through the origin with unit slope are shown dashed; axis ranges are from 0 to 1 for all axes.

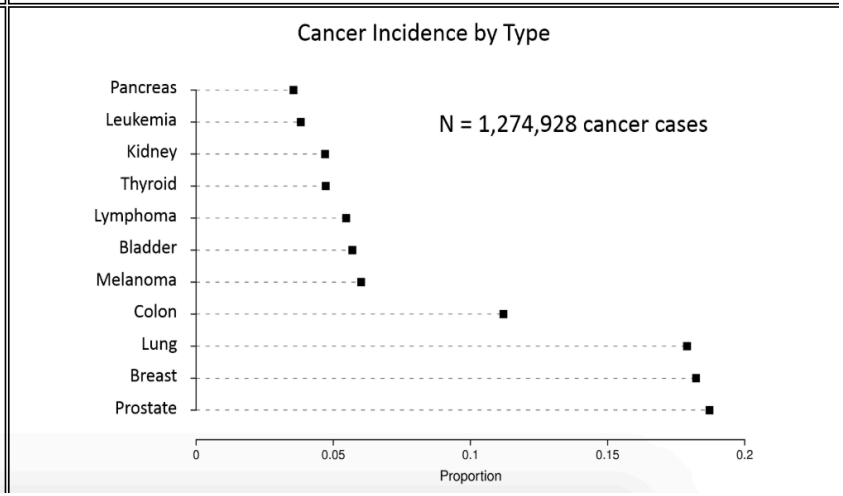
Graphs: Bad examples

Sometimes there is no right nor wrong, it just depends on your interest.





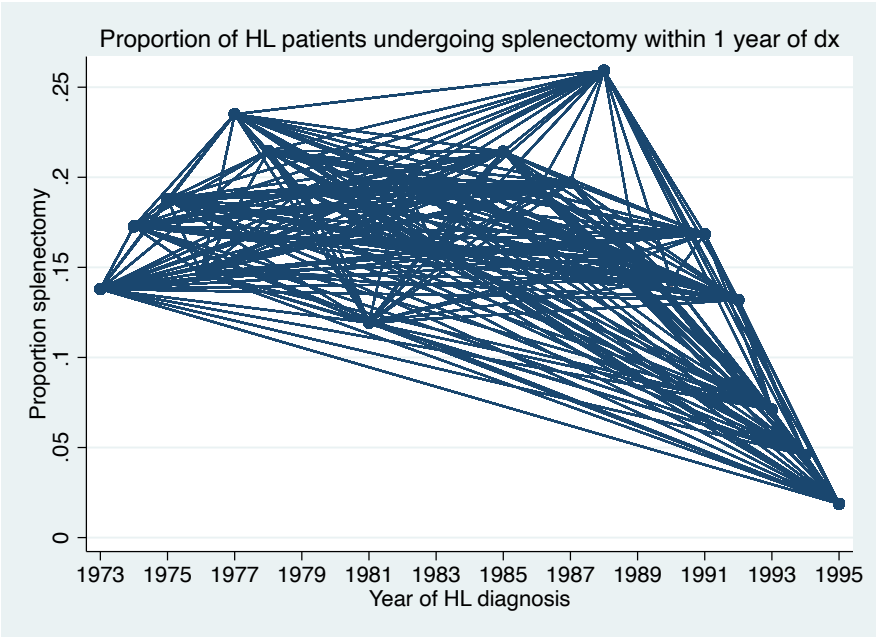




Graphs: Learning from errors

Which part went wrong here?
Hint: something was missed in the code.

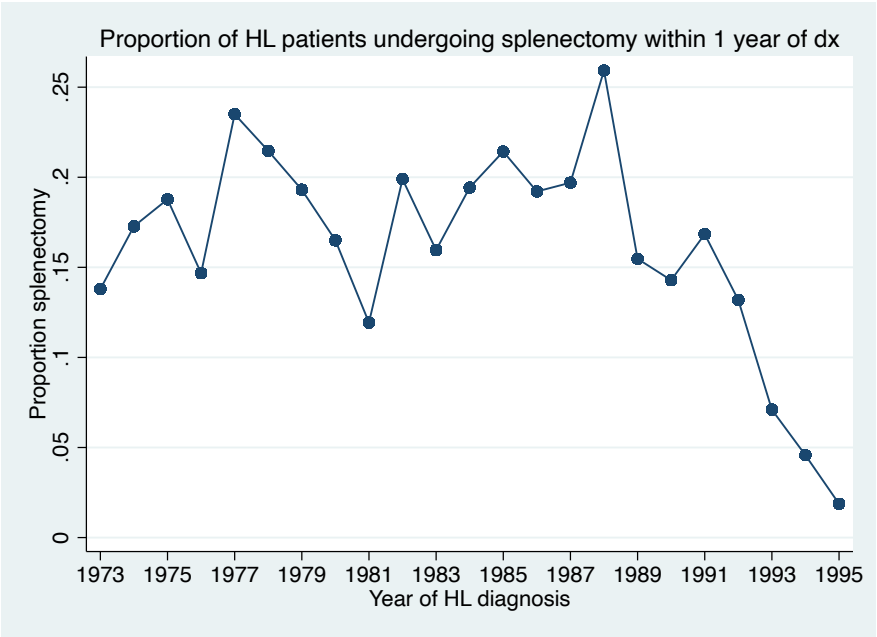
```
twoway connected prop diagyear, ///
subtitle("Proportion of HL patients") ///
ytitle(Proportion splenectomy) ///
xlabel(1973(2)1995)
```



Graphs: Learning from errors

It makes such a big difference if you missed `sort`!

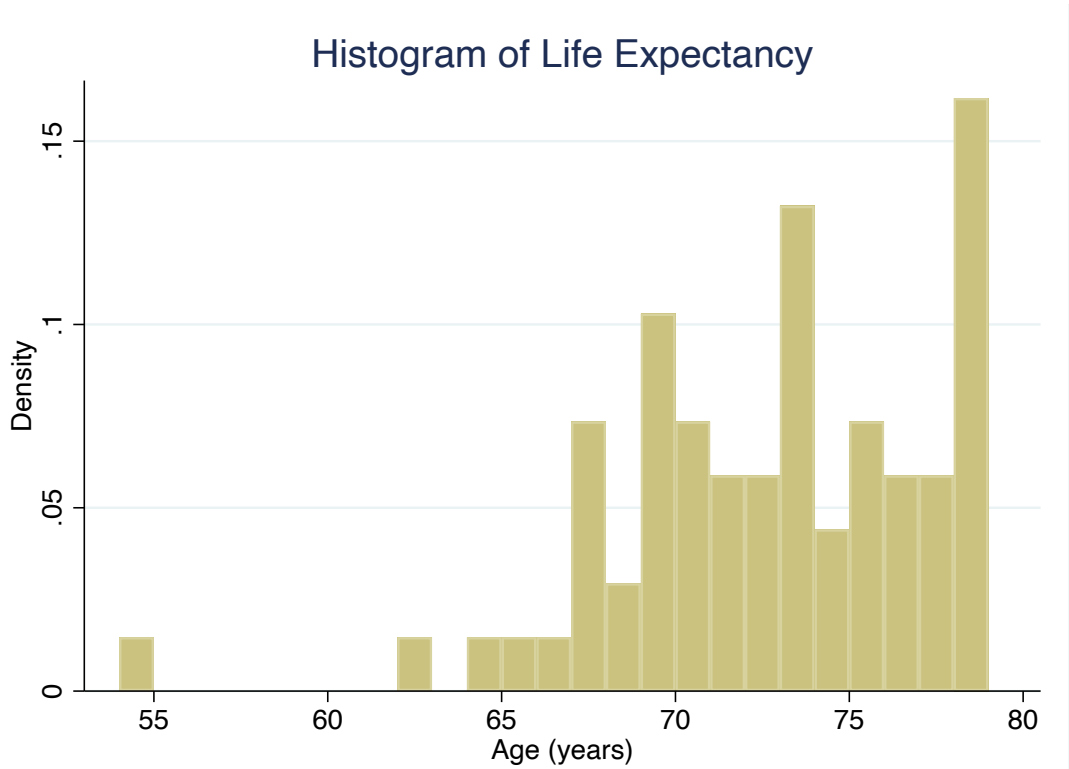
```
twoway connected prop diagyear, ///
subtitle("Proportion of HL patients") ///
ytitle(Proportion splenectomy) ///
xlabel(1973(2)1995) ///
sort
```



Graphs: Histogram

Histogram depicts the distribution of data, where x-axis is usually a continuous variable.

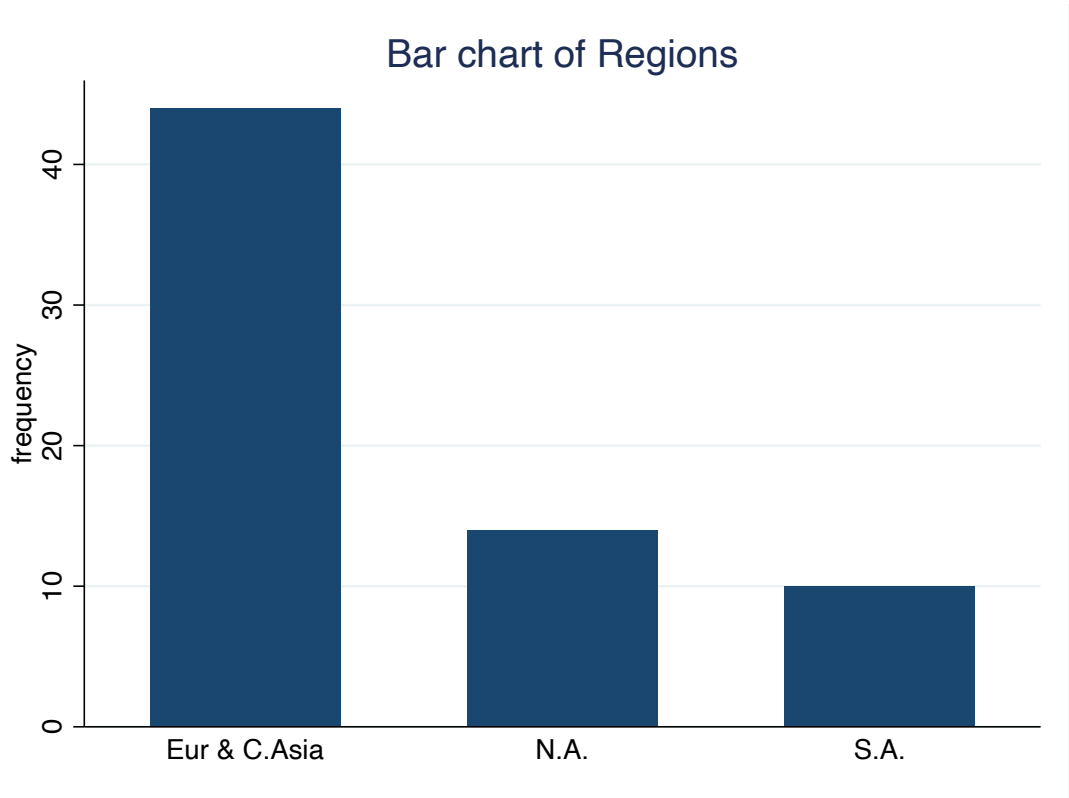
```
hist lexp, title("Histogram of Life Expectancy") ///
           xtitle(Age (years)) width(1) /// By each age
           graphregion(color(white)) //
```



Graphs: Bar chart

Bar chart shows the distribution of discrete (categorical) data.

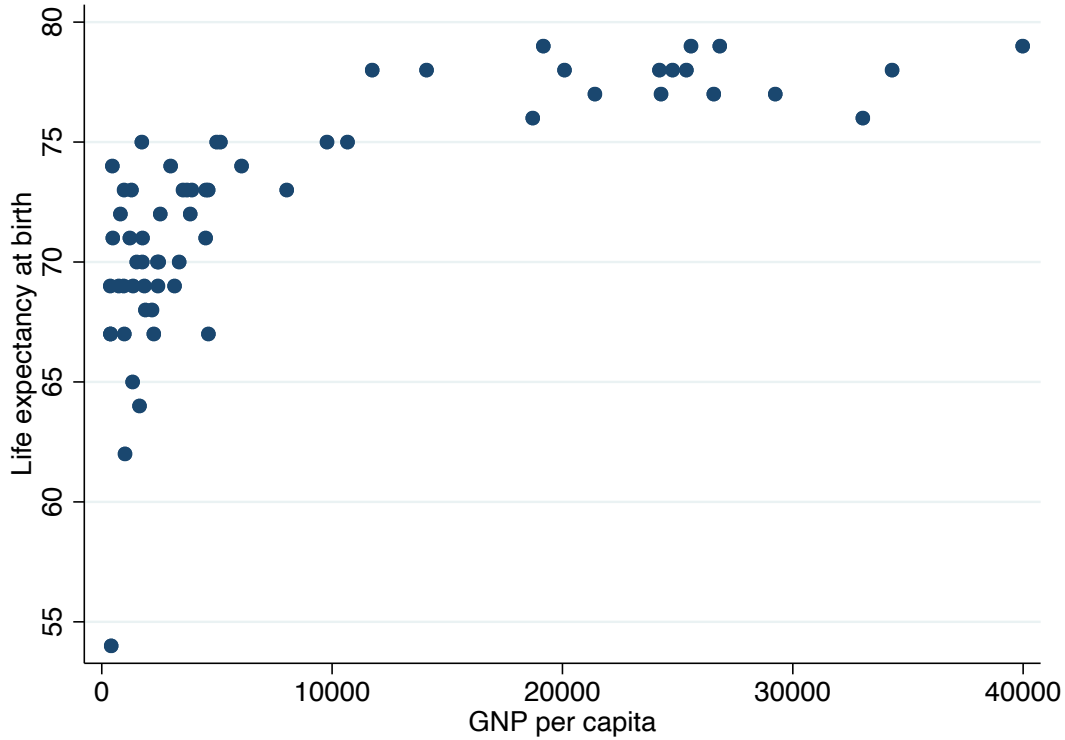
```
graph bar (count), over(region) ///
                   title("Bar chart of Regions") ///
                   graphregion(color(white)) //
```



Graphs: Scatter plot

Scatter plot demonstrates the relationship between two continuous variables.

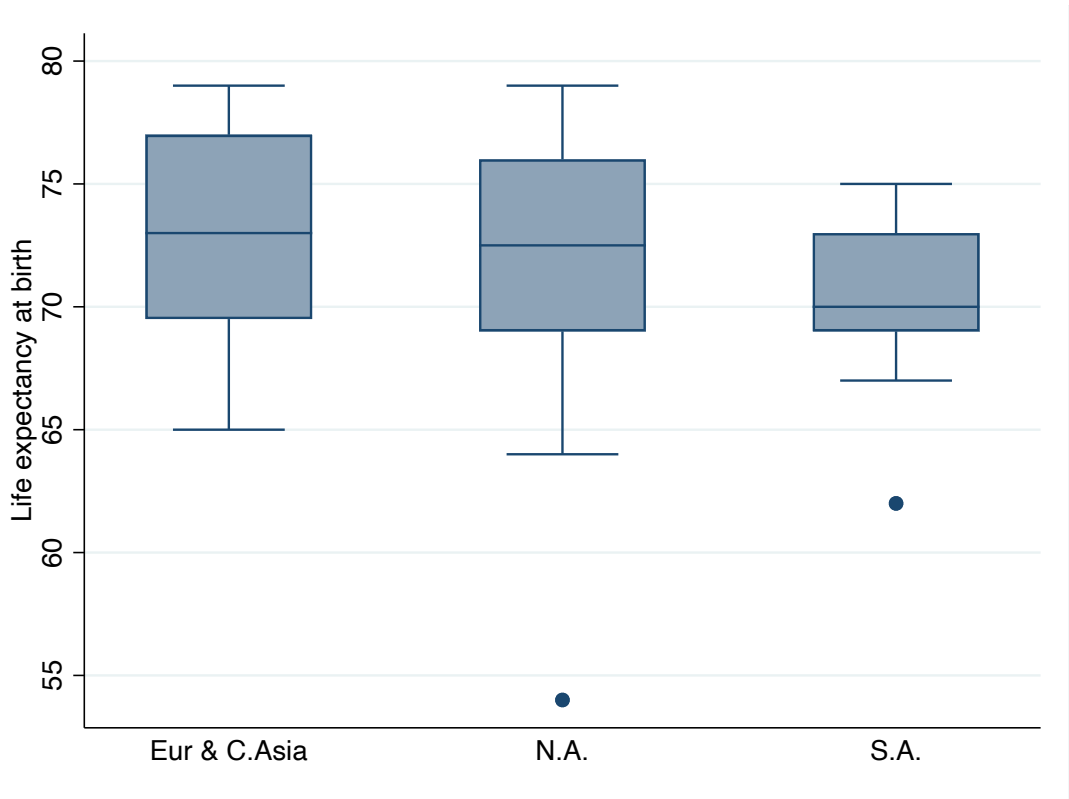
```
twoway scatter lexp gnppc, graphregion(color(white))
```



Graphs: Box plot

Box plot summarises the distribution of the data, with the 25th, 50th, and 75th percentile and 1.5 IQR.

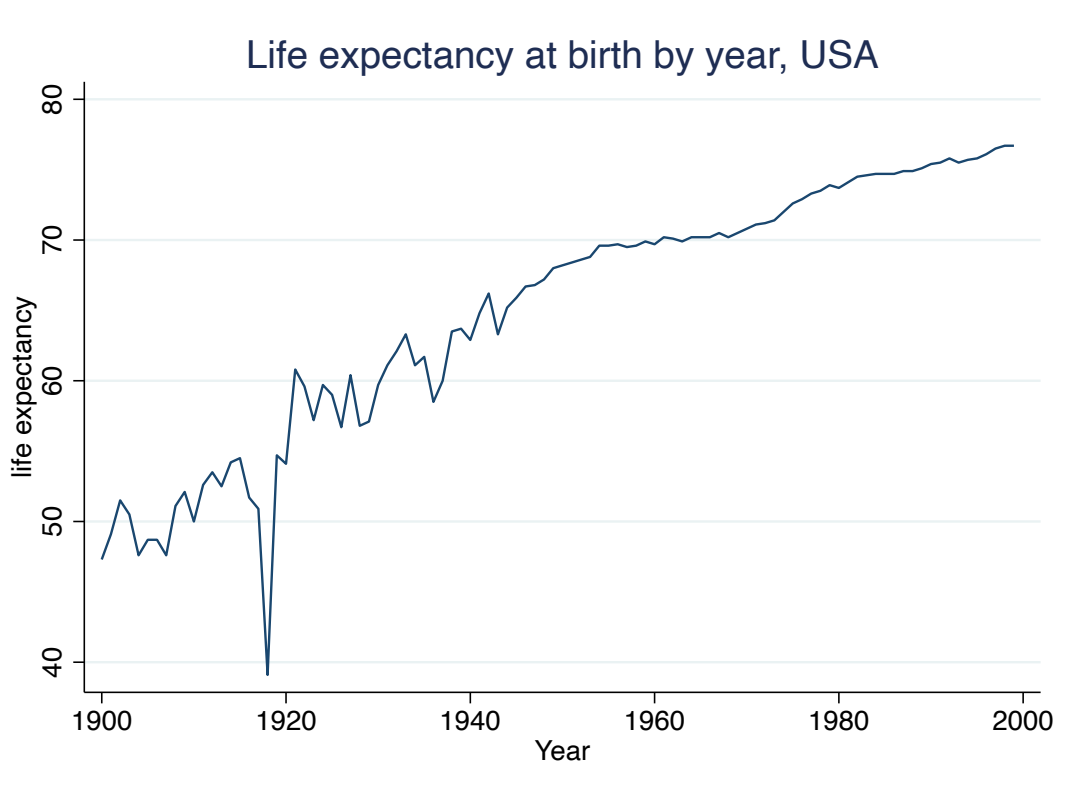
```
graph box lexp, over (region) ///
                graphregion(color(white))
```



Graphs: Line graph

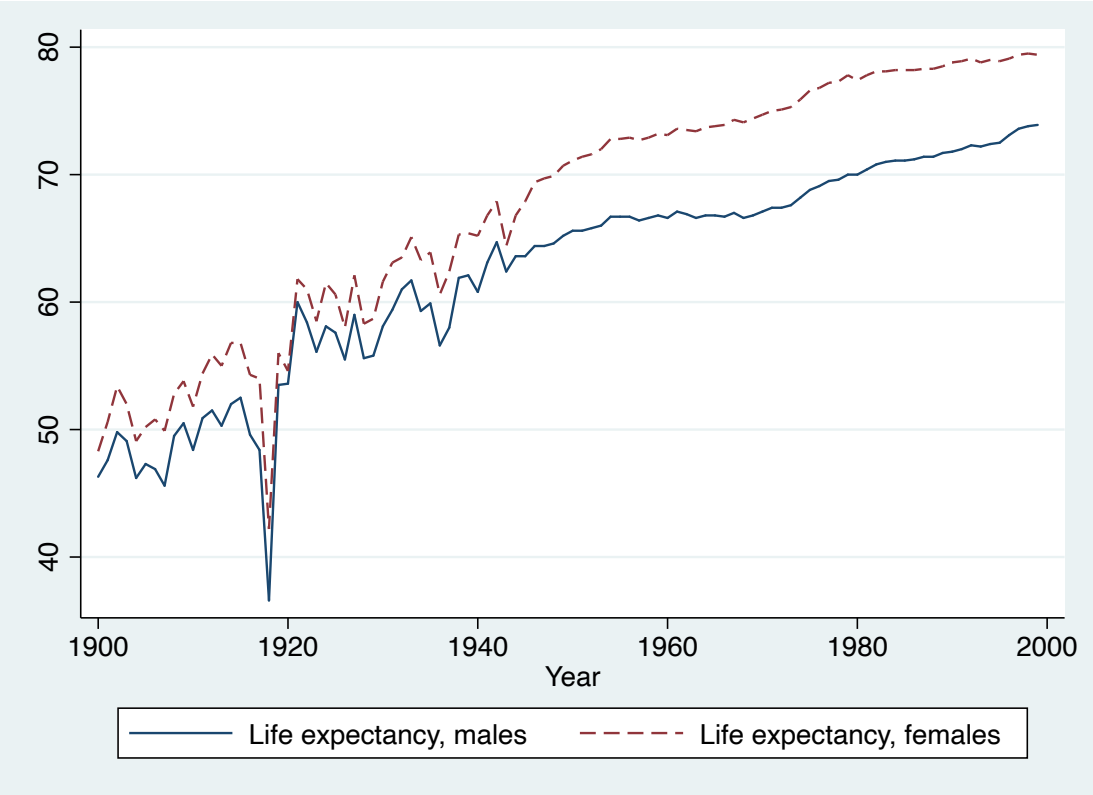
Line graph functions similarly as scatter plots, with time as x-axis usually.

```
sysuse uslifeexp, clear
twoway line le year, title("Life expectancy at birth by year, USA")
       graphregion(color(white)) }
```



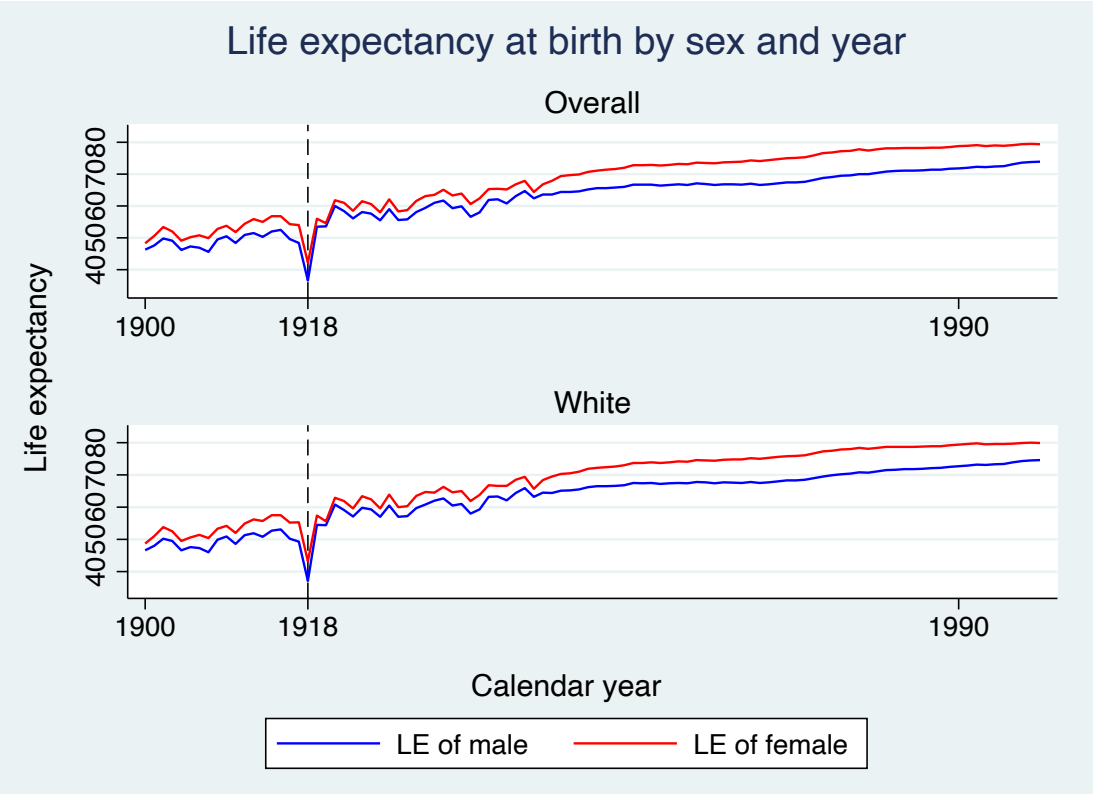
Graphs: Stratification

Data is already in separate columns. Or using `by()`.
Hint: `by()` is often used in individual-level data.
Btw, why did I use one solid line and the other dash line here?



Graphs: Putting graphs together

`grc1leg2` plays the role in plotting graphs together.
Hint: `grc1leg2` is not a default Stata command. See `help grc1leg2` to install it.

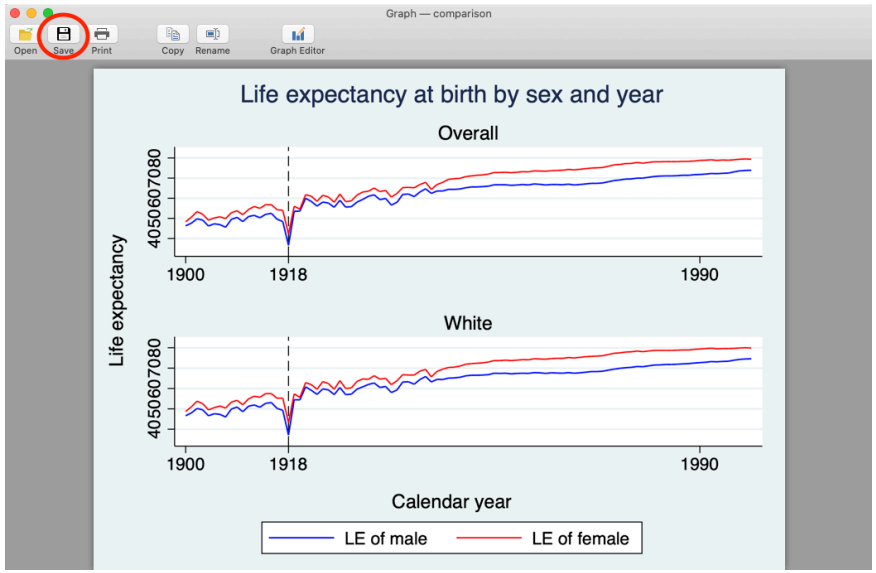


Graphs: Export

- A standard way:

```
graph export "location" /// assign the location
, as(pdf) name("")
```

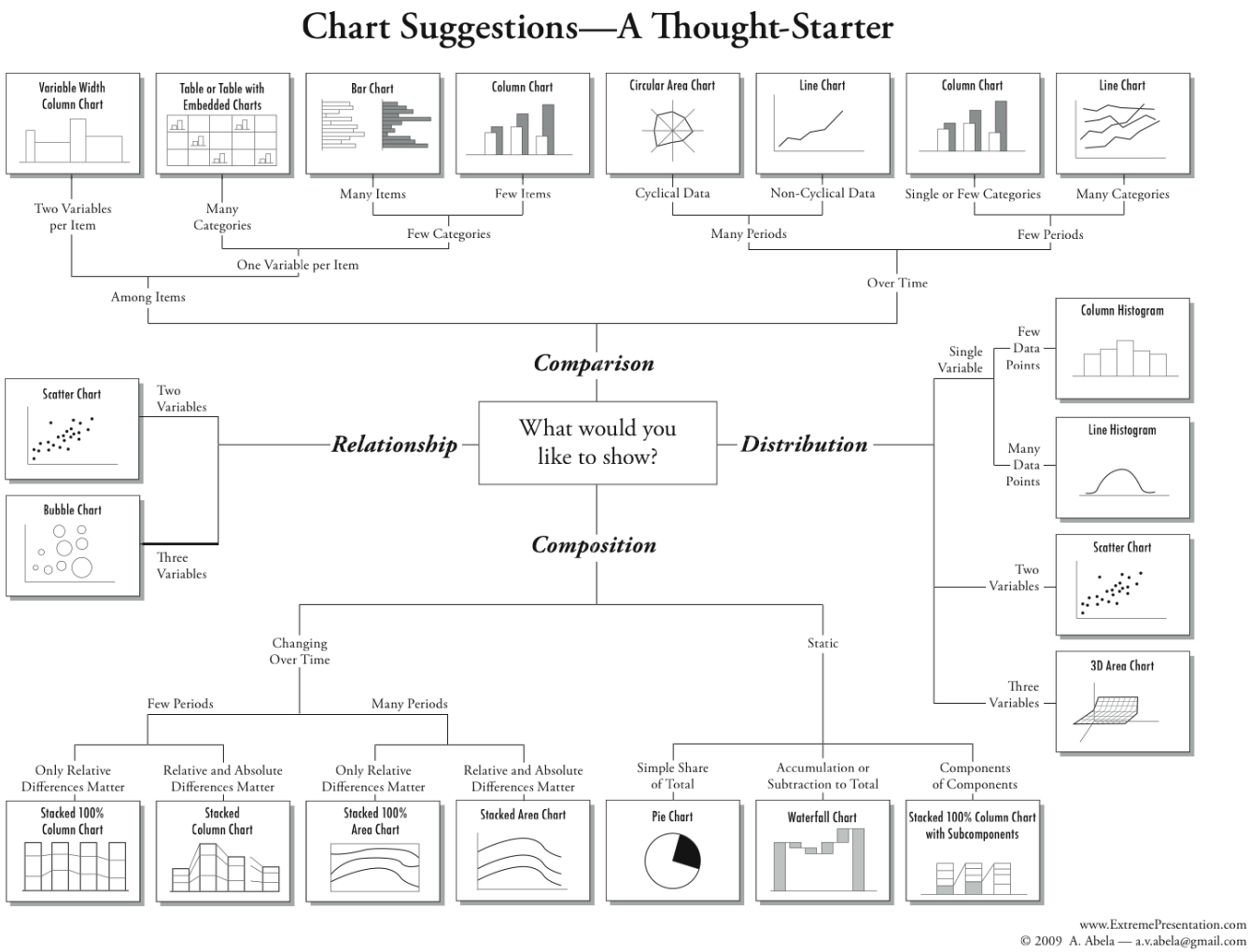
- An intuitive way:



- And then copy and paste the code back to the do-file.

Graphs: Study map

Check the webpage: `https://extremepresentation.com/tools/`



References