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Age-specific mortality

Data analysis and Report writing
workshop for Civil registration and
vital statistics data.

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Why we use age-specific mortality rates

- ◆ All-age mortality is not very useful for health planning or monitoring
- ◆ We need to know how many deaths occur in different age groups.
- ◆ But the percent distribution of deaths by age group is affected by a population's age structure.
- ◆ Therefore we calculate age-specific mortality rates.



Question:

- ◆ Country X had an age-specific mortality rate of 1.5 deaths per 1,000 males aged 15-19 in 2017
- ◆ Country Y had an age-specific mortality rate of 3.1 deaths per 1,000 males aged 15-19 in 2017
- ◆ In which country is mortality higher among males aged 15-19?
- ◆ In which country is mortality higher for all males?



Answer

- ◆ Age-specific mortality rates allow comparison between countries and over time for specific age groups
 - ◆ Expressed as a rate per 1,000 in that age group
- ◆ Country Y has higher mortality among males aged 15-19 years (3.1 > 1.5 deaths per 1,000 males aged 15-19 years)
- ◆ However, we need more information to determine which country had higher levels of overall mortality in males

Age-specific Mortality Rates

Like the crude birth rate, age-specific mortality rates are calculated by dividing those dying at a particular age by the population in that age group.

<u>Age-Specific Rate</u>	<u>Numerator</u>	<u>Denominator</u>
Age 0 mortality rate	deaths at age 0	mid-year age 0
1-4 mortality rate	deaths 1-4	mid-year 1-4
5-9 mortality rate	deaths 5-9	mid-year 5-9
10-14 mortality rates	deaths 10-14	mid-year 10-14
Etc.,		

...

$$= \frac{\text{Number of deaths in specified age group}}{\text{Mid period population for specific age group}} \times 1,000$$



= Number of deaths in specified age group x 1,000
Mid period population for specific age group

Age group	Male deaths	Male population	Male Age-specific mortality rates
0	40	3045	13.1
1-4	10	11230	0.9
0-4	50	14275	3.5
5-9	3	15130	0.2
10-14	7	15780	0.4
15 - 19	17	15870	1.1
20 - 24	28	15800	1.8
25 - 29	25	13490	1.8
30 - 34	27	12650	2.1
35 - 39	39	13080	3.0
40 - 44	50	13920	3.6
45 - 49	103	12700	8.1
50 - 54	102	11900	8.6
55 - 59	143	9110	15.7
60 - 64	172	6240	27.6
65 - 69	233	4290	54.3
70 - 74	206	3000	68.7
75 - 79	214	1890	113.1
80 +	506	1570	322.5
Total	1925	180695	

Age-specific death rate of males aged 15-19 years
 $= 17/15,870 \times 1,000$
 $= 1.1$ deaths to 1,000 males aged 15-19 years

Age-specific death rates in demographic terms

Age-specific central death rates M_x are calculated as the number of deaths in a particular age group per 1,000 population in the same age group:

$$D_x/P_x$$

Age-specific death rates are calculated as the number of deaths in a particular age group per 1,000 population in the same age group.

In symbols:

$${}_nM_x^t = \frac{{}_nD_x^t}{{}_nP_x^t} \times 1,000$$

Where:

${}_nM_x^t$ is the age-specific death rate between ages x and $x+n$ for year t ;

${}_nD_x^t$ is the number of deaths between ages x and $x+n$ for year t ; and

${}_nP_x^t$ is the population between ages x and $x+n$ for year t .

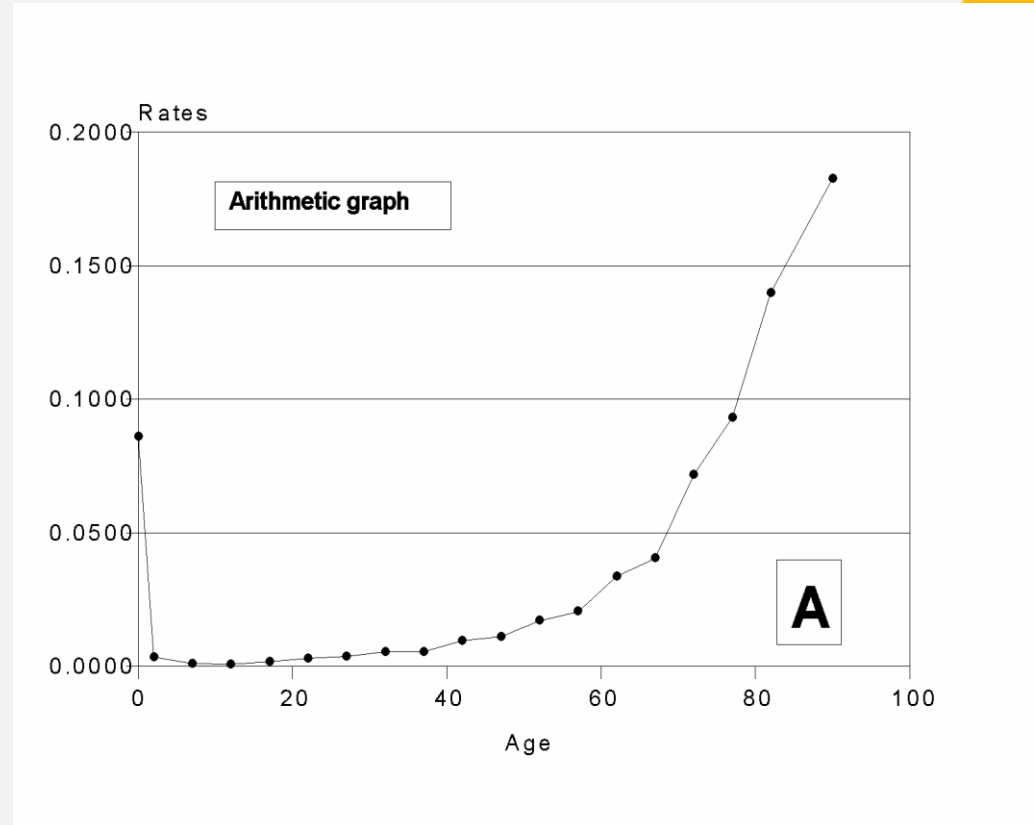
Age-specific death rates are J-shaped

The typical mortality pattern over all age groups has a J-shape.

Mortality is high among infants and young children, after which it declines rapidly, reaching its lower level usually between ages 5-14.

As a general rule, mortality rates start to increase exponentially beyond age 35 or so.

At progressively older adult ages, mortality tends to rise. In this example, it increases rapidly after age 65.

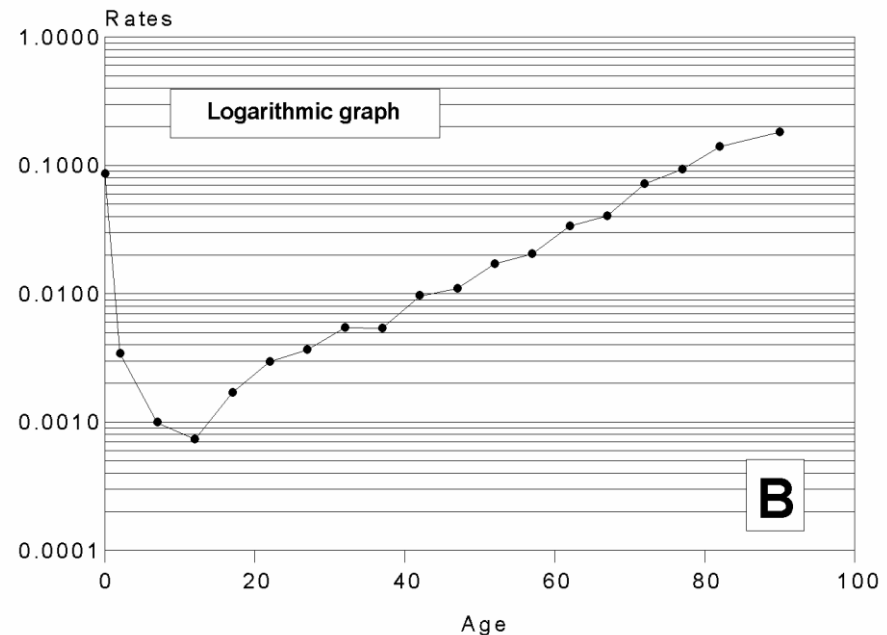
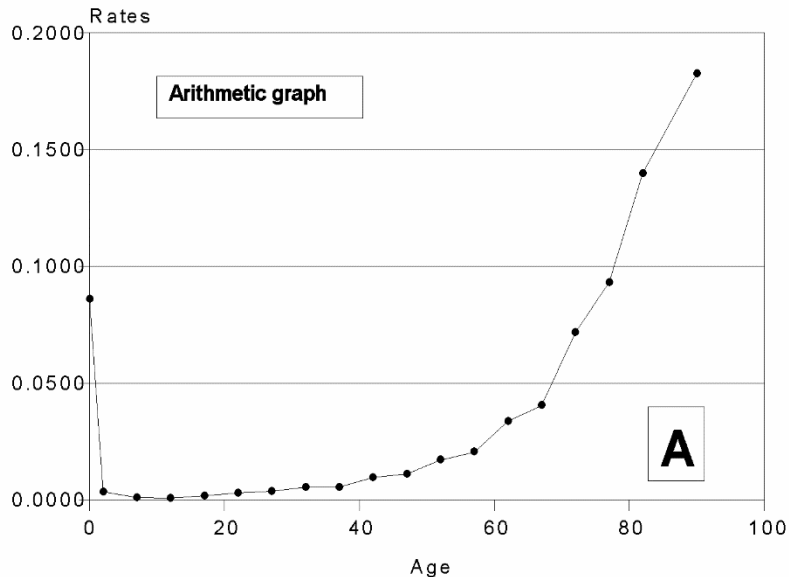


Graph from U.S. Census Bureau's *Population Analysis with Microcomputers Volume I Presentation of Techniques*

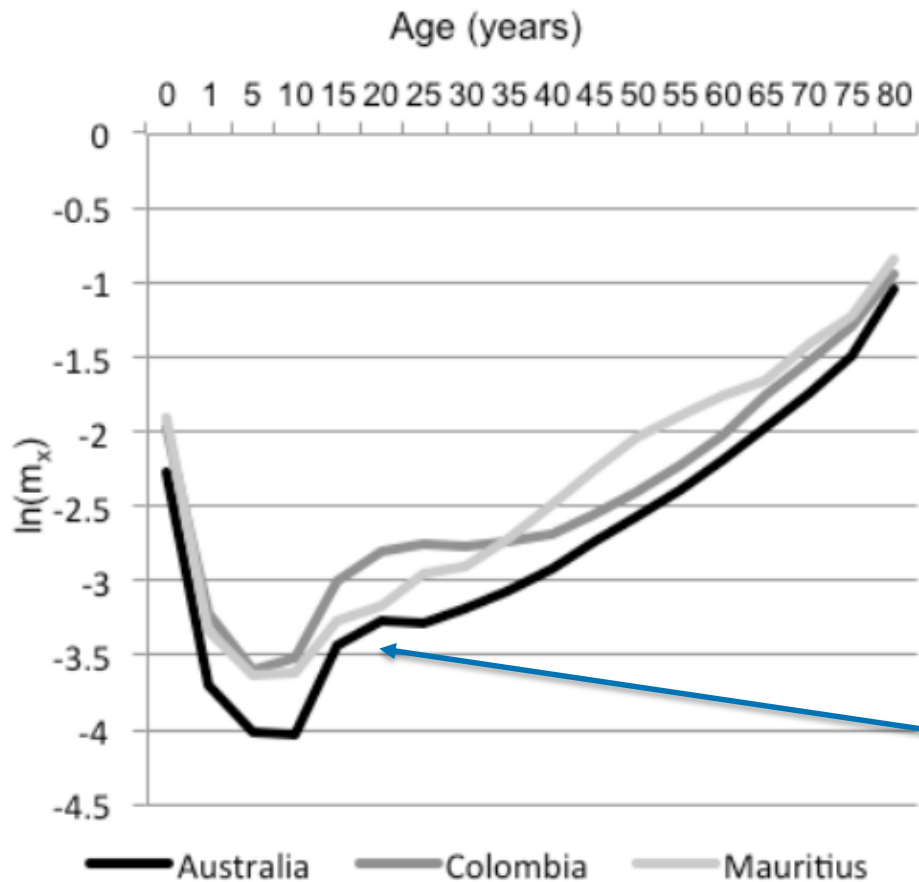
Graphing age-specific mortality rates using a logarithmic scale

- It may be difficult to see differences in mortality between age groups using an arithmetical scale.
- For this reason, we often graph age-specific death rates using a logarithmic scale.

Graphs from U.S. Census Bureau's *Population Analysis with Microcomputers Volume I Presentation of Techniques*



Another log example (males)

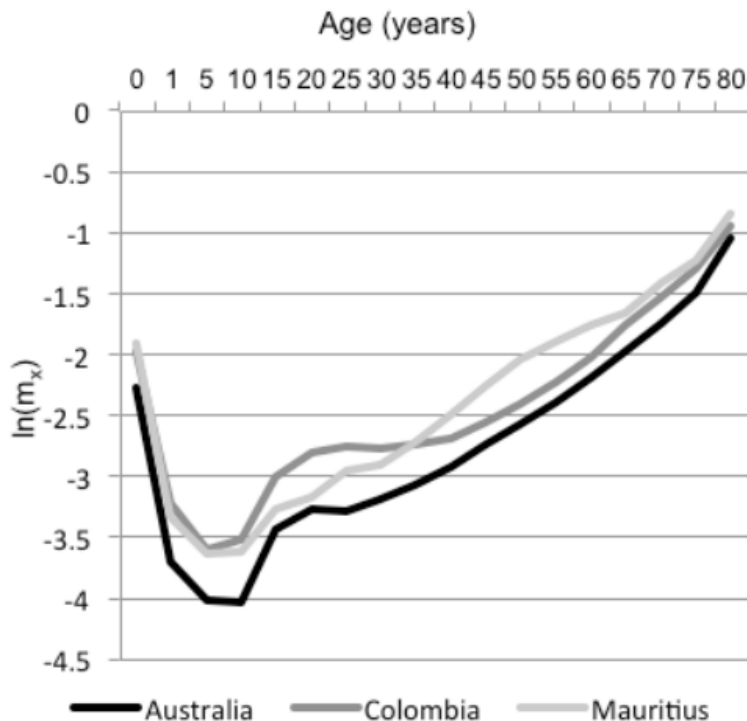


Source: Institute for Health Metrics and Evaluation database

Graph from: University of Queensland Health Information Systems Knowledge Hub's *Mortality statistics: a tool to improve understanding and quality*

What is going on here?

Another log example

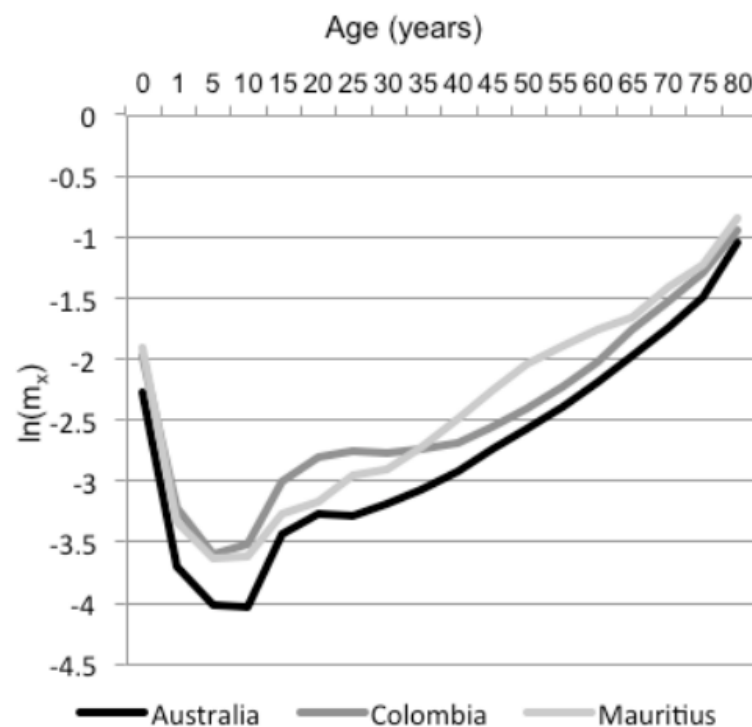


Source: Institute for Health Metrics and Evaluation database

- It can be common to see a bump in mortality in young men aged 15-24
- This is due to increased risky behavior and subsequent deaths due to accidents and suicide
- In some countries, there may also be a bump in young females, but this may be due to the risk of maternal mortality in young women

Assessing data quality

- Assessing the pattern in your data can help assess data quality and possible under-registration of deaths at certain ages.
- It is not the level of mortality that matters but the relative age pattern of mortality among different age groups.
- Generally, beyond age 35, death rates rise exponentially which translates to a straight line on logarithmic graphs.
- Departure from this linear pattern suggests deaths are being underreported in certain age groups or that age is being misreported
- Australia —mortality increases smoothly in a straight line from around age 35, as would be expected with more complete death registration.
- Mauritius —Mortality does not increase linearly, from around age 65 the line is not smooth, suggesting underreporting of deaths, particularly at the oldest ages.

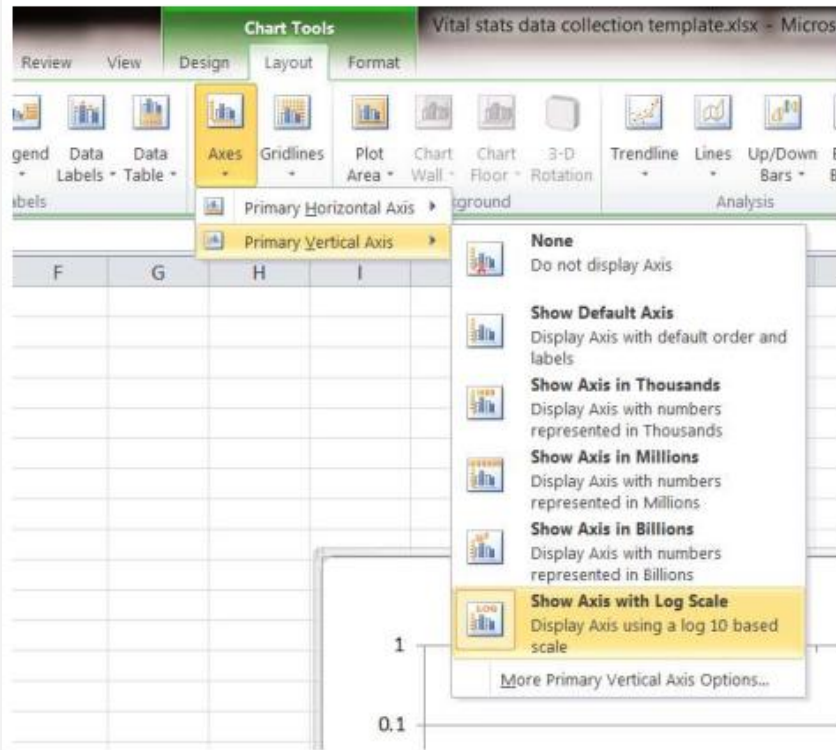


Source: Institute for Health Metrics and Evaluation database

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Logarithmic graphs in Excel

Next we will graph our data points on a logarithmic scale. To do this in Excel, click on your graph then click on the layout tab => Axes => Primary Vertical Axis => Show Axis with Log Scale.



Ask a facilitator for help in newer versions of Excel

See page 71 in the SPC Data Analysis and Report Writing for Civil Registration and Vital Statistics Coursebook for more information.

Exercises

- ◆ Calculate age-specific mortality rates for each sex from the test data set.
 - ◆ Should you use adjusted or unadjusted numbers?
- ◆ Graph your results on both a regular and logarithmic graph.
 - ◆ How does your data look? Does it follow the mortality pattern you would expect?
- ◆ Repeat this exercise with your country data