MSc/BSc Programmes in International and Global Health Epidemiology and Statistics Week 2:

What is a normal weight for a baby?

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What is a normal weight for a baby?

No two babies weigh exactly the same – weight is continuously variable

So what is a "normal" weight?

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What is a normal weight for a baby?

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 $-\operatorname{weight}$ is continuously variable

So what is a "normal" weight?

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Sample of 100 boys

- central line marks the median in the sample (half the sample below)
- box marks out lower and upper quartiles (1/4 & 3/4 of the sample below)
- whiskers mark out full range of values (with some additional subtleties – see Bland)













































Means and medians

- Mean and median are both ways of describing a
 "typical" value
- The mean has some useful mathematical properties, but is only really "typical" when the shape of the distribution is symmetric

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Means and medians

The mean is the "balancing" point of the distribution, if you imagine it balanced on a pivot.

With a strongly asymmetric distribution the mean is unduly influenced by the long **tail**





Means and medians

- For a symmetric distribution, summarise using mean and standard deviation
- For an asymmetric distribution, summarise using median and interquartile range

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Type of varia	ıble	Example	Values	
	Binary	Mortality	Dead / Alive	
Categorical	Nominal	Eye colour	Blue / Brown / Grey / Green	
	Ordinal	Severity of disease	Mild / Moderate / Severe	
Quantitative	Discrete	Number of siblings	0, 1, 2, 3,	
	Continuous	Weight		



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Quantitative	Continuous		Weight	



Continuous and discrete quantitative variables

- Measurements are almost never truly on a continuous scale – we record values to a certain number of decimal places or digits
- Any discrete quantitative variable where the difference between successive values is small compared with the range of possible values is often treated as continuous
- Discrete quantitative variables are often summarised with mean or median, just like continuous variables

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Relationships between variables

When thinking about the relationship between two variables, it often helps to think of one as the **outcome** and the other as the **predictor** (or **exposure**)

Relationships between variables

The same variable might be an outcome in one context, and a predictor in another

e.g.

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sex (M/F) vs smoking status (never/ex/current): sex is predictor → smoking status is outcome

but

smoking status vs symptoms of breathlessness: smoking status is predictor → breathlessness is outcome

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Smoking status	Sex			Total		
	Male		Fe	Female		
	No.	%	No.	%	No.	%
Never	76	33,3%	143	52.6%	219	43.8%
Ex	87	38.2%	74	27.2%	161	32.2%
Current	65	28.5%	55	20.2%	120	24.0%
Total	228	100.0%	272	100.0%	500	100.0%



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Smoking status	Sex Mole			То	tal	
	No.	wale %	No.	male %	No.	%
Never	76	33,3%	143	52.6%	219	43.8%
Ex	87	38.2%	74	27.2%	161	32.2%
Current	65	28.5%	55	20.2%	120	24.0%
Total	228	100.0%	272	100.0%	500	100.0%
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Normal weight for a baby: what does "normal" mean?

"normal" = Normal distribution?

Don't be confused by this terminology – not all naturally occurring measurements are Normally distributed

e.g. distribution of boys' weights at 6 months is skewed (non-Normal)

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"normal" = commonly seen

Could summarise this with a mean or median

e.g. median weight for a 6-month-old boy is 7.9kg

but this ignores variability

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Normal weight for a baby: what does "normal" mean?

"normal" = commonly seen

Often summarised using percentiles

e.g. boys' weights at 6 months: 3rd centile = 6.4kg 97th centile = 9.7kg 94% of six-month-old boys weigh between 6.4kg and 9.7kg

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Normal weight for a baby: what does "normal" mean? "normal" = commonly seen in a healthy population e.g. WHO growth standards limited to children from high social class families, with non-smoking, breastfeeding mothers

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Normal weight for a baby: what does "normal" mean?

"normal" = leads to good health outcomes

Requires evidence of the health consequences of different weights

"Normal" in this sense does not necessarily mean "commonly seen"!

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Summary

The word "normal" is used in a variety of ways in health statistics:

- a Normal distribution
- · what is commonly seen
- · what is commonly seen in a healthy population
- · what leads to good health outcomes

Always make sure you understand which is meant!

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