The Queen's Nursing Institute

Masterclass:

Introduction to quantitative data analysis

SUMMARY

Wednesday 14 June 2023
1pm - 2.15pm, via Zoom

#QNIResearch

The Queen's Nursing Institute

Dr Caroline Dickson, QMU Senior Lecturer in Community Nursing Queen Margaret University, Edinburgh, @cawdickson

- Welcome to everyone, a recording of this masterclass will be available shortly
- Brief overview of the forum: it's a national forum for community nurses who are undertaking or considering carrying out research and those keen to be more research aware.
- It aims to strengthen the capacity of community-based nursing research through peer support, mentorship, and supporting personal development and research opportunities.
- Gives us a space to learn about research together
- There are currently over 450 members across the UK.
- We offer monthly newsletters about research and research activities, webinars, masterclasses.
- There are website resources and we have just launched a mentorship scheme, to help develop your research career.
- To sign up and/or find out more, go to: https://qni.org.uk/nursing-in-the-community/community-nursing-research-forum/ or scan the QR code right

This free 1-hour masterclass with Anthony Manning-Stanley is focussed on quantitative data analysis for research papers.

Anthony Manning-Stanley, Director of Studies and Lecturer for the Diagnostic Radiography degree programme, University of Liverpool, @_antms; antms@Liverpool.ac.uk

- My background is I have an undergraduate degree in Biology - I had an epiphany in my late 20s (a quarter-life crisis!) I was working in finance and I retrained as a diagnostic radiographer
- I've done quite a lot of statistic projects and would say I have a positivist background as I've worked on a lot of qualitative projects
- After this session you should hopefully be able to: identify the different types of data which can be subject to quantitative data analysis and select appropriate descriptive and inferential statistics application to the various data types.
- The first thing to establish with any research is what is your research question? It's all about what you're trying to achieve with the project.
- There are a number of methodologies, quantitative research designs include case-control study; cohort study and randomised control trial.

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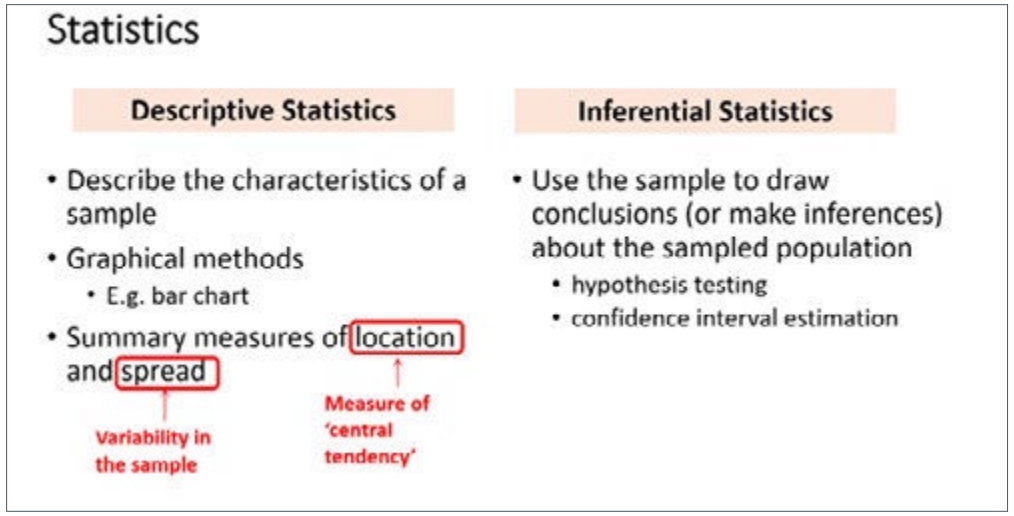
- **Case-control study**: is retrospective, compares those with disease and without disease and the outcome is expressed as an odds ratio
- **Cohort study:** is prospective typically, for eg how exposure to different risk factors affects a group of people and is expressed as a hazard ratio
- **Randomised control trial:** randomised to control/intervention arm - to minimise bias, no differences in baseline characteristics and you can compare outcomes at end of trial. Please note: randomised control trial is not always indicated or ethical to conduct.
- Today we will explore p values, t tests, means, standard deviation, and think about how we choose our methodology from a quantitative perspective.



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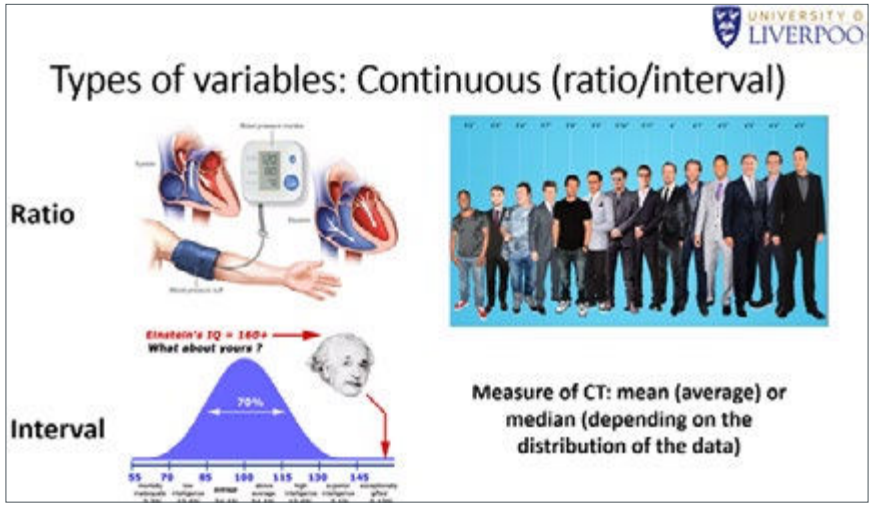
- Types of variables, categorical:

1. **binary:** one or the other, dead or alive, pregnant or not.
2. **nominal data:** blood groups for example, no hierarchical ranking in this data. Can represent or store values for binary or nominal data. Numbers don't have numerical value here, it helps summarise.
3. **ordinal data**: for clinical trials, for example asking patients what their pain is on a scale of 1 to 10. Or you might have different populations, for example, upper, middle and lower class. That scale isn't calibrated, there are gaps between each points, which aren't necessarily the same distance.

- Descriptive statistics: Binary: proportions or odds, 65% were classified as female for example
- Nominal: we can think of central tendency, in this case it's mode
- Ordinal: measure of central tendency is median ie middle of rank ordered description
- Interval: measure of central tendency is average , for example IQ



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Measures of central tendency: mean ($\bar{x}$)

- Divide the sum of the measurements by the number of measurements
- e.g. 3, 4, 5, 6, 1, 4, 5 (7 measurements)

$\bar{x}$ = (2, 5, 6, 7, 1, 2, 5)/7 = 28/7 = 4

- Also consider 4, 4, 4, 4, 4, 4, 4 as a series of measurements

$\bar{x}$ = (4, 4, 4, 4, 4, 4, 4)/7 = 28/7 = 4

Measures of spread: standard deviation (σ)

This is the 'average' deviation from the mean

Take the difference between mean and observed value

Divide sum of differences by number of observations

$\bar{x}$	$\bar{x} - x$	$\bar{x} - x =$
4	4-2	2
4	4-5	-1
4	4-6	-2
4	4-7	-3
4	4-1	3
4	4-2	2
4	4-5	-1
	Sum =	0

Measures of spread: standard deviation (σ)

Need to add an extra column in...

$\bar{x}$	$\bar{x} - x$	$\bar{x} - x =$	$(\bar{x} - x)^2$
4	4-2	2	4
4	4-5	-1	1
4	4-6	-2	4
4	4-7	-3	9
4	4-1	3	9
4	4-2	2	4
4	4-5	-1	1
	Sum =	0	32

Measures of spread: standard deviation (σ)

To summarise: $\sigma = \sqrt{\Sigma(\bar{x} - x)^2 / n}$

Or:

We find the mean ($\bar{x}$)

We calculate all of the differences to the mean for our data ($\bar{x} - x$)

We square the differences $(\bar{x} - x)^2$ and add them all up (Σ)

We then divide that number by the number of observations (n)

We find the square root of that number ($\sqrt{}$)

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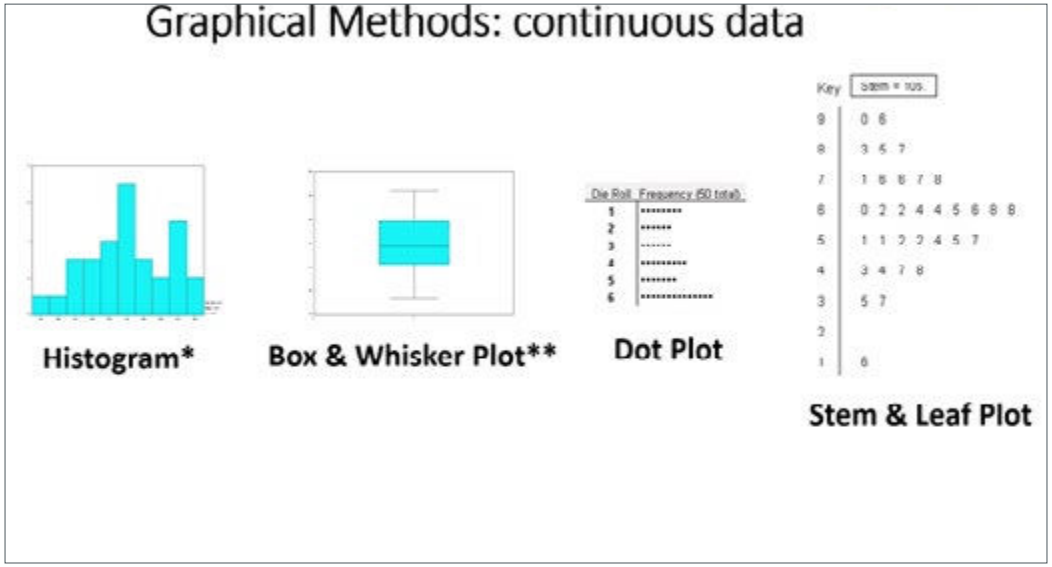
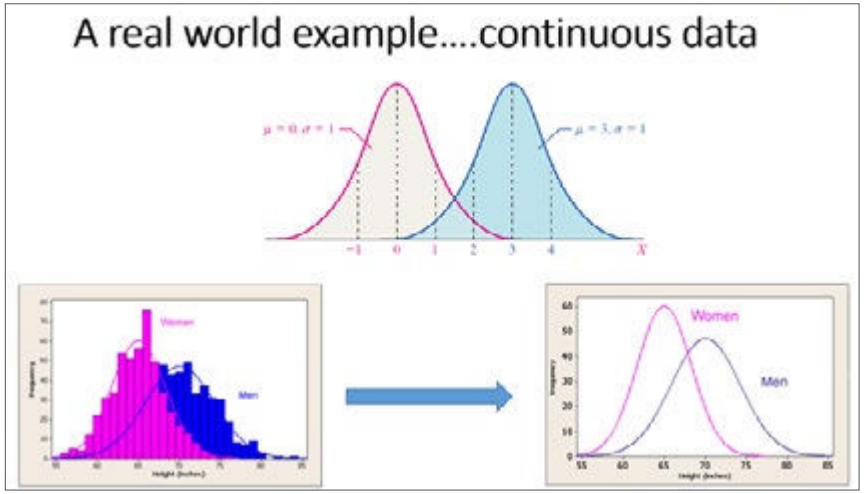
- Bar chart vs pie chart: I attended a writing for publication workshop and we were discouraged from using pie charts, bar charts are more effective as the small sections of the pie charts are less easy to see.
- Stem and leaf plot graphs are much less common. Notice the histogram, there is no gap between each bar:





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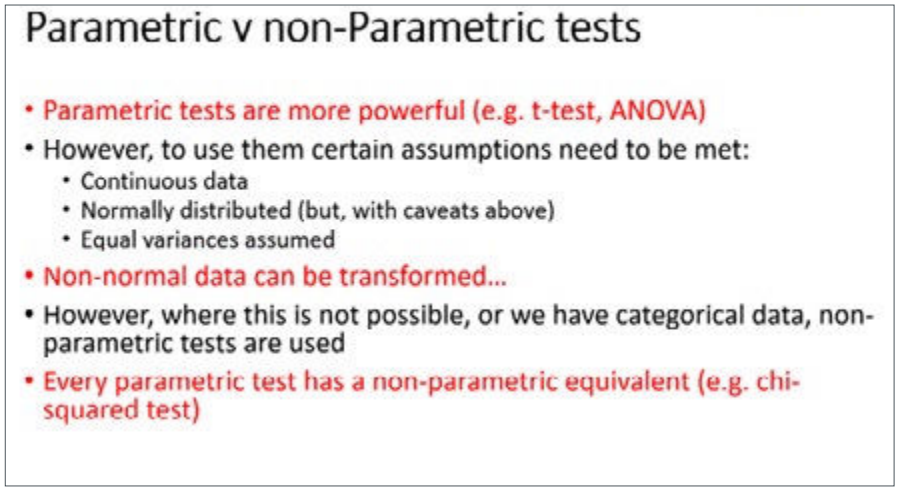
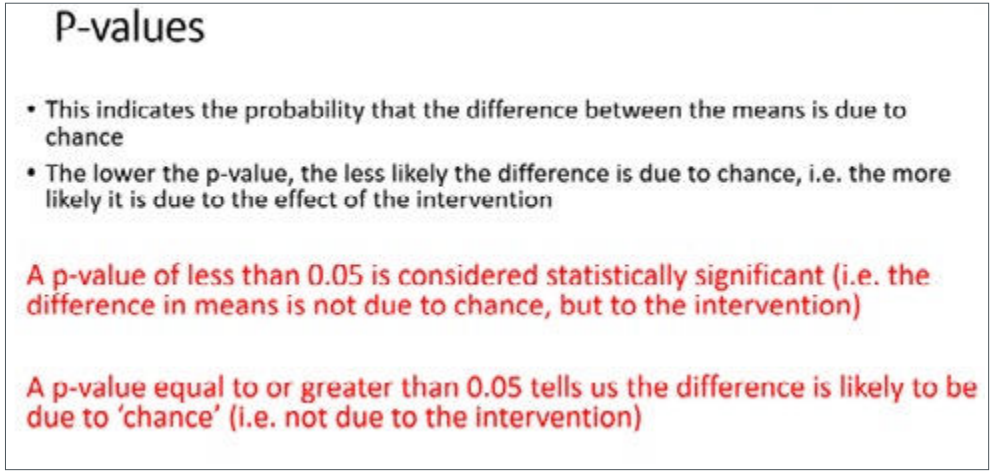
- Correct method of analysis: you have several factors to consider: the number of groups, type of data (ie categorical or continuous), observations (ie independent or paired) and distribution of the data (ie symmetric or skewed).
- Always check the assumptions of the test are valid.
- Even within statistics there's no hard and fast rule you can find evidence to support different approaches. There's not always an answer, there's debate in statistics literature if you see one methodology in one paper, how have they justified it etc?
- That's where parametric vs non parametric tests come in:





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- In summary: engage with statistics expert: always adopt a team approach, no one can do it on their own, everyone has their different strengths. It's not what you know sometimes but who you know.
- Match the research question…is collecting numeral data going to help you with your project for example? It's important you know what kind of data you're working with, consider this early on.
- It's important we make sure from outset that its well defined.
- Descriptive vs inferential statistics: at the outset in terms of analysis we need to use the appropriate one.
- It's also important to report both positive (ie significant) and negative (ie non-significant results). This is an important a problem in the research world: where journals only report positive results.
- If you've got a project and you're unsure what direction to take it in, my email is: antms@Liverpool.ac.uk.
- Lastly, don't be afraid to give it a go!

Thank you to all delegates who attended today's Masterclass.

Next masterclass in the series:

Using Quality Improvement and Audits to Enhance Care
Thursday 13 July 2023, 1-2pm
Book here:
https://qni.org.uk/news-and-events/events/research-masterclass-13-07-23/

To read past summaries or to watch past masterclasses, please go to:

https://qni.org.uk/nursing-in-the-community/community-nursing-research-forum/research-masterclasses-on-demand/

COMMENTS

A selection from delegates:

Thank you, a really interesting session.

Thanks for a really great session Anthony

Thank you very much for your advice - very helpful

Thank you and I really liked the stats decision tree too

Thanks: it's lovely to hear your passion and enthusiasm for research and statistical analysis. Thank you for sharing this and the quick summary of stats methods. I love your flow chart - it's more straightforward than the one I was given when doing my MSc!

Thank you! :-)

Thank you again for support and advice today

It was great. Best wishes to all doing some v interesting study!