Generalizability and representativeness in quantitative research. A big deal? Some personal observations

Philip Schluter

My (borrowed) observations

o Clinical and epidemiologic investigations are paying increasing attention to the critical constructs of "representativeness" of study samples and "generalizability" of study results

o "This study sample is not representative of the population!" "Our results are not generalizable …"

o Such comments are increasingly familiar but what exactly do they mean?

So what does...

o representativeness, and

o generalizability

actually mean?

And does...

Representativeness $\longrightarrow$ Generalizability?

– *Suggested reading*:

Kukull W.A. and Ganguli M. (2012). Generalizability: the trees, the forest, and the low-hanging fruit. *Neurology*, 78(23): 1886-1891.

Rothman K.J. and Greenland S. (1998). *Modern Epidemiology* (2nd edn.) Philadelphia; Lippincott-Raven.

My (borrowed) observations

o Clinical and epidemiologic investigations are paying increasing attention to the critical constructs of "representativeness" of study samples and "generalizability" of study results

o This is a laudable trend and yet, these key concepts are often misconstrued and conflated, masking the central issues of internal and external validity…

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What does representativeness mean?

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Representativeness is defined as the level of how well or how accurately something reflects upon a sample. When a study gives a good indication of what the whole population believes, this is an example of a study with good **representativeness**.

Representativeness dictionary definition | representativeness defined
www.yourdictionary.com/representativeness

? About this result   Feedback

Statistical inference

- Rare to have data on entire population: so sampling needed

- Statistical inference is the process of using information from a sample to infer something about the population from which the sample was drawn

- Sampling strategy critical in evaluating the role of "chance" in the interpretation of research study results

Statistical inference

- So the target population $\geq$ sampling frame $\geq$ sample

Target population

Sample

Sampling frame
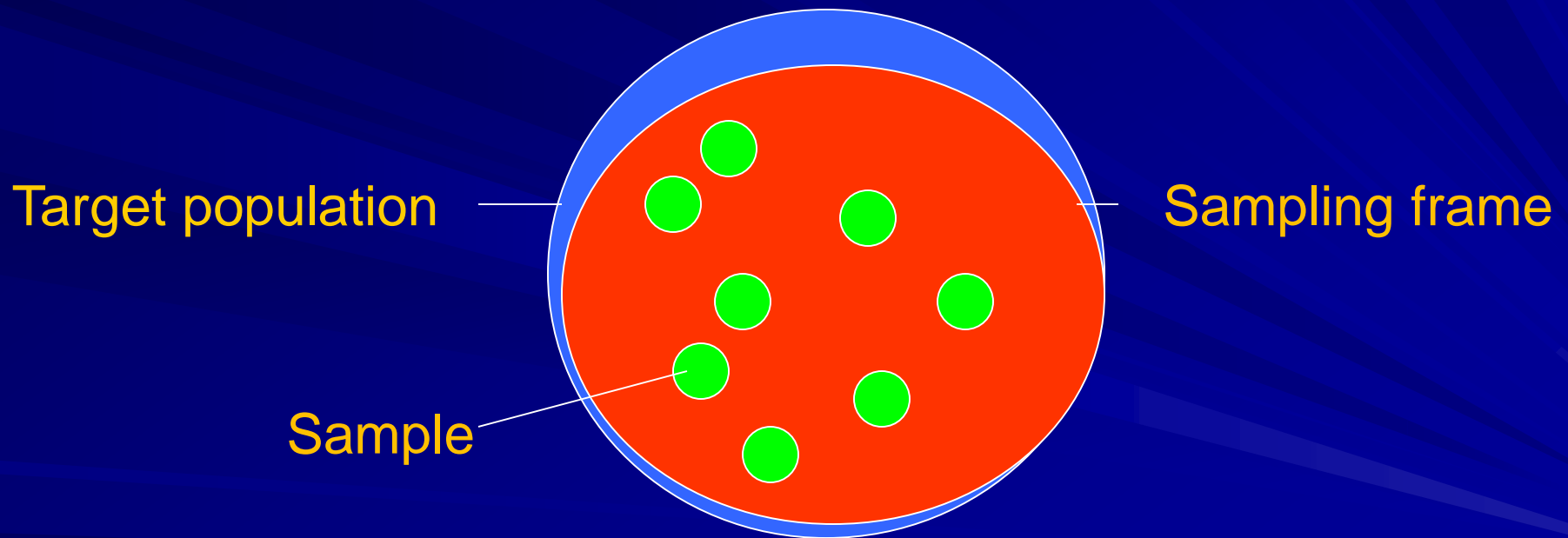
The aim of many studies is to "generalize" from what we see in the sample to that of the total population…

Sampling methods

- **Probability sampling**

  – enable us to quantify the sampling variation using statistical methods

  – reduces estimator bias for the quantity of interest

    E.g.: simple random sampling, systematic sampling, stratified sampling, cluster sampling, two-stage sampling…

- **Non-probability sampling**

  – does not allow accurate sampling variation calculations and is prone to bias

    E.g.: convenience sampling & haphazard sampling…

Example…

Comprehensive clinical assessment of home-based older persons within New Zealand: an epidemiological profile of a national cross-section

Representative: yeah, nah?

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Table 2: Sex and ethnic distributions of the interRAI-HC cohort aged 65+ years (45,418 people) and the New Zealand population (NZ pop^n) aged 65+ years usually resident at the 2013 Census (607,035 people) stratified by 10-year age bands.

| | 65-74 years | | | | 75-84 years | | | | 85-94 years | | | | 95+ years | | | |
| | interRAI-HC | | NZ pop^n | | interRAI-HC | | NZ pop^n | | interRAI-HC | | NZ pop^n | | interRAI-HC | | NZ pop^n | |
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Sex[a]																
Males	3,256	(43.9)	167,565	(48.4)	7,364	(40.1)	85,128	(45.4)	6,316	(35.2)	25,023	(36.6)	434	(25.7)	1,164	(23.7)
Ethnicity[b]																
Māori	879	(11.8)	22,188	(6.7)	1,033	(5.6)	8,505	(4.7)	338	(1.9)	1,416	(2.2)	21	(1.2)	75	(1.6)
Pacific	489	(6.6)	9,225	(2.8)	670	(3.7)	3,693	(2.1)	269	(1.5)	741	(1.1)	12	(0.7)	27	(0.6)
Asian	232	(3.1)	17,847	(5.4)	501	(2.7)	7,596	(4.2)	260	(1.4)	1,302	(2.0)	12	(0.7)	72	(1.5)
European/Other	5,821	(78.4)	280,596	(85.1)	16,147	(88.0)	159,570	(89.0)	17,092	(95.2)	61,953	(94.7)	1,642	(97.3)	4,521	(96.3)

a: 2 observations missing in the interRAI-HC for people aged 65-74 years;

b: In the 2013 Census, 16,275 people aged 65-74 years had unstated ethnicity; 8,220 people aged 75-84 years had unstated ethnicity; 3,003 people aged 85-94 years had unstated ethnicity; 207 people aged 95+ years had unstated ethnicity.

Representativeness...

- vs. internal validity!

- When, oh when, do we **need** population representativeness?

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Generalizability

o Somewhat more slippery – discipline and historically specific

o Internal validity conflated with external validity…

o Two fundamental questions:

  o (i) are the results of the study robust – or are they an artefact of the way the study was designed and conducted (i.e. is the study internally valid?)

  o (ii) are the study results likely to apply, generally or specifically, in other settings or samples (i.e. is the study externally valid?)

o Assertions of whether those "internally valid" results will then broadly "generalize" is much a matter of judgement as of statistical inference

And you guessed it...

o representativeness DOES NOT imply generalisability OR

o non-representativeness DOES NOT IMPLY non-generalisability

o Doll R. and Hill A.B. (1954). The mortality of doctors in relation to their smoking habits: a preliminary report. *BMJ*, 1:1451-1455.

Questions/discussion...

Thank you!