Data and statistics for journalism

Thomas Lumley

“Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.”

– Samuel Wilks, paraphrasing H.G. Wells

"The statistician's task is to go into the light and spread darkness”

– Scott Emerson

Everybody says that statistics should be taught. But how ?

Statistics are not simply figures. It is said that nothing lies like figures except facts. You want statistics to tell you the truth. You can find truth there if you know how to get at it, and romance, human interest, humor and fascinating revelations as well. The journalist must know how to find all these things truth, of course, first. His figures must bear examination. It is much better to understate than to overstate his case, so that his critics and not himself may be put to confusion when they challenge him to verify his comparisons.

He must not read his statistics blindly; he must be able to test them by knowledge and by common sense. He must always be on the alert to discover how far they can actually be trusted and what they really mean. The analysis of statistics to get at the essential truth of them has become a well-developed science whose principles are systematically taught. And what a fascinating science it is!

-- Joseph Pulitzer, 1904

Me

- Main author of StatsChat
- Theoretical and applied medical statistician
- *Herald* and *Dom Post* and *Spinoff* subscriber

You

- Journalism interests
- Particular data interests?

Outline

Context: compared to what?

- Denominators
- Trends

Uncertainty

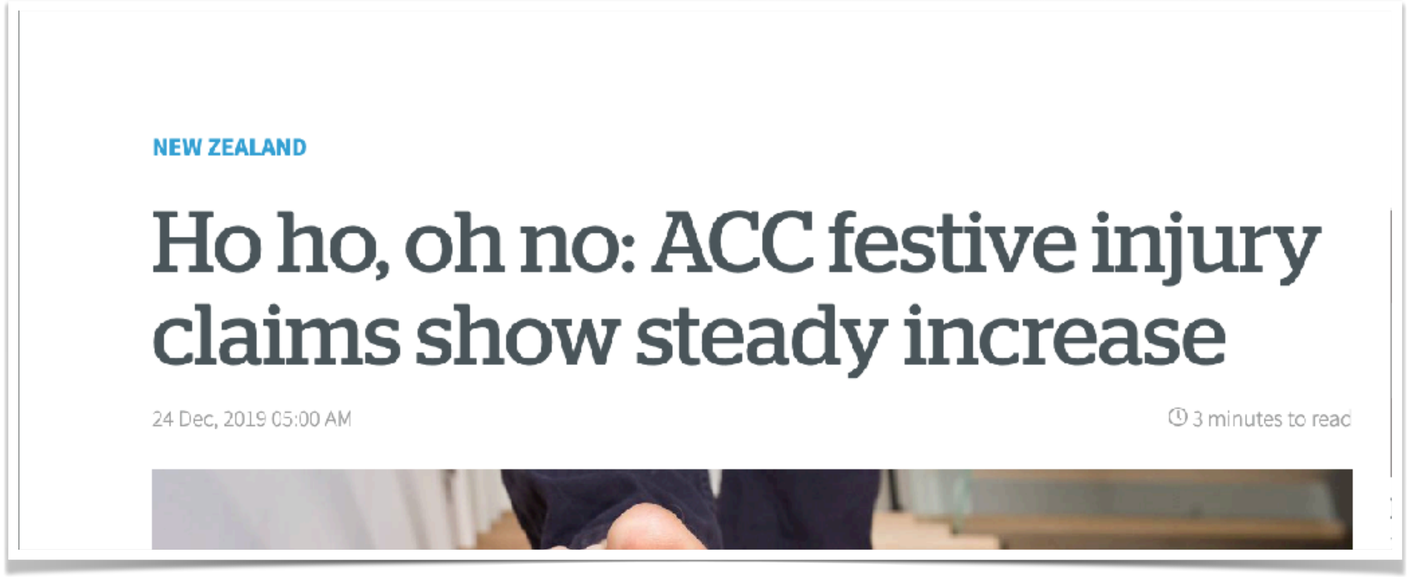
- Sampling error
- Random variation

Visualisation

- Compared to what?

Compared to what?

The fundamental question: compared to what?



NEW ZEALAND

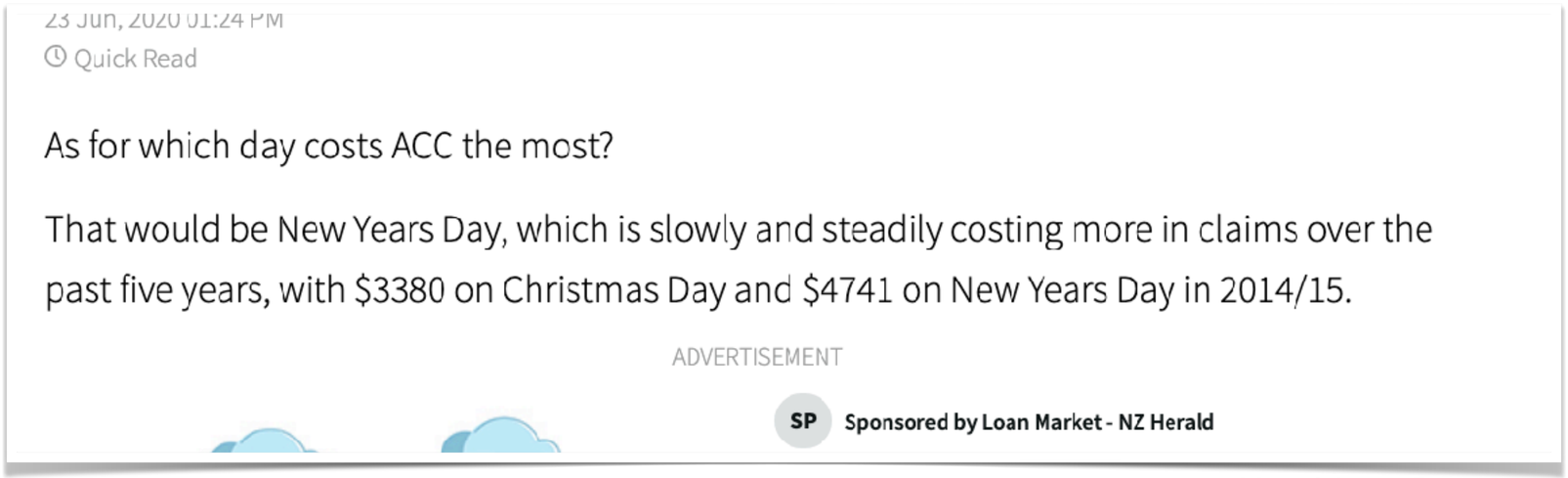
Ho ho, oh no: ACC festive injury claims show steady increase

24 Dec, 2019 05:00 AM

3 minutes to reac

up 11% over four years:
- **inflation: 7.9%**
- **population growth: 8.8%**

down 7% per capita in constant dollars



23 Jun, 2020 01:24 PM

Quick Read

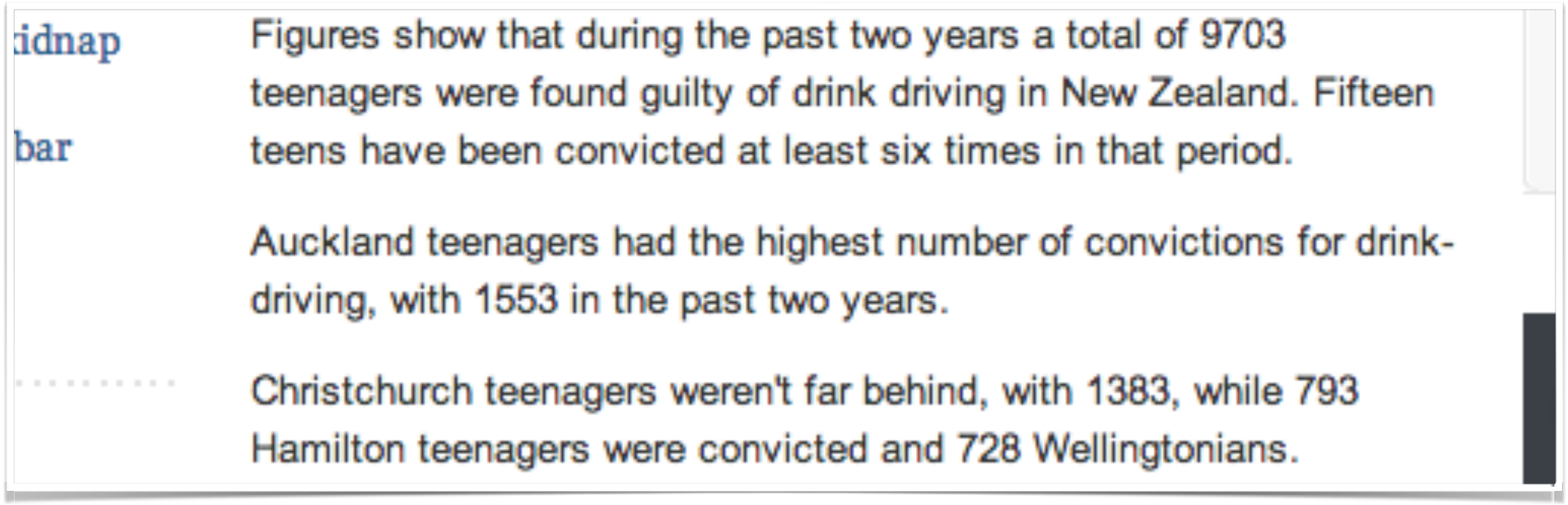
As for which day costs ACC the most?

That would be New Years Day, which is slowly and steadily costing more in claims over the past five years, with $3380 on Christmas Day and $4741 on New Years Day in 2014/15.

The whole holiday period has lower accident costs than a typical working day

Herald, 24 Dec 2019

Denominators



stuff.co.nz, 29 October 2012

Rate of convictions per capita is *lowest* in Auckland

Auckland + Wellington have about *half* the national average rate

Christchurch rate is high.

More students cheat in exams, and most are in Auckland

4:26 PM Thursday Jun 30, 2016

NZ Qualifications Authority

SHARE:

More students are cheating in NCEA exams, figures show. Photo / iStock

2015 cheats by region:

- Auckland - 159
- Bay of Plenty - 6
- Canterbury - 23
- Central Plateau -
- East Coast - 3
- Hawke's Bay - 12
- Manawatu - 7
- Nelson/Marlborough - 5
- Northland - 25
- Otago - 5
- Southland - 2
- Taranaki - 4
- Waikato - 20
- Wairarapa - 2
- Wanganui - 1
- Wellington - 27
- West Coast - 4
- Cook Islands -

159/290 means Auckland is high

25/290 means Northland is *much* higher.

Also, rate is 2 per 1000, so we're probably missing a few

Herald, 30 June 2016

Otago Daily Times

News | Sport | Life & Style | Entertainment | Business | Regions

Wednesday, **21 October 2020**

Rate of assaults in Wellington 10 times higher than nation's average

An analysis of the country's crime statistics by Dot Loves Data shows the rate of assaults in Wellington is 10 times higher than the national average.

It considered all reported crimes over a five-year period, and found in the capital there were 2056 counts of assault and 176 counts of sexual assault reported.

Those crimes were centred around the Cuba-Courtenay precinct, comprising most of the city's nightlife and bars.

"[In] Wellington, assaults and sexual assaults stick out," said Dot Loves Data's

Denominator?

Also too, comparison?

https://www.statschat.org.nz/2020/10/23/compared-to-what-6/

Special investigation: Auckland house prices

5:00 AM Saturday Jul 11, 2015

Auckland Region | China | NZ Labour Party | National

Exclusive: Leaked figures support claims that Chinese investors are a big influence on Auckland's overheated property market.

Labour claims the data shows for the first time the scale of an issue that is pricing first-home buyers out of the Auckland market. Photo / Doug Sherring

The first picture has emerged of Chinese buying patterns in Auckland's pressure-cooker housing market — and it suggests a powerful, big-spending influence.

What do you think the Government should do about overseas-based investors buying houses in Auckland?

Herald, 11 July 2015

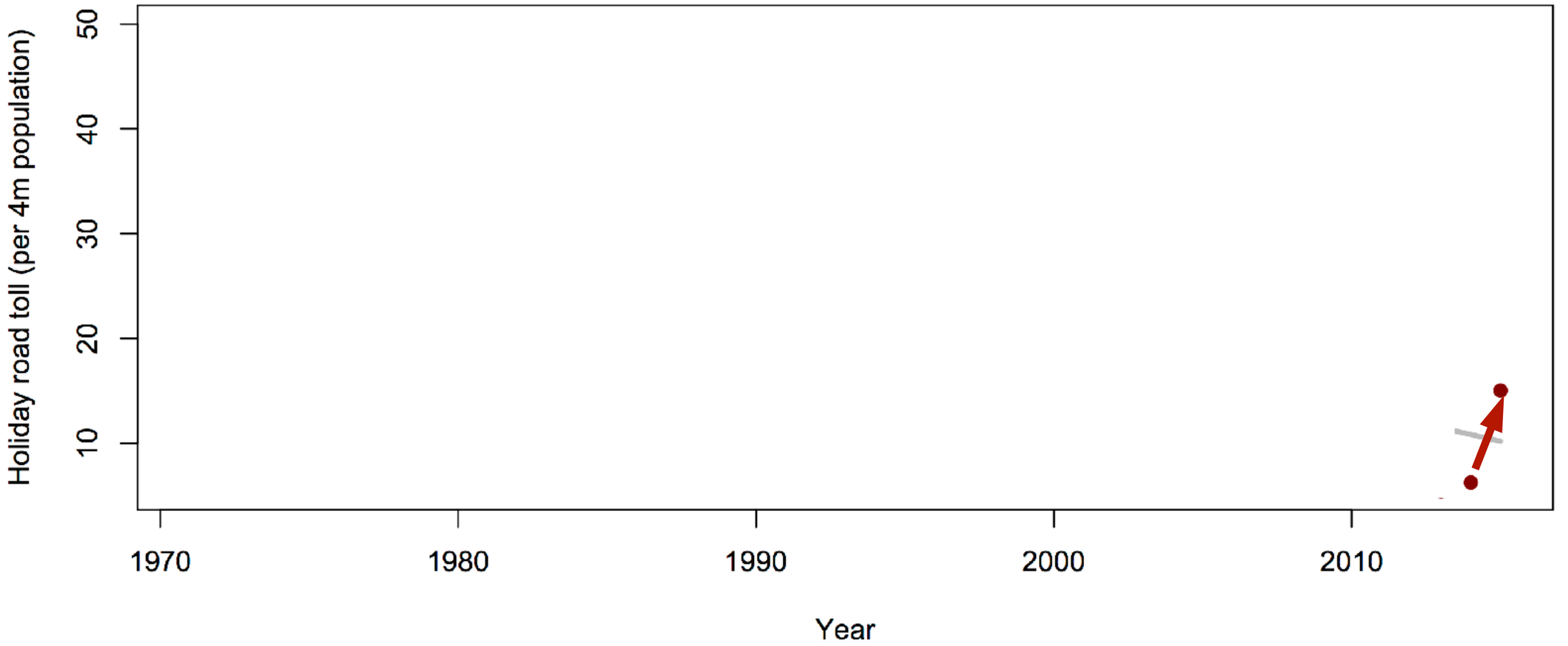
Your turn

From the pre-reading

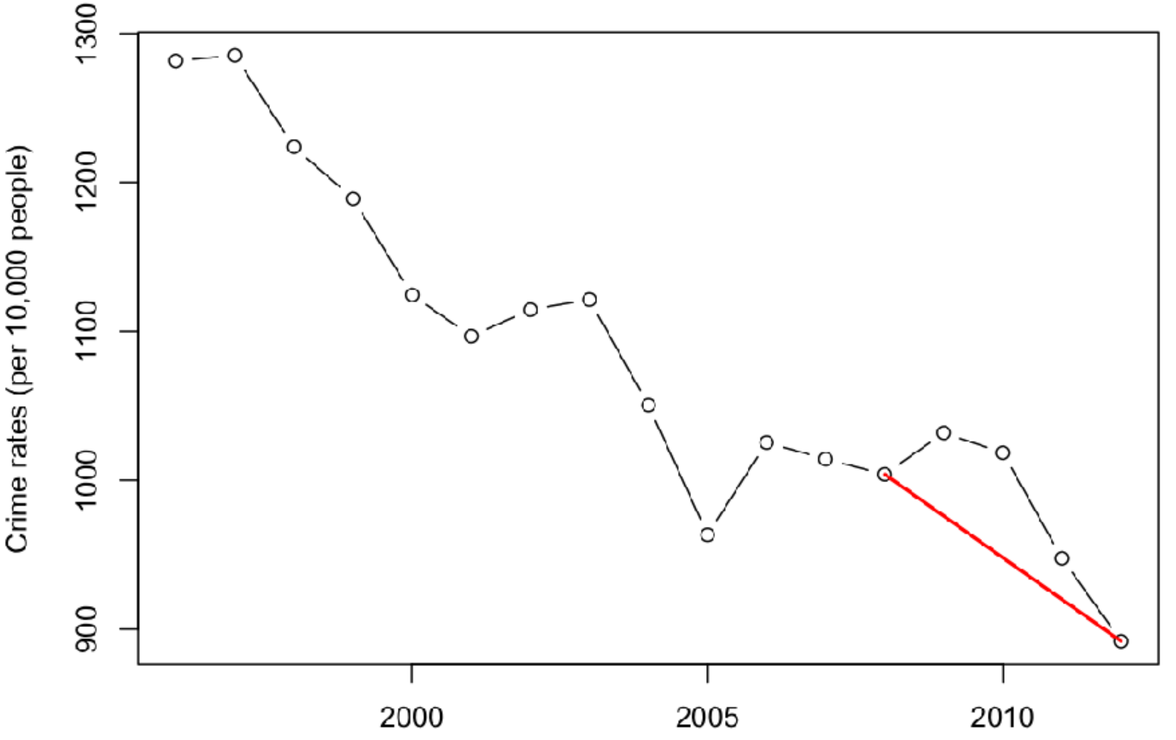
1. Read **Infidelity: it's a right-wing, meat-eaters' thing** NZ Herald, January 2012. This starts *"If your partner supports National, has a PC, drinks Coke, eats meat, has a tattoo, smokes and is a Christian, be warned - they could be a cheater."* Why is this misleading? How different was the proportion supporting National from the population proportion? How meaningful do you think the differences mentioned between cities are? How do you think this story came to be written?

2. Read **Auckland student brings gun to university to 'use as a film prop'** Stuff, August 2020. Roughly what proportion of tertiary students are subject to disciplinary action for cheating? Do you think that's a large fraction of those who cheat? Based on the numbers here, what can you say about the rates of sexual harassment and sexual assault at NZ universities?

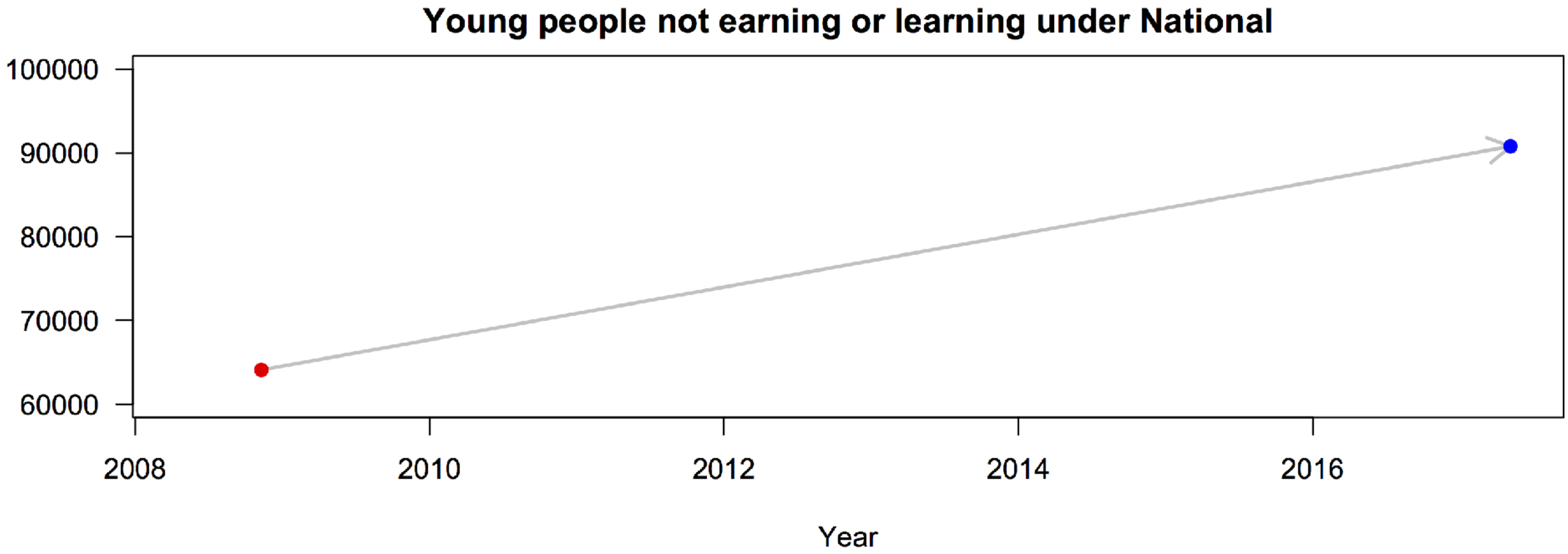
Trends


Holiday road toll (per 4m population)
10
20
30
40
50
1970
1980
1990
2000
2010
Year


Building a safer New Zealand
Crime is down
2008
1011*
*Recorded crimes
per 10,000 people
2012
848*
The lowest crime rate in 30 years


Crime rates (per 10,000 people)
1300
1200
1100
1000
900
2000
2005
2010

“Under National, the number of young people not earning or learning has increased by 41%”. (Labour ad)



Break

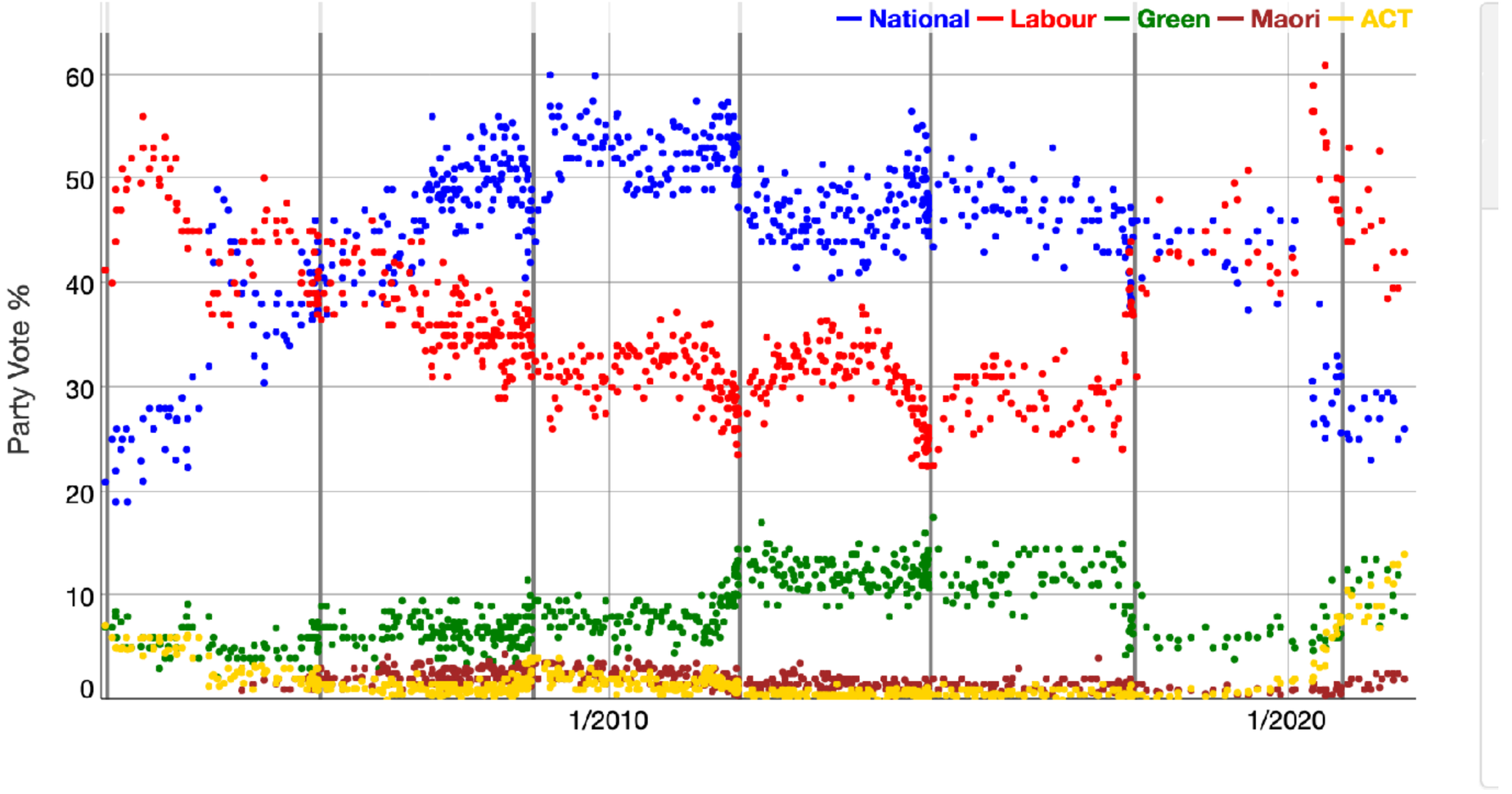
See you in a few

Uncertainty

'Statistics can be reduced to the question "Why aren't all these numbers the same?"'

Richard Arnold, VUW

New Zealand Political Opinion Polls



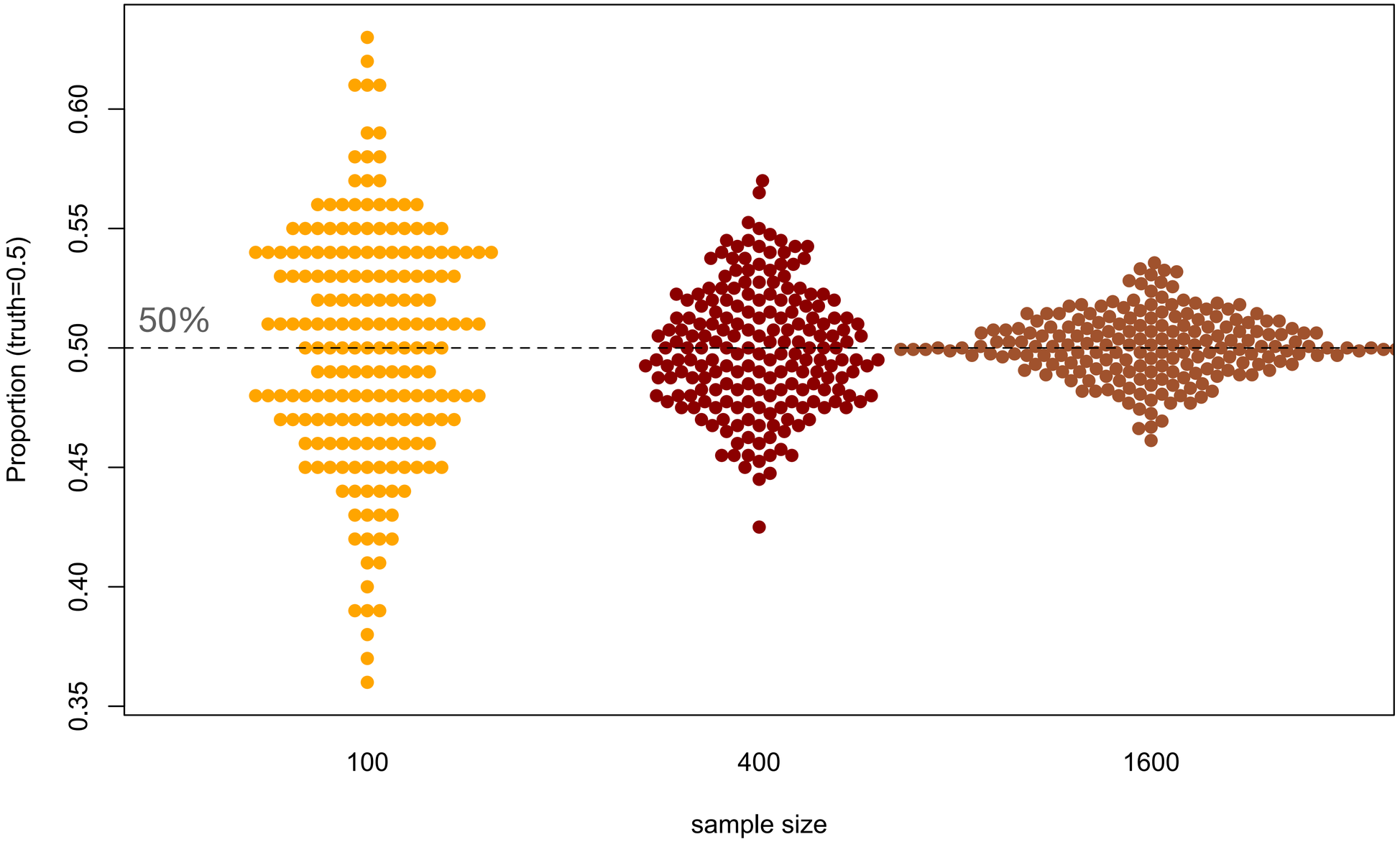
https://www.andrewchen.nz/polls

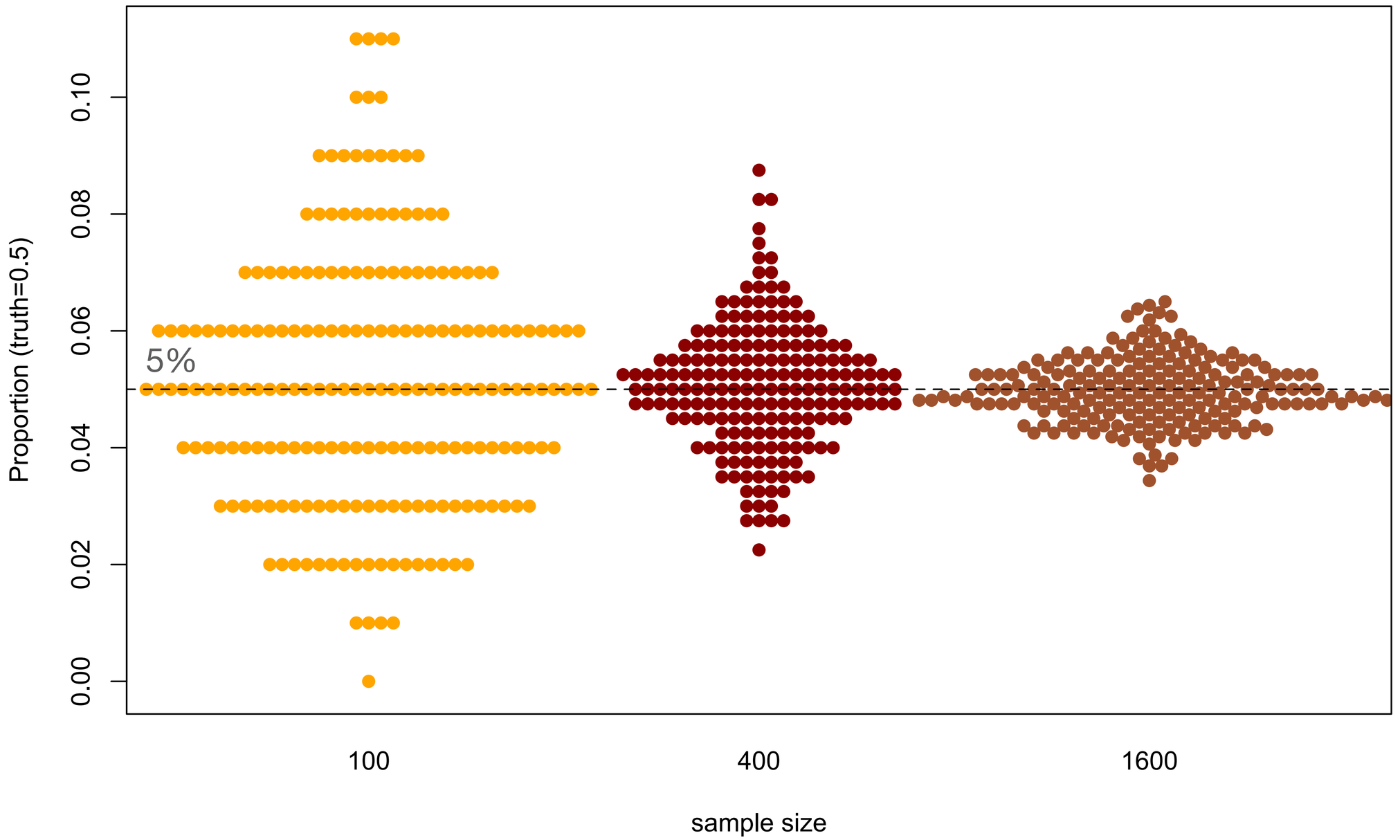
Your turn

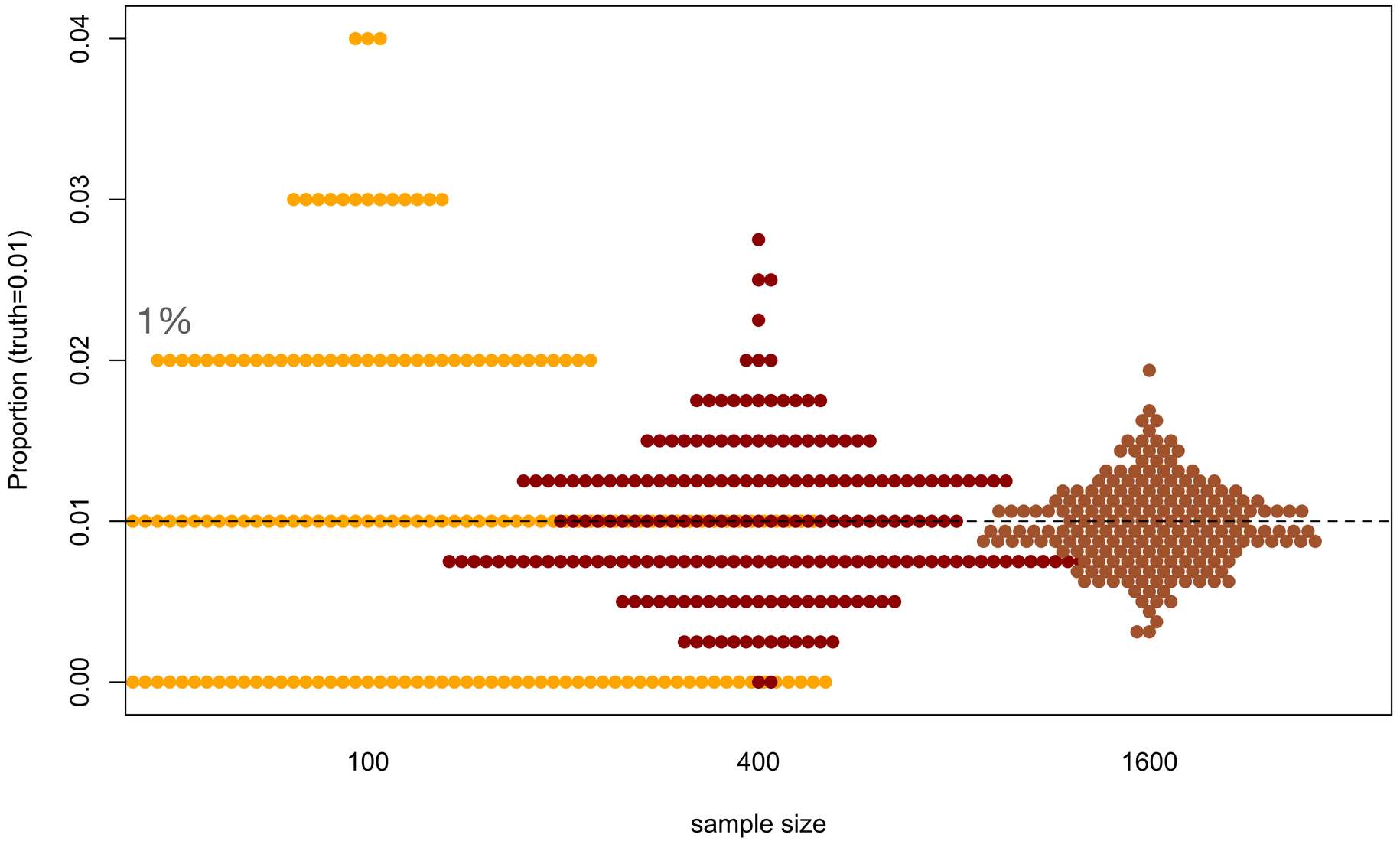
From the pre-reading

1. Roughly how much variability is there in poll results for National at times when their support is roughly constant?
2. Is the variability for Labour more or less or about the same?
3. How about the Greens?
4. Pick out a few places where you think the polls show a real chance in public opinion

Sampling uncertainty


Proportion (truth=0.5)
0.35
0.40
0.45
0.50
0.55
0.60
50%
100
400
1600
sample size


Proportion (truth=0.5)
0.00
0.02
0.04
0.06
0.08
0.10
5%
100
400
1600
sample size


Proportion (truth=0.01)
0.00
0.01
0.02
0.03
0.04
1%
100
400
1600
sample size

Mathematically ideal surveys

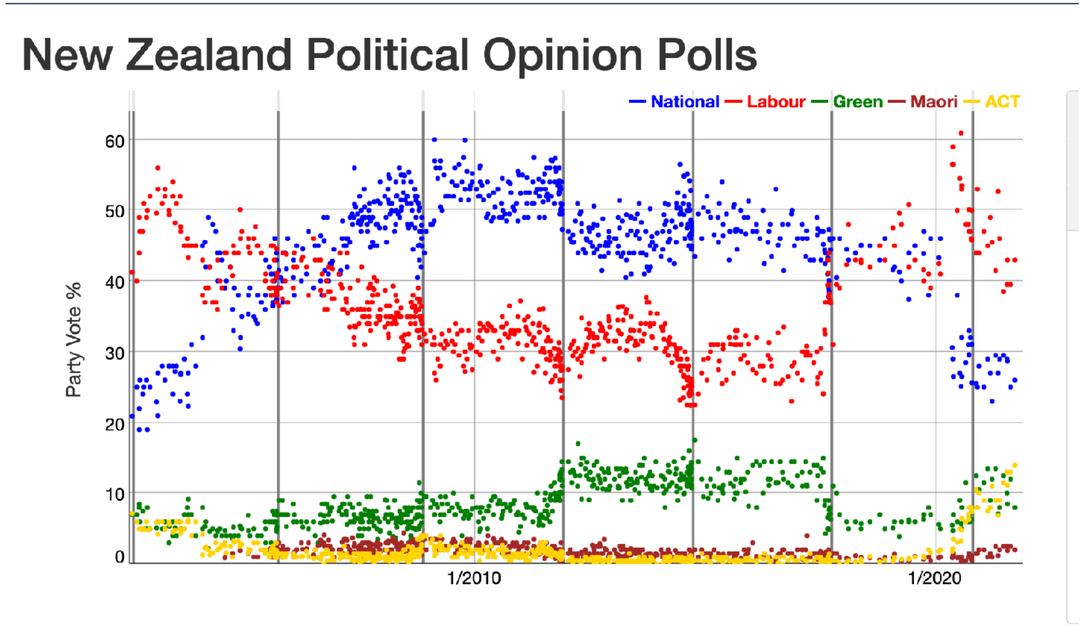
- Absolute error is smaller for small groups (eg minor parties)
- Relative error is larger for small groups
- You need four times the sample size to get half the error
- 1000 people gives 3% 'margin of error' for proportions near 1/2
- Margin of error for poll-to-poll change is 4.5%

- Magic formula for small groups: (or here)
  - take **count**, square root it
  - add and subtract one to get two numbers,
  - square them, then divide by total sample size to get proportions.

Real opinion surveys

- Not a perfect random sample: most people refuse/aren't contacted
- Data are reweighted to look like the whole population
- Error is still **larger** than for ideal surveys: maybe 1.5 times higher

Most 5% changes from poll to poll don't mean anything



Your turn

- Which of these changes are larger than the margin of error?
- Both reports compare to the last survey by the same company, not the most recent poll. Is this good/bad?
- Which changes are larger than the margin of error between the two polls?

Labour is only just ahead of National in the latest Taxpayers' Union-Curia poll, with just 0.9 points separating the parties.

Labour is on 36.2 per cent, falling 6.1 points. National is also down, but its support only fell 3.1 points to 35.3 per cent.

The big winners are the Greens and Act.

The Greens soared 6.1 points to 12.4 per cent, while Act climbed 4.6 points to 11.2 per cent.

Herald 17 March

National has surged 7 points to 39 per cent to take the lead in the latest poll - the first since January.

Labour has dropped 3 points to 37 per cent. It is the first time National has been ahead of Labour since February 2020, a month before the Covid 19 pandemic tore through the world and New Zealand was plunged into lockdown.

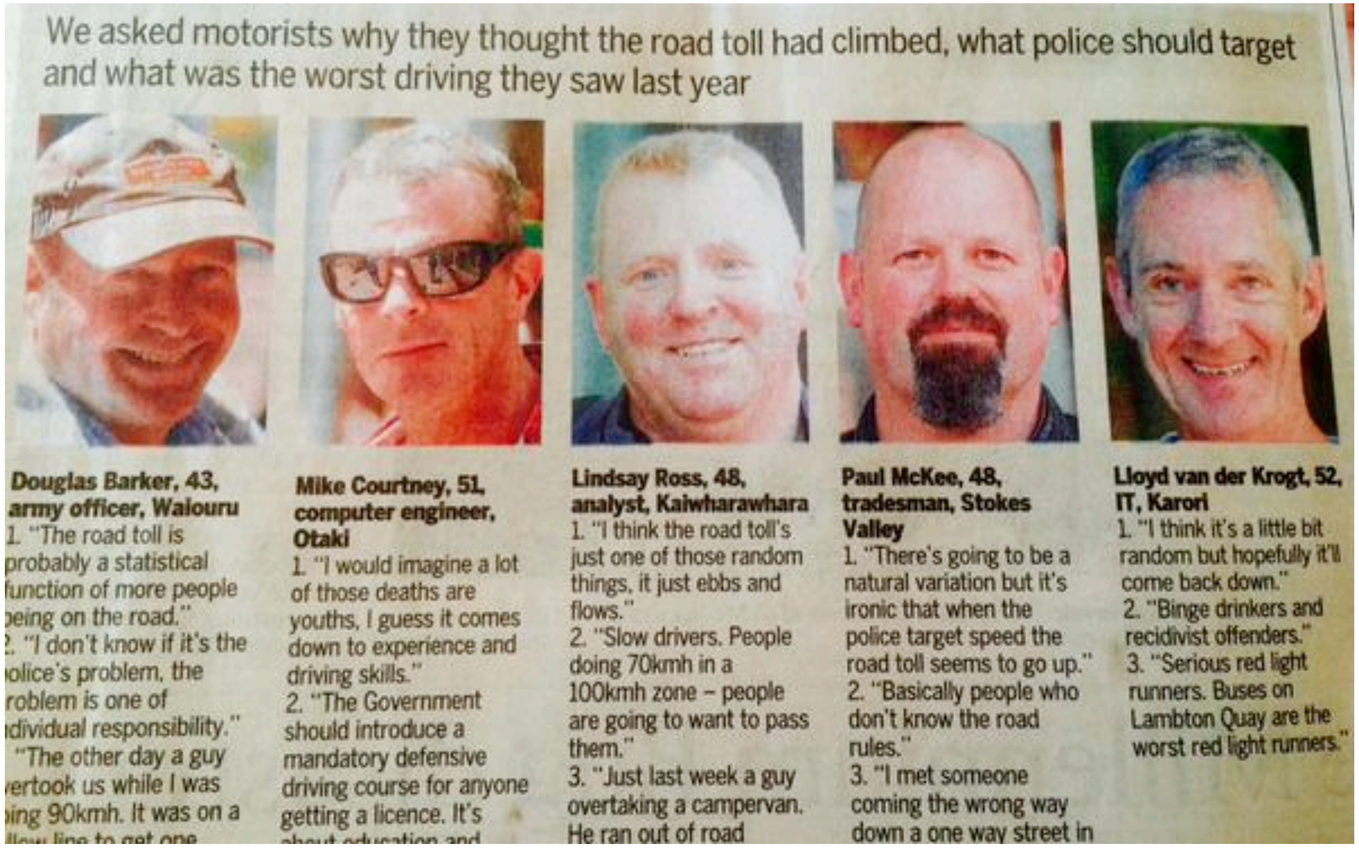
The Greens are steady on 9 per cent, while Act has fallen 3 points to 8 per cent.

Te Pāti Māori is on 2 per cent. If it wins an electorate seat and enters Parliament, it would be in a kingmaker position as neither obvious governing blocs would have enough seats to govern outright. The parties need a minimum of 61 seats to govern.

Herald 11 March

Bogus polls

- Self-selected online clicky things with no reweighting
- Completely uninformative. Don't even try to interpret them quantitatively



We asked motorists why they thought the road toll had climbed, what police should target and what was the worst driving they saw last year

Douglas Barker, 43, army officer, Waiouru
1. "The road toll is probably a statistical function of more people being on the road."
2. "I don't know if it's the police's problem, the problem is one of individual responsibility."
"The other day a guy overtook us while I was going 90kmh. It was on a

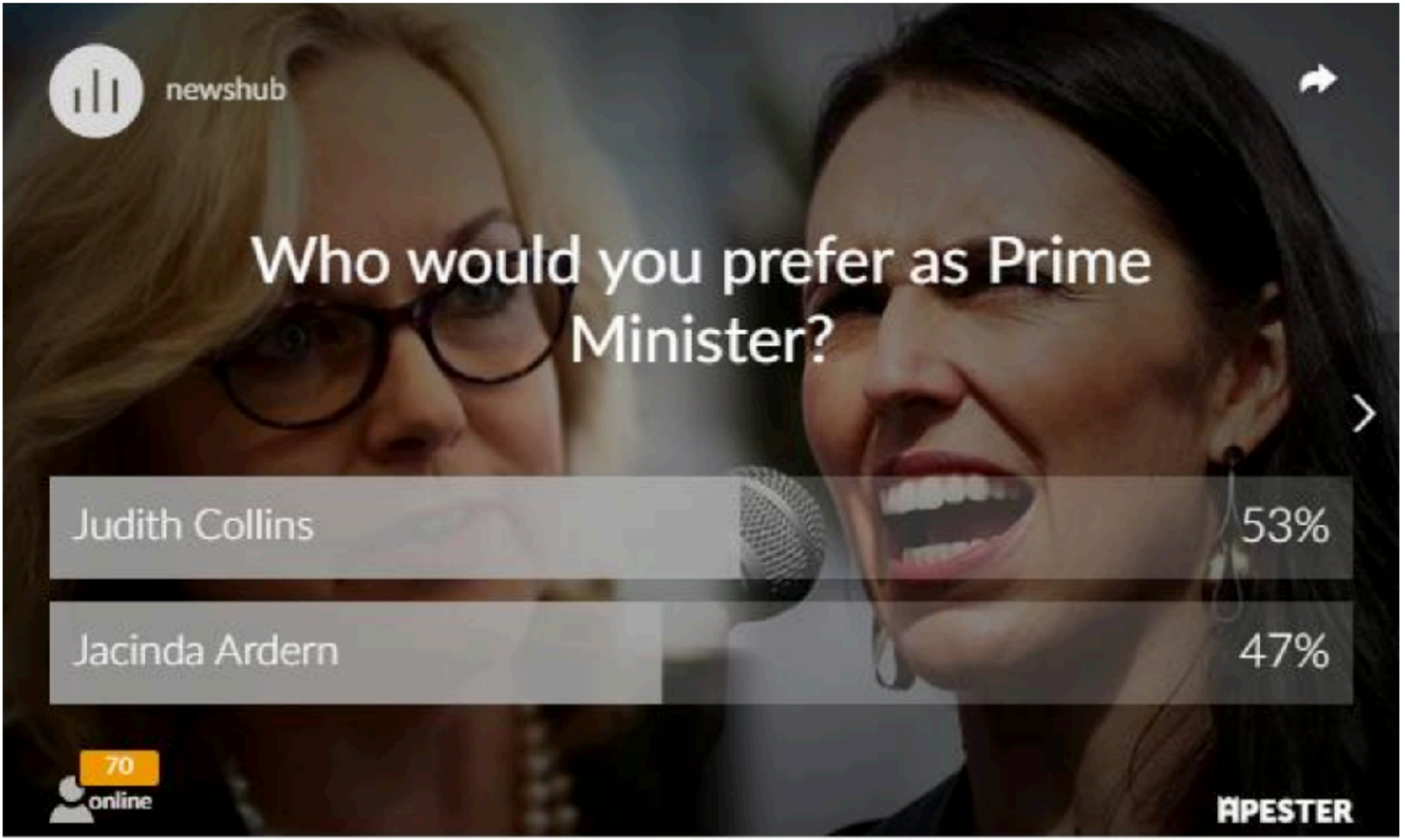
Mike Courtney, 51, computer engineer, Otaki
1. "I would imagine a lot of those deaths are youths, I guess it comes down to experience and driving skills."
2. "The Government should introduce a mandatory defensive driving course for anyone getting a licence. It's

Lindsay Ross, 48, analyst, Kaiwharawhara
1. "I think the road toll's just one of those random things, it just ebbs and flows."
2. "Slow drivers. People doing 70kmh in a 100kmh zone – people are going to want to pass them."
3. "Just last week a guy overtaking a campervan. He ran out of road

Paul McKee, 48, tradesman, Stokes Valley
1. "There's going to be a natural variation but it's ironic that when the police target speed the road toll seems to go up."
2. "Basically people who don't know the road rules."
3. "I met someone coming the wrong way down a one way street in

Lloyd van der Krogt, 52, IT, Karori
1. "I think it's a little bit random but hopefully it'll come back down."
2. "Binge drinkers and recidivist offenders."
3. "Serious red light runners. Buses on Lambton Quay are the worst red light runners."

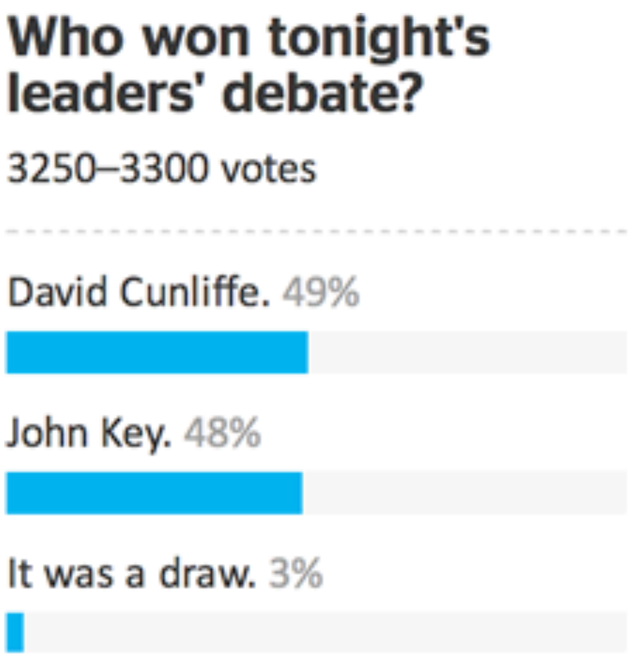
Dominion Post, 2015-1-2



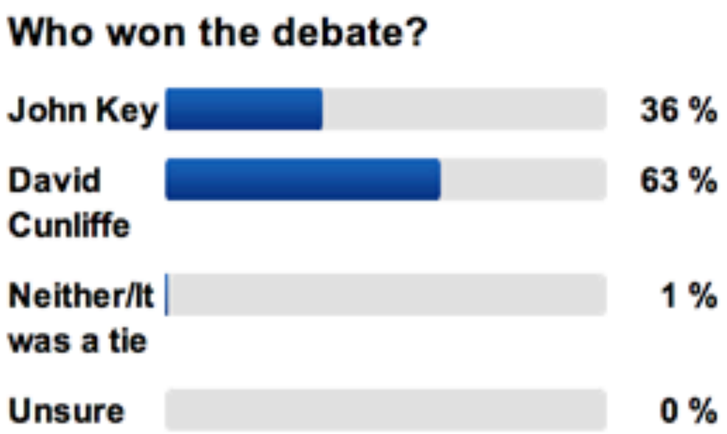
Newshub, 15 July 2020

1 News/Colmar Brunton
54% Ardern
20% Collins

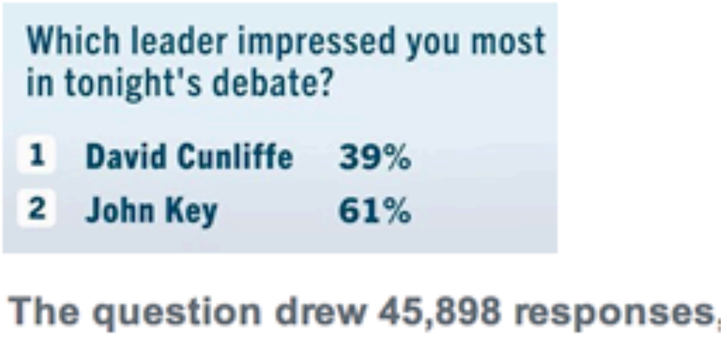
3/Reid Research:
62% Ardern
15% Collins



NZ Herald



Newstalk ZB



TVNZ

28 August 2014

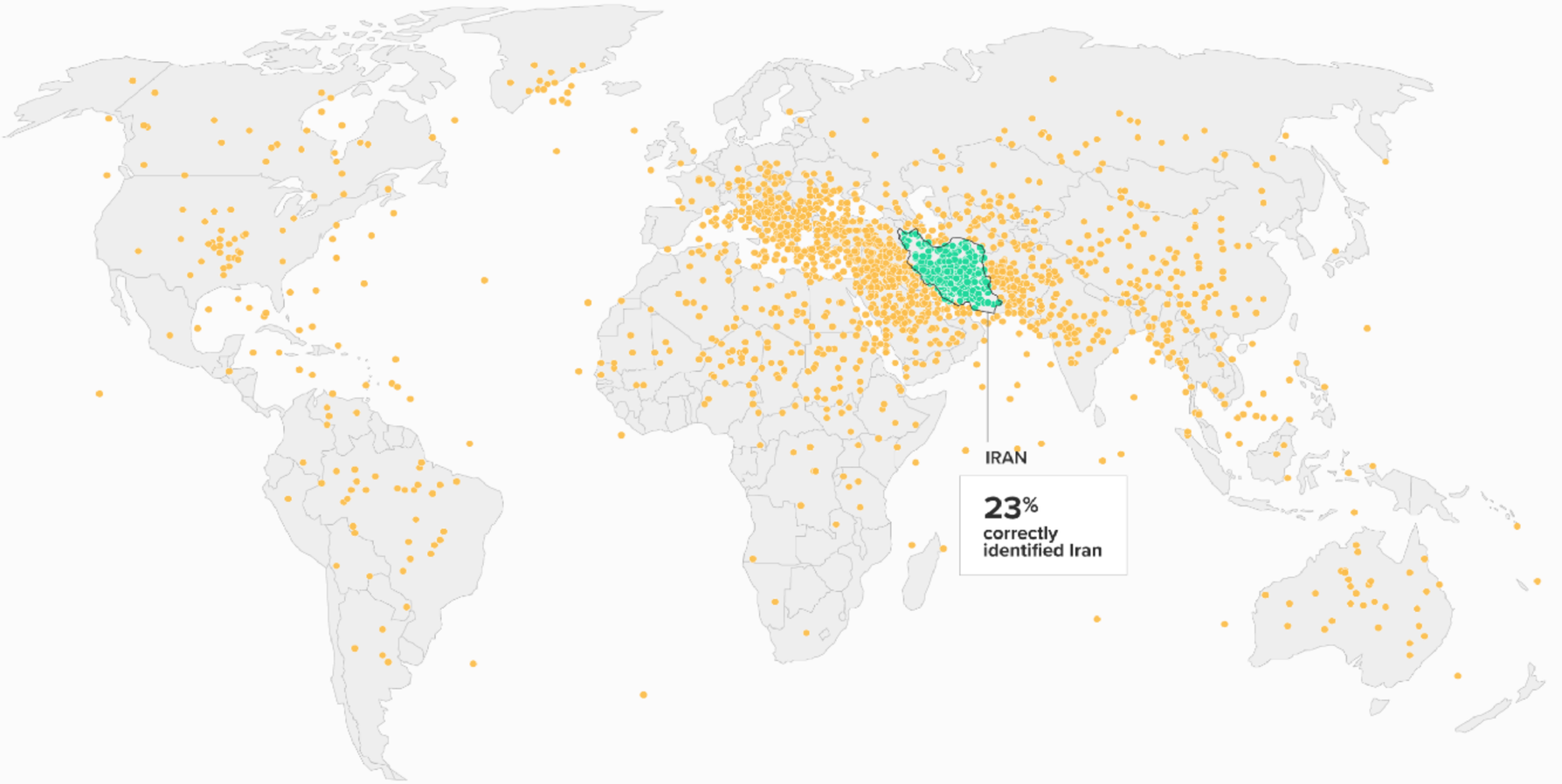
While the Middle East saw definite clustering, some respondents believed — among dozens of wild responses — that Iran was located in:

- *The U.S.*
- *Canada*
- *Spain*
- *Russia*
- *Brazil*
- *Australia*
- *The middle of the Atlantic Ocean*

-- Rashaan Ayesh, Axios

(January 2020)

Respondents were asked to identify Iran on the map



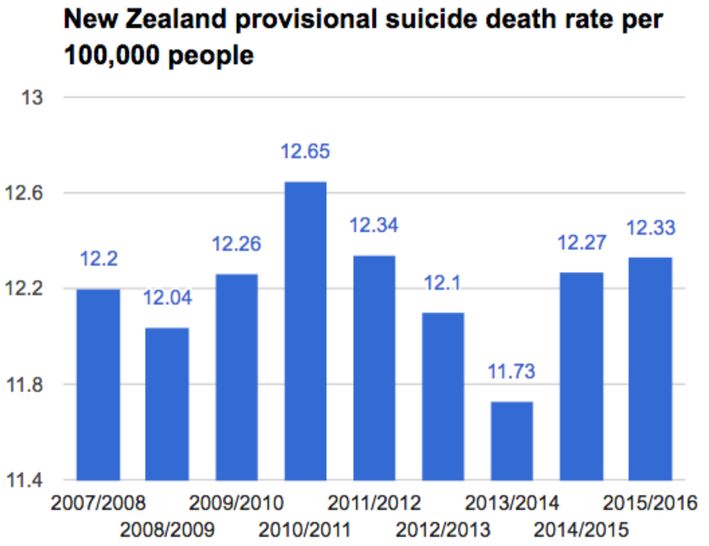
Each ● represents a respondent's guess. Each ● represents correct placement.

MORNING CONSULT

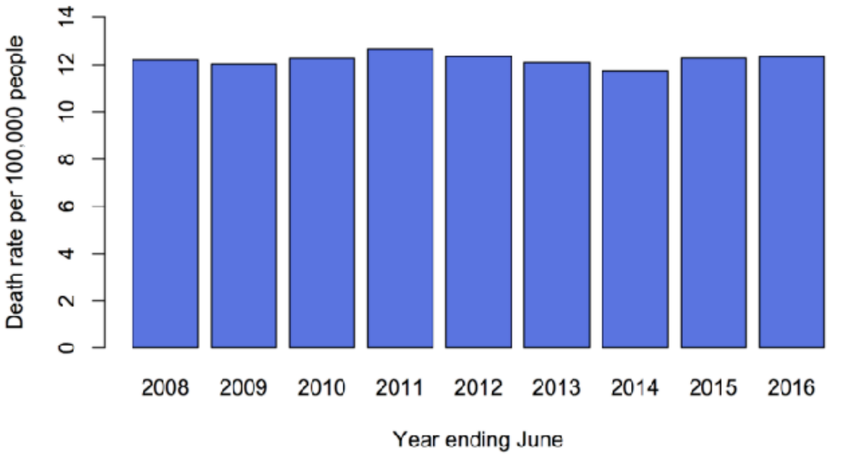
Poll conducted Jan. 4-5, 2020, among 1,995 registered voters with a margin of error of +/- 2%.

See also

Random variation

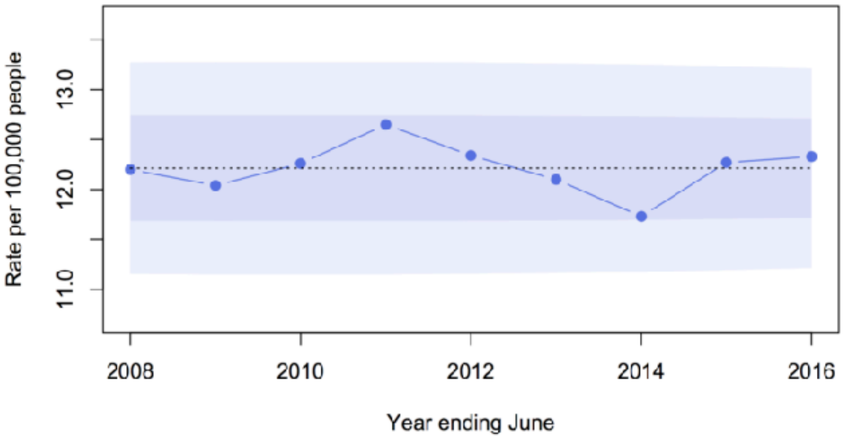


Herald, 2016-10-18



Simplest mathematical model for count data: "Poisson"
Standard deviation = square root of mean
+/- 1 standard deviation: about 2/3 of points
+/- 2 standard devaitions: about 95% of points

Real variability is usually bigger than this

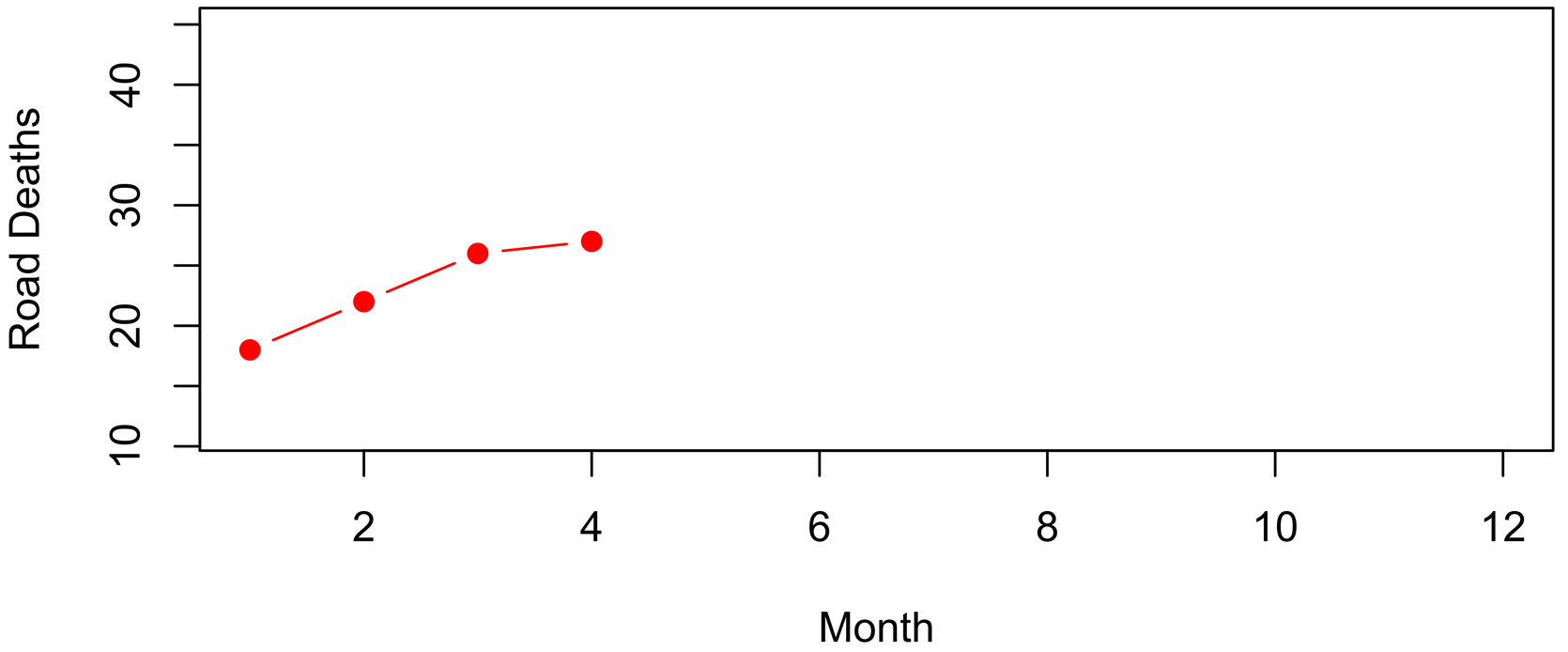


Rising road toll alarms police

MICHAEL DALY

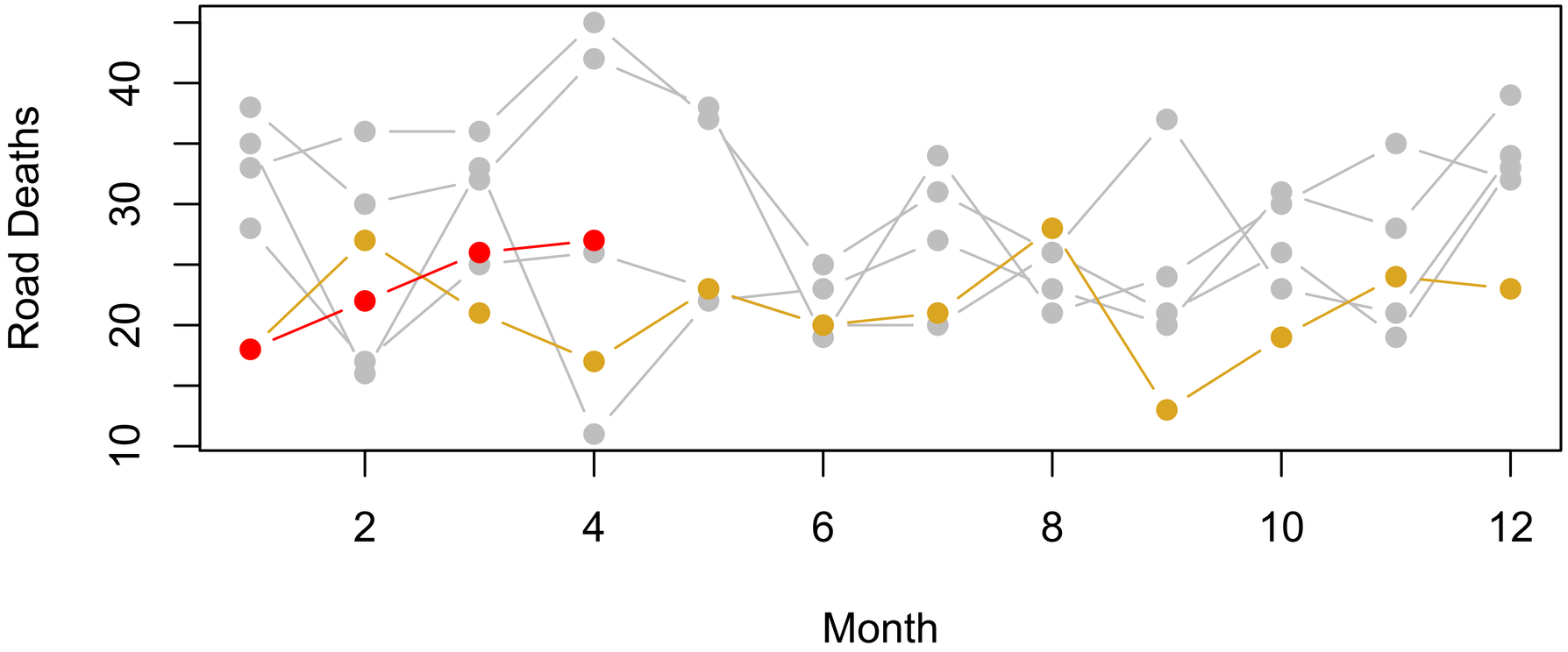
Last updated 11:10 07/05/2014

Like 92 Tweet 9 g+1 Share



"Poisson" variability is about +/- 5 for 1 standard deviation, +/-10 for 2

Historical variability



Uncertainty: summary

- Quantifying uncertainty tells you if the data can support a story
  - There could still be a story if they can't, it's just not based on the data
- For well-conducted surveys, we know the uncertainty fairly precisely
  - (bogus polls aren't data)
- For data that count things, we can get a useful lower bound
- Historical variability is also a good guide

People tend to underestimate random variability in almost every field.

Break

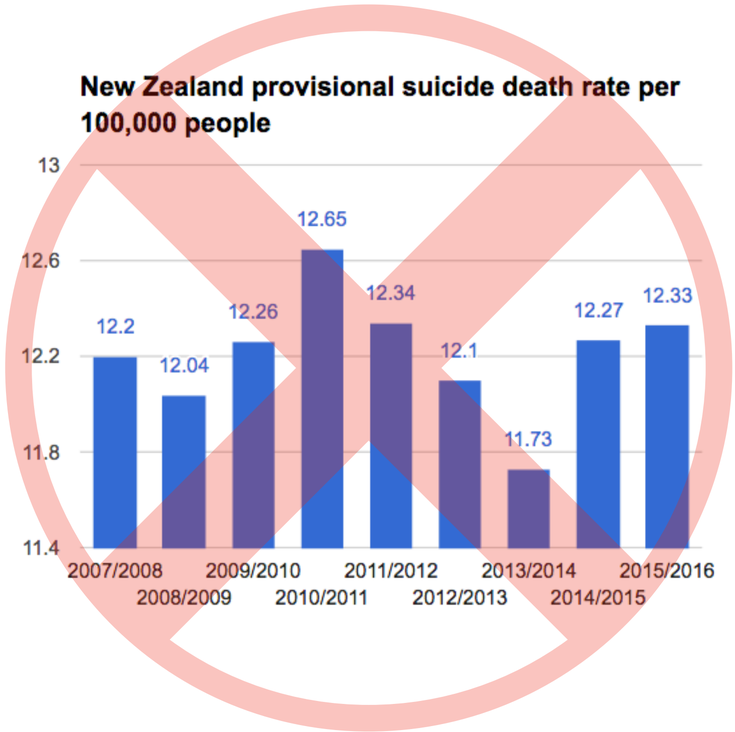
See you in a few

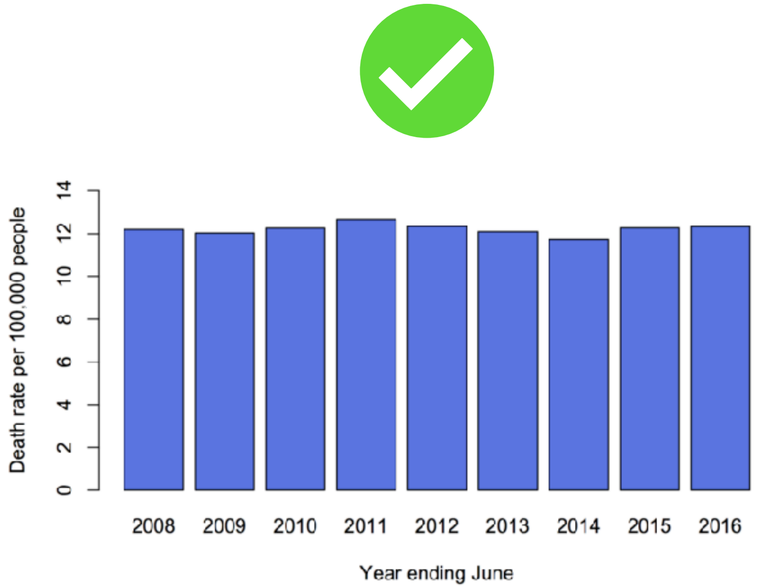
Data visualisation

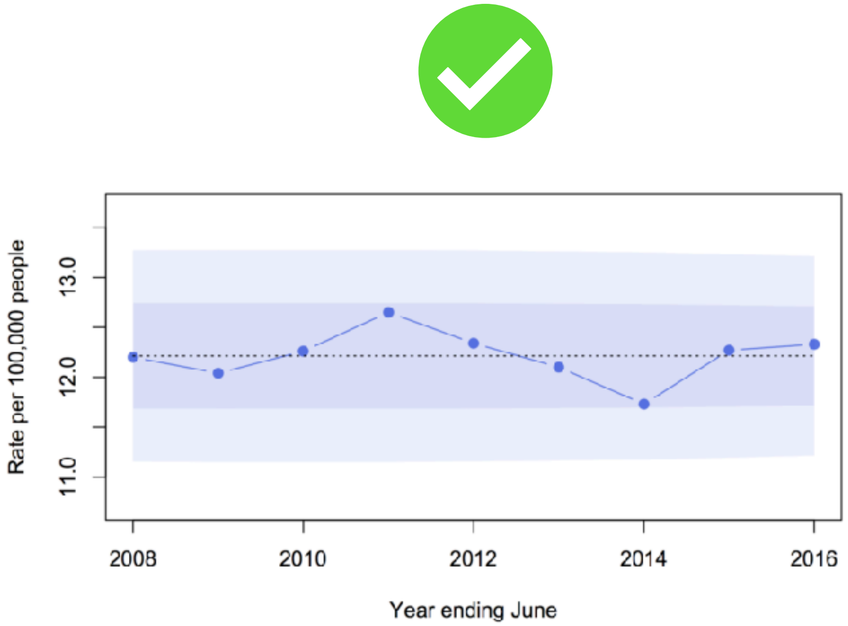
"A language is something you can use to lie"
-- paraphrase of Umberto Eco

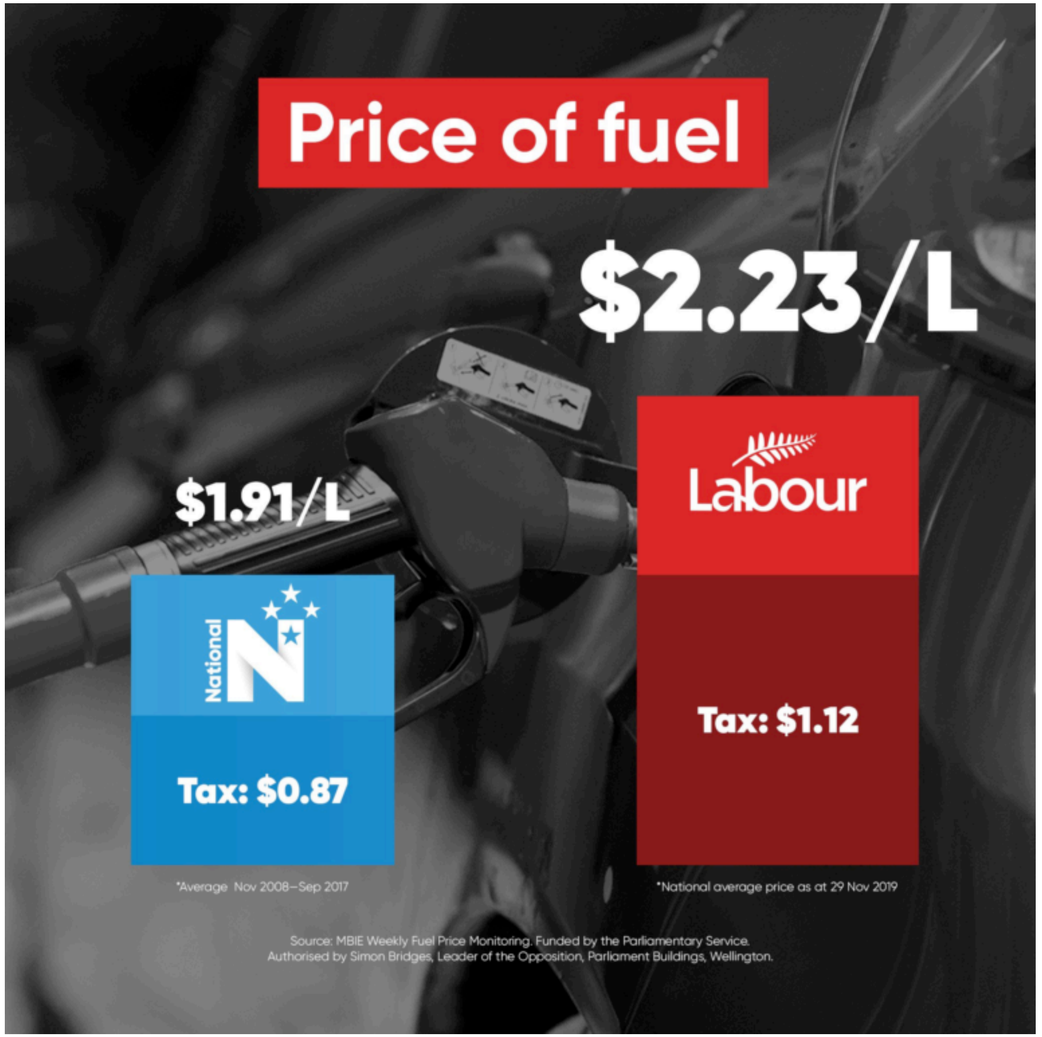
Principles

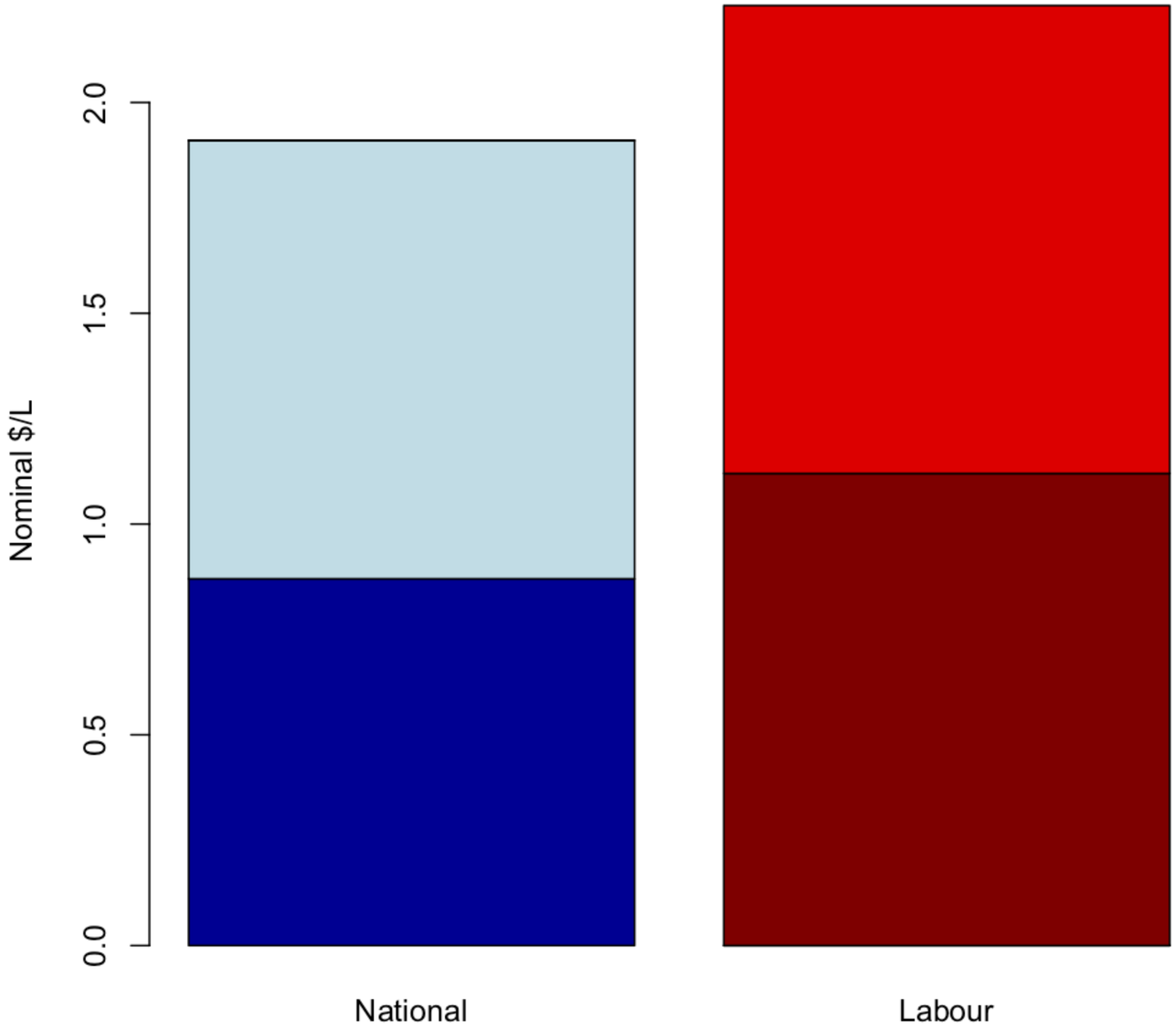
- Data visualisation is for communicating numbers, not decoration
- Communicating numbers is usually about comparisons
- The primary choice is how numbers are coded in the graph





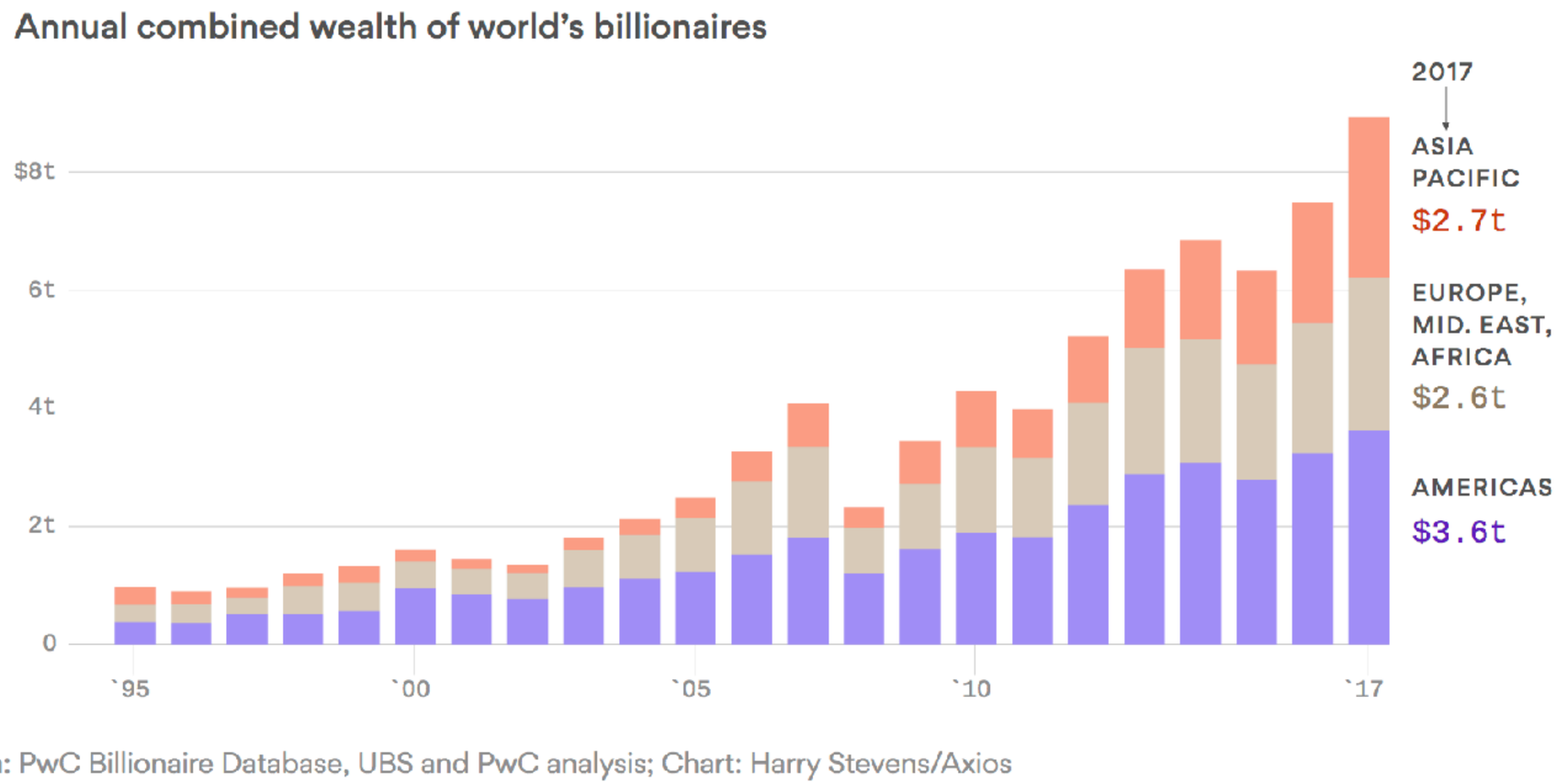



Price of fuel
$2.23/L
$1.91/L
Labour
National
Tax: $0.87
Tax: $1.12
*Average Nov 2008–Sep 2017
*National average price as at 29 Nov 2019
Source: MBIE Weekly Fuel Price Monitoring. Funded by the Parliamentary Service.
Authorised by Simon Bridges, Leader of the Opposition, Parliament Buildings, Wellington.


Nominal $/L
0.0
0.5
1.0
1.5
2.0
National
Labour

The wealth of the world's billionaires rose by $1.4 trillion in 2017, the largest annual increase ever.

The details: *Nearly all of that increase was driven by the Asia-Pacific region, and specifically China, where billionaire wealth rose 39%.*

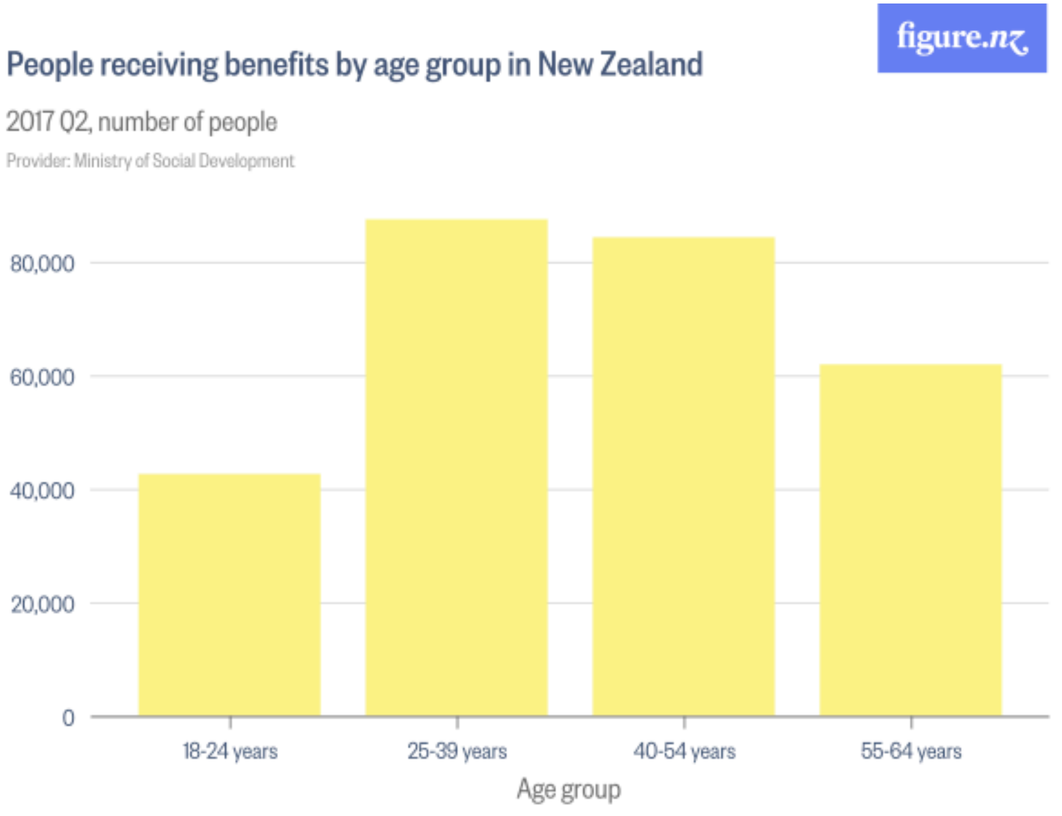


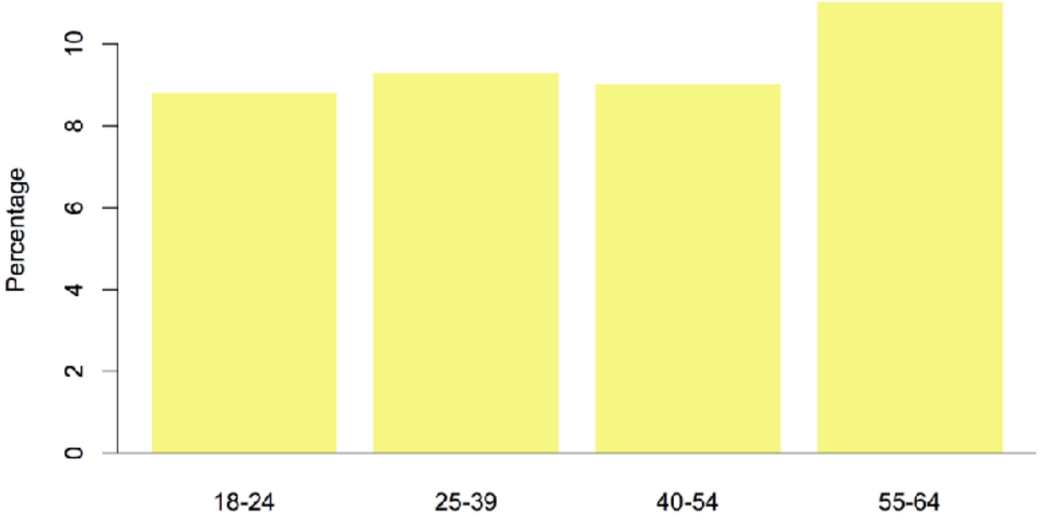
Data: PwC Billionaire Database, UBS and PwC analysis; Chart: Harry Stevens/Axios

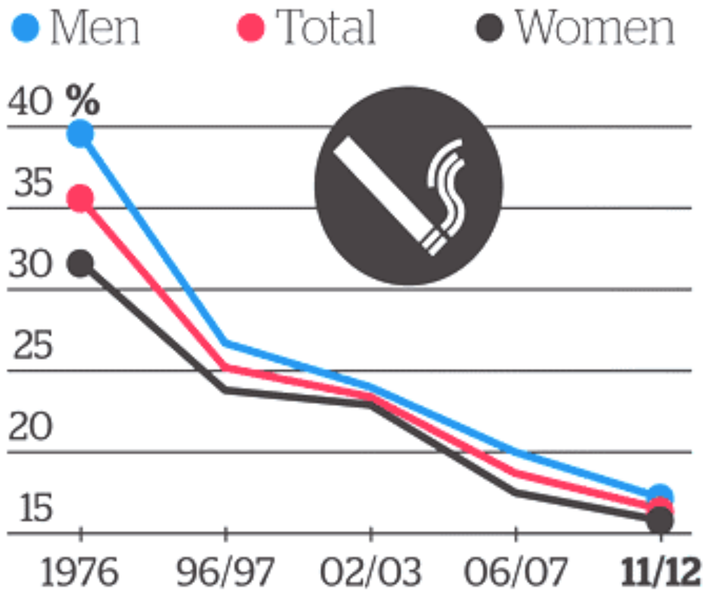
Which age group receives the most working-age benefits?

09:46, Aug 11 2017

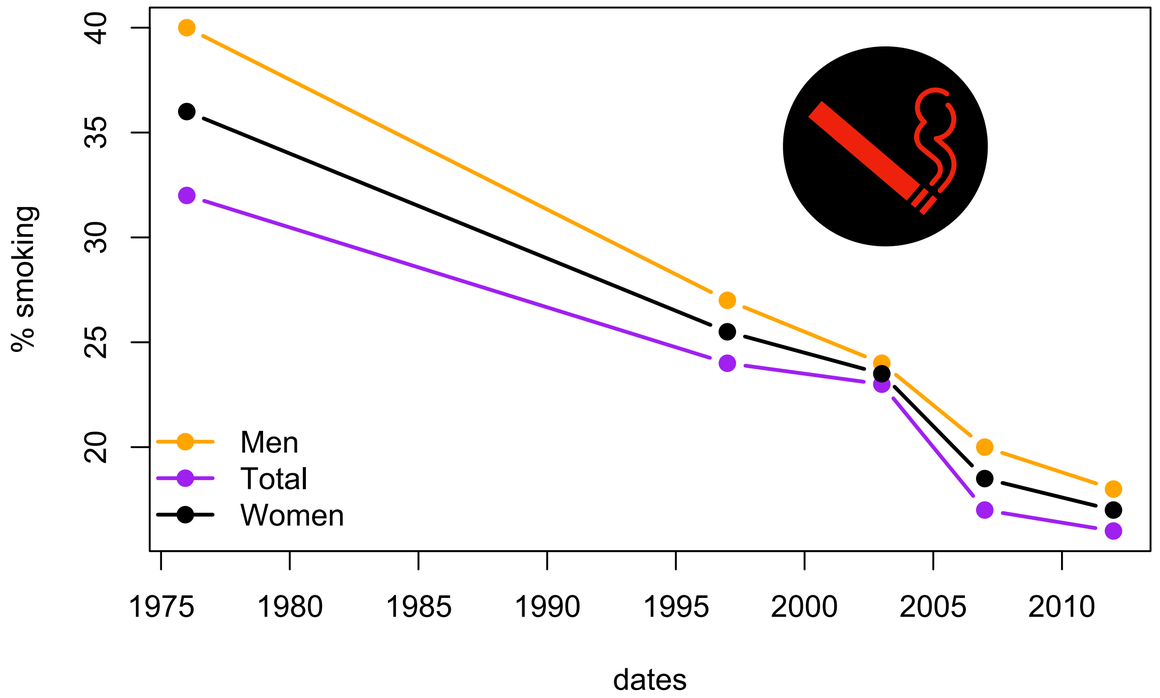
Stuff







Herald, Feb 2013



Doing it yourself

Software tools

- ☐ Prototype in Excel then draw it in eg Adobe *Illustrator*
- ☑ *DataWrapper*
- ☑ *Flourish*
- ☑ *R+ggplot2* (+ touch up in *Illustrator*)

Flourish

- Upload spreadsheet data (no useful data editing in app)
- Pick graph type, customise it (mostly good defaults and pretty)
- Supports individual graphics, stories
- *The Spinoff* uses it. Alberto Cairo likes it. (I hate it a lot less than most non-code systems)
- Private or public publishing: example

Examples

Interruptions of US Supreme Court judges by other judges during court presentations. Source: Empirical SCOTUS, 2016

NCEA results by school in NZ. Released by Ministry of Education, processed a bit by Luis Apiolaza

Your turn

`crashes.csv` has yearly data from the Ministry of Transport on total distance driven, number of deaths in road crashes, and rate of deaths per billion km.

- Draw a graph of changes in total distance driven. Look at changing line types, at putting in a title, at annotating the horizontal axis to show the Global Financial Crisis.

- Draw a graph of deaths over time.

- Draw a graph of deaths per billion km travelled. Why is this better? Does it give a different message?

- How could you make it look as if deaths have gone up and it's Labour's fault? National's fault?

Questions.

You ask.

Bye

See you around