What types of evaluation study move the digital behaviour change field forward ?

Prof Jeremy Wyatt DM FRCP ACMI Fellow

Leadership chair in eHealth research, University of Leeds &
Clinical Advisor on New Technologies, Royal College of Physicians, London

j.c.wyatt@leeds.ac.uk

In the next 25 minutes…

UNIVERSITY OF LEEDS

Why behaviour change matters to us all

How we can achieve it: some successes and failures

Why *digital* behaviour change ?

Going beyond theory and expertise: the need for evaluation studies

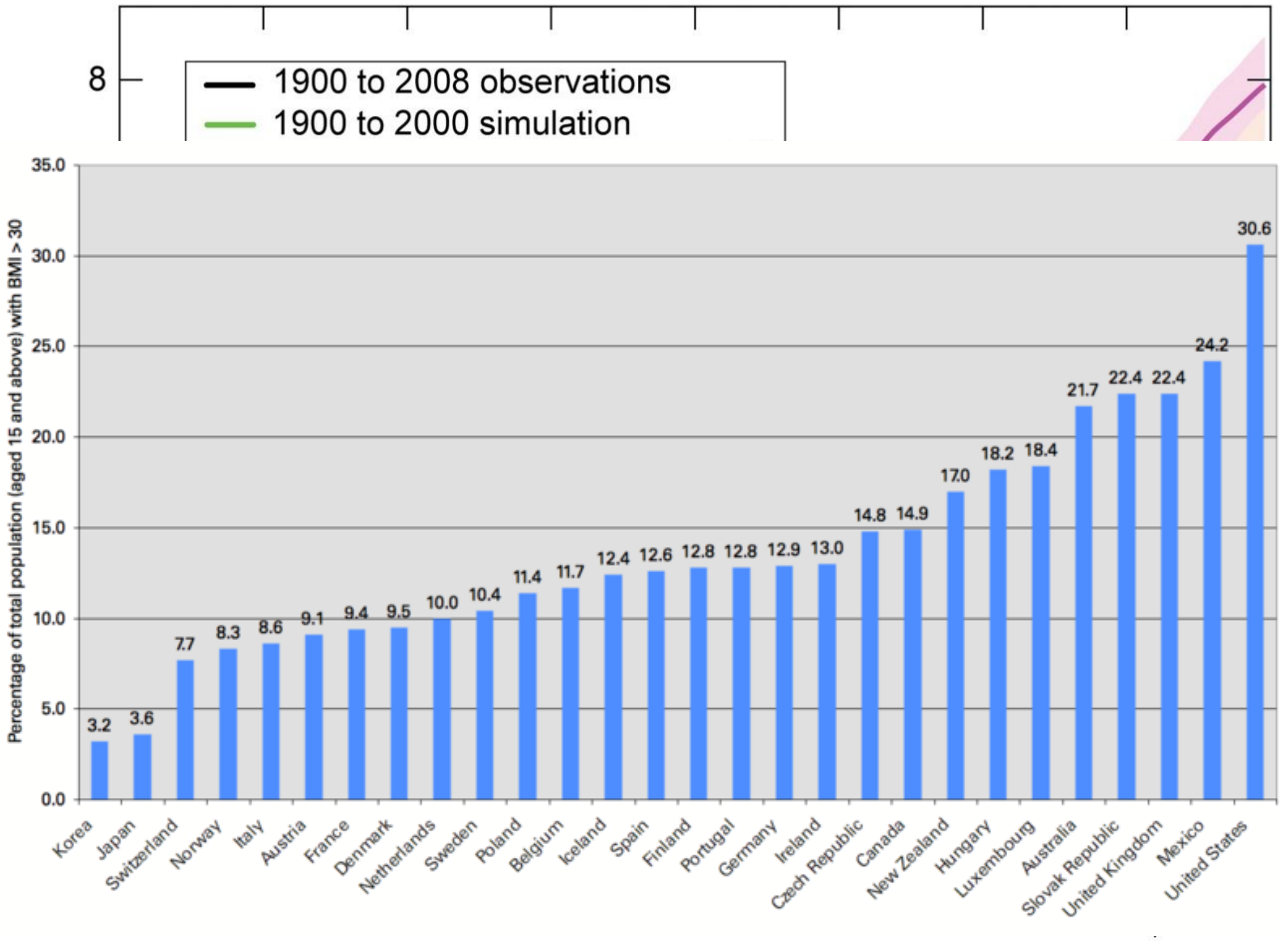
Some different types of study that we can carry out:

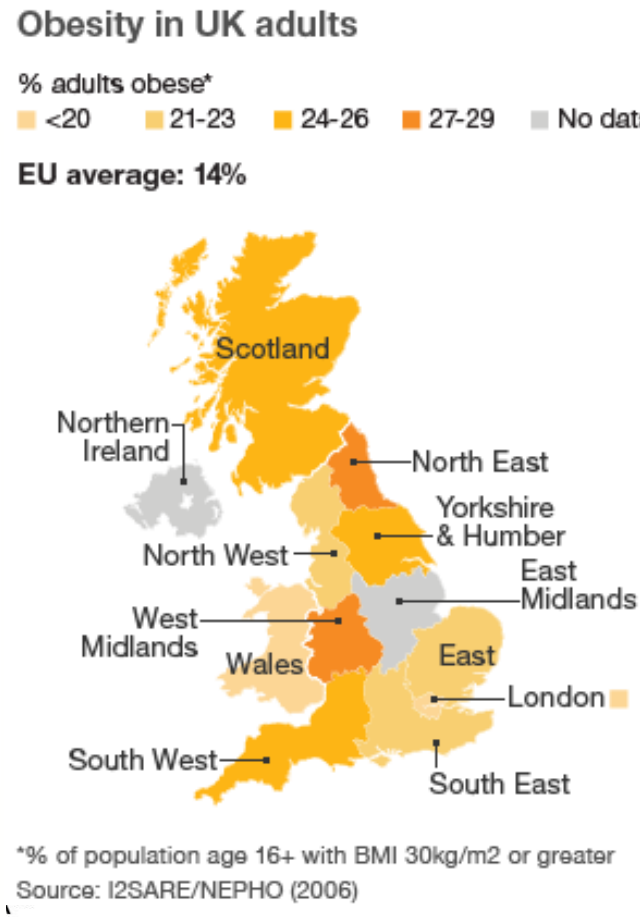
- Some examples of these studies
- Which type of study is the most useful ?

Summary & conclusions

Why behaviour change matters to us all

UNIVERSITY OF LEEDS

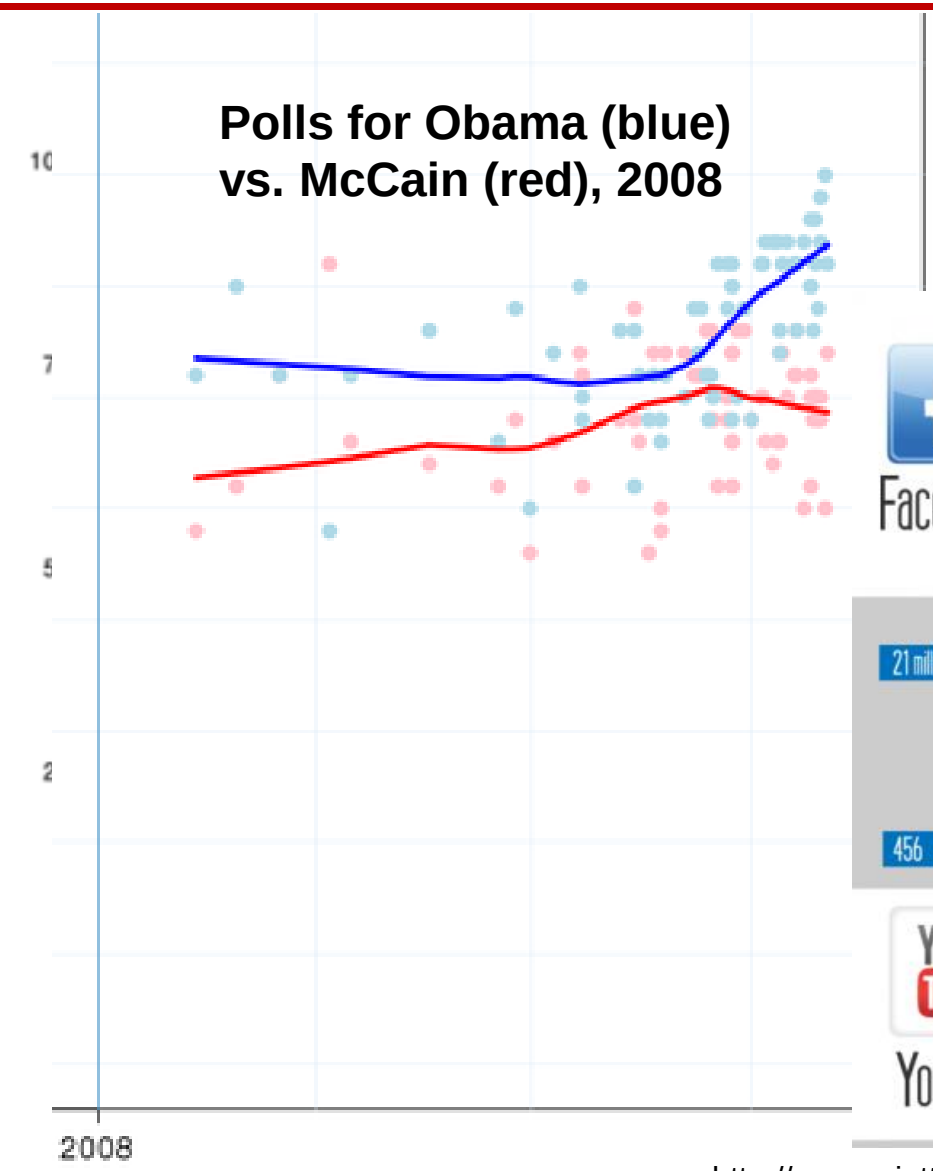


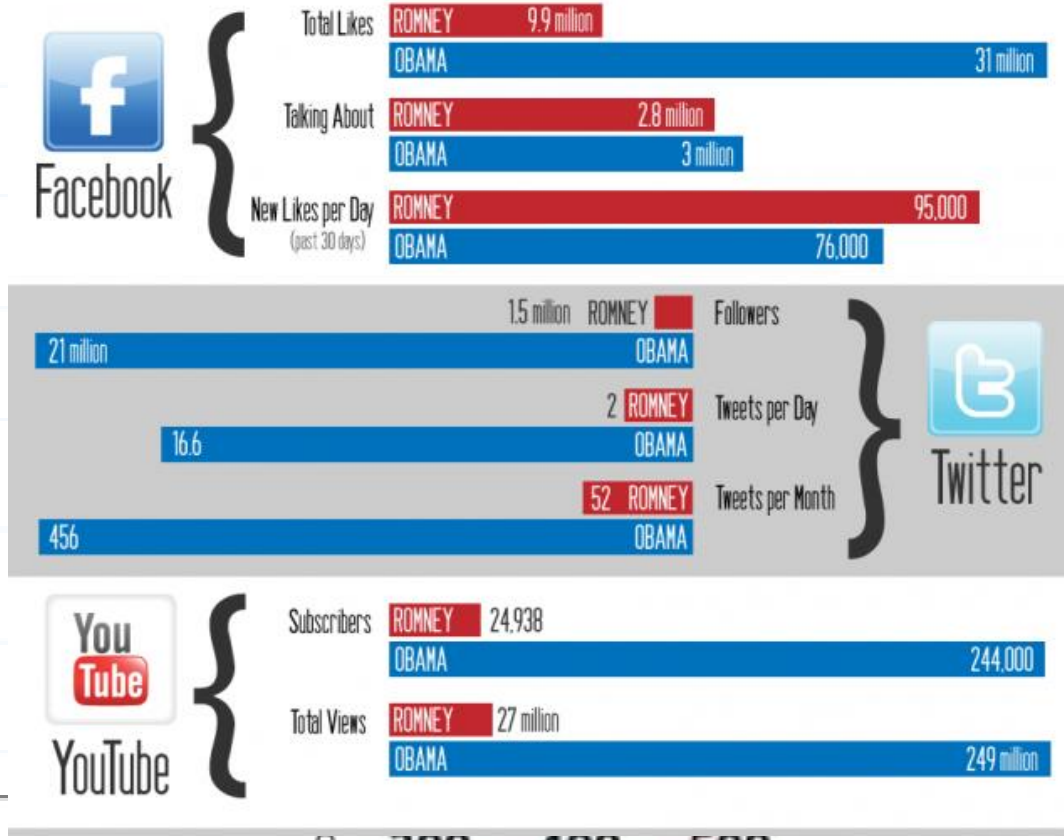


Observed and projected changes in the global average temperature under three IPCC no-policy emissions scenarios. The shaded areas show the likely ranges while the lines show the central projections from a set of climate models. A wider range of model types shows outcomes from 2 to 11.5ºF.[68] Changes are relative to the 1960-1979 average.

Who is good at it ?

UNIVERSITY OF LEEDS





http://www.minttwist.com/blog/2015/01/14/the-role-of-social-media-in-political-news/

Some behaviour change methods

UNIVERSITY OF LEEDS

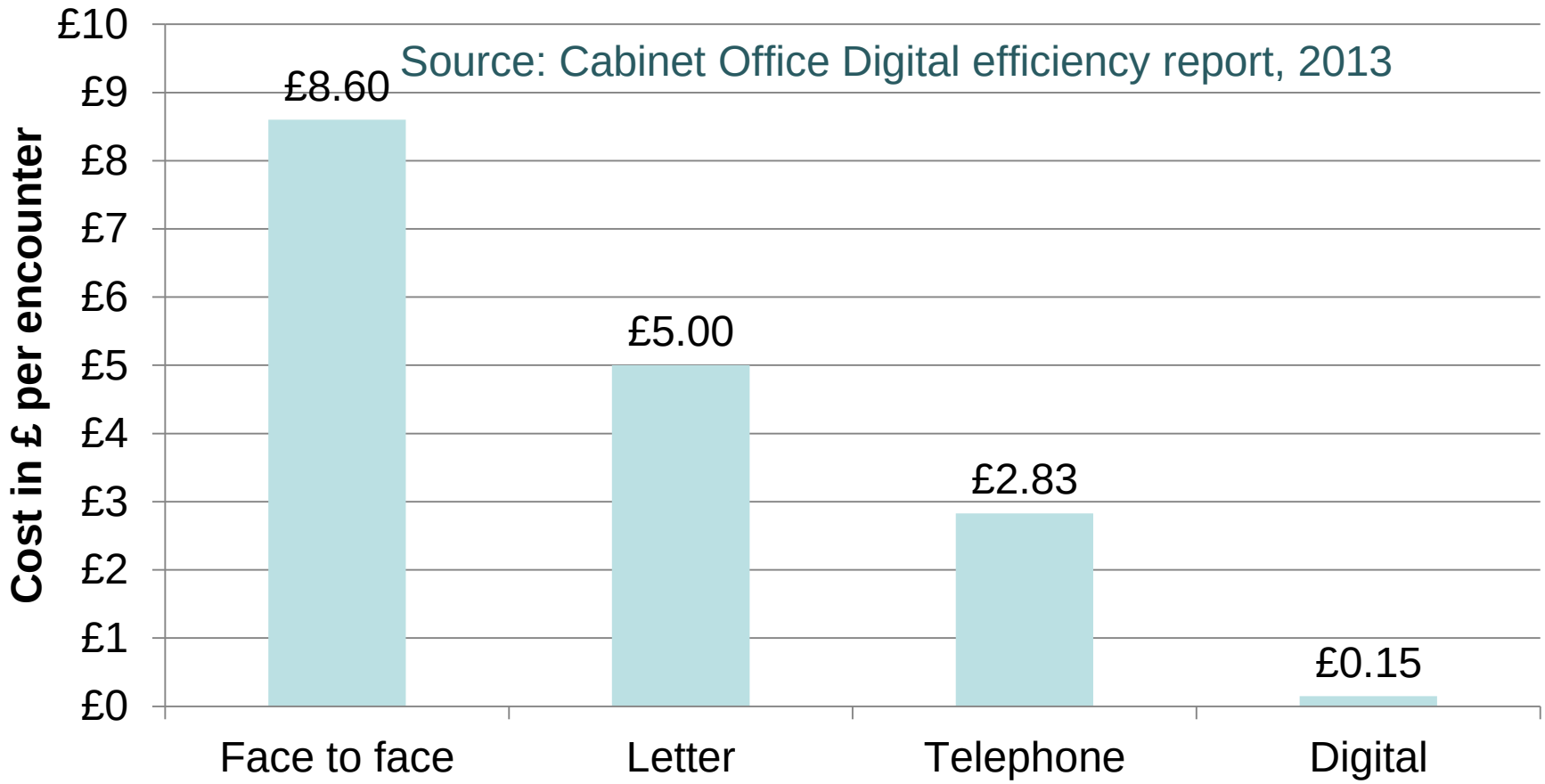
Broad method	Example
Make it illegal	Class A drugs; speeding; smoking in pubs
Tax it	Alcohol, vehicle fuel, car CO_2 emissions
Subsidise it	QOF for GPs (asthma etc.); set aside for farmers
Mass media	Tax returns by 31st January; TV ads (cancer symptoms)
Posters, letters, leaflets	Diabetes / cancer screening
Motivational interviewing	Alcohol, OCD…
Websites	Behavioural Insights Team DVLC website megatrial on NHS organ donation register sign-up rates
Apps	Weight loss (My Meal Mate), smoking cessation…
Txt msgs	Ditto
Decision support systems	Clinical uptake of NICE guidelines / evidence
Serious games	Coping strategies for stress etc.

"Digital behaviour change"

Digital behaviour change

UNIVERSITY OF LEEDS

Mean public sector cost per completed encounter across 120 councils



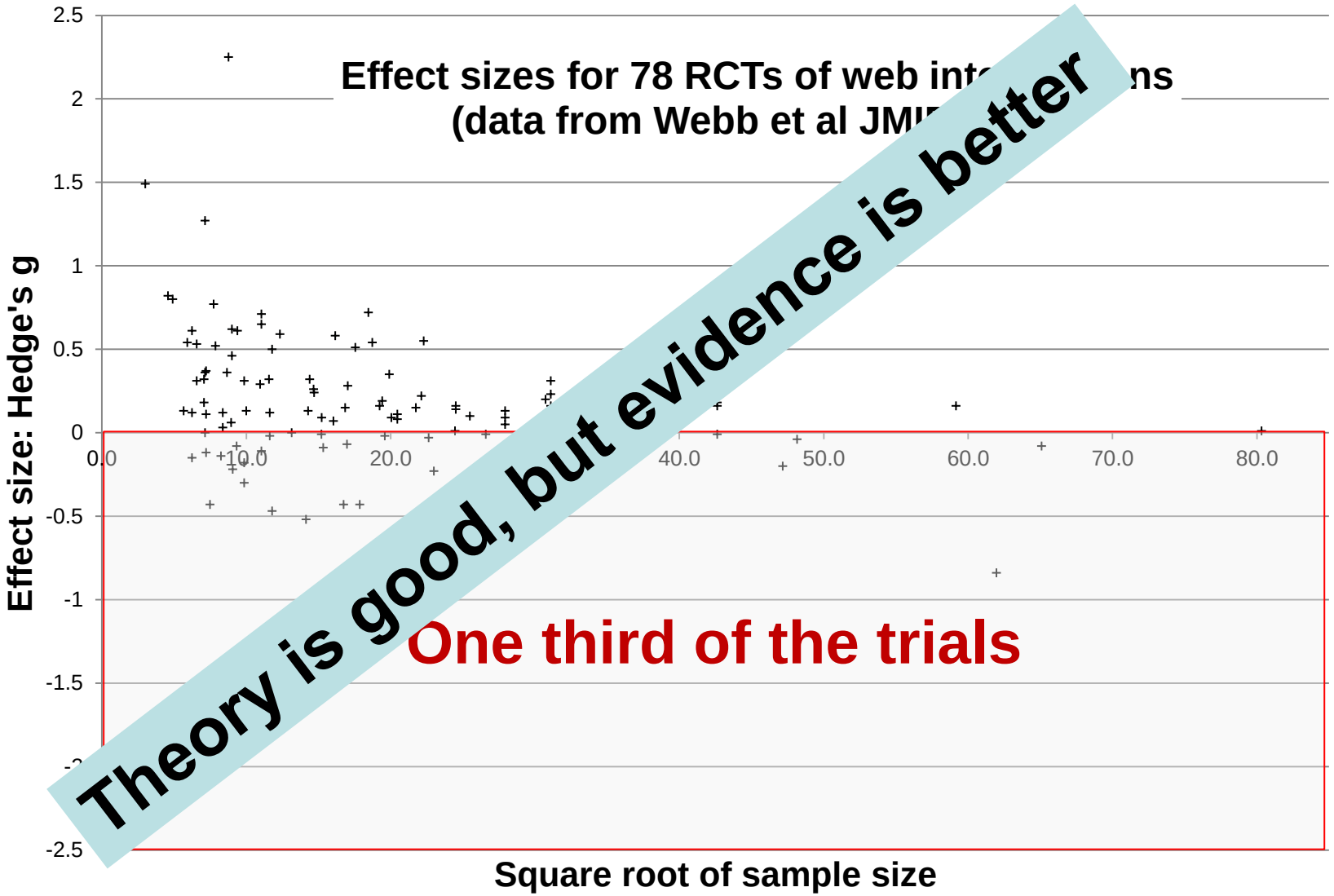
But we don’t always get it right…

UNIVERSITY OF LEEDS

Chindogu device for restarting your PC

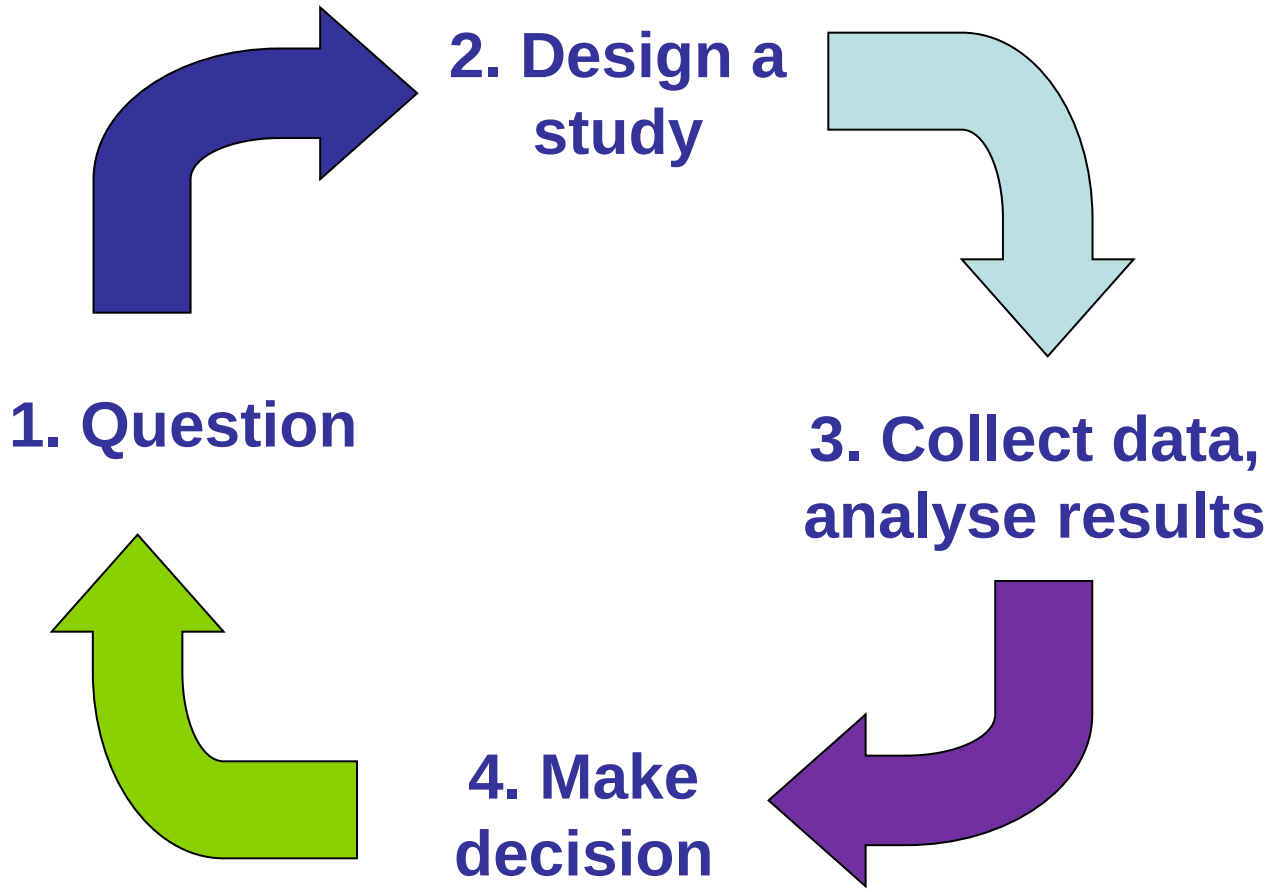
Even experts who trial BC websites get them wrong

UNIVERSITY OF LEEDS



Evaluation as an information-generating cycle

UNIVERSITY OF LEEDS



What kinds of evaluation study can we do ?

UNIVERSITY OF LEEDS

Question	Study types
How to measure the behaviour ?	Qualitative studies: what do people call it ? **Develop & validate a measurement instrument**
What is the size of the problem: how many people do that, how often?	Analysis of routine data Survey, observational study
Why do people behave like that ?	Qualitative studies of incentives / risk perception / understanding / barriers to change…
How could we help them ?	User centred design / co-design process
Will people accept this intervention ?	Usability studies, surveys, **user ratings**
Is it likely to work ?	**Accuracy studies** **Neuromarketing studies** **Scenario-based studies**
Does this intervention **actually** work ?	Impact study, eg. RCT
What went wrong ?	Analyse log files; focus groups
Does general theory ***X*** help us design better BC interventions?	**Scenario or impact study comparing BC intervention based on theory *X* vs. not**

1. Is capturing infant feeding data by SMS reliable & valid?

UNIVERSITY OF LEEDS

Background: young mothers are digital natives b busy

Sent msgs to 350 young mothers in Tayside ant feeding every 2 weeks; free text resp

Reliability: compared SMS respons

- Duplicate msgs in 48 women ter
- Phone calls to 62 women

Validity: compared SM ponses to:

- Health visitor at 2 weeks
- Other fac related / not correlated with feeding method

Funded 3 Scotland Chief Scientist

Highly reliable, valid and acceptable to the participants

Whitford H et al, JAMIA 2012

Social approval bias in measurement: dietary recall

UNIVERSITY OF LEEDS

Social approval bias: our tendency to modify responses to fit in with (presumed) social norms

Randomised study in 163 US women aged 35-65 yrs:

- Intervention group: letter described “fruit & veg intake study” with 5-a-day fridge magnet
- Controls: letter described “nutritional study”; no magnet
- Outcomes: blind phone interview 10 days later using Food Frequency Questionnaire + 24hr recall to estimate fruit & veg intake

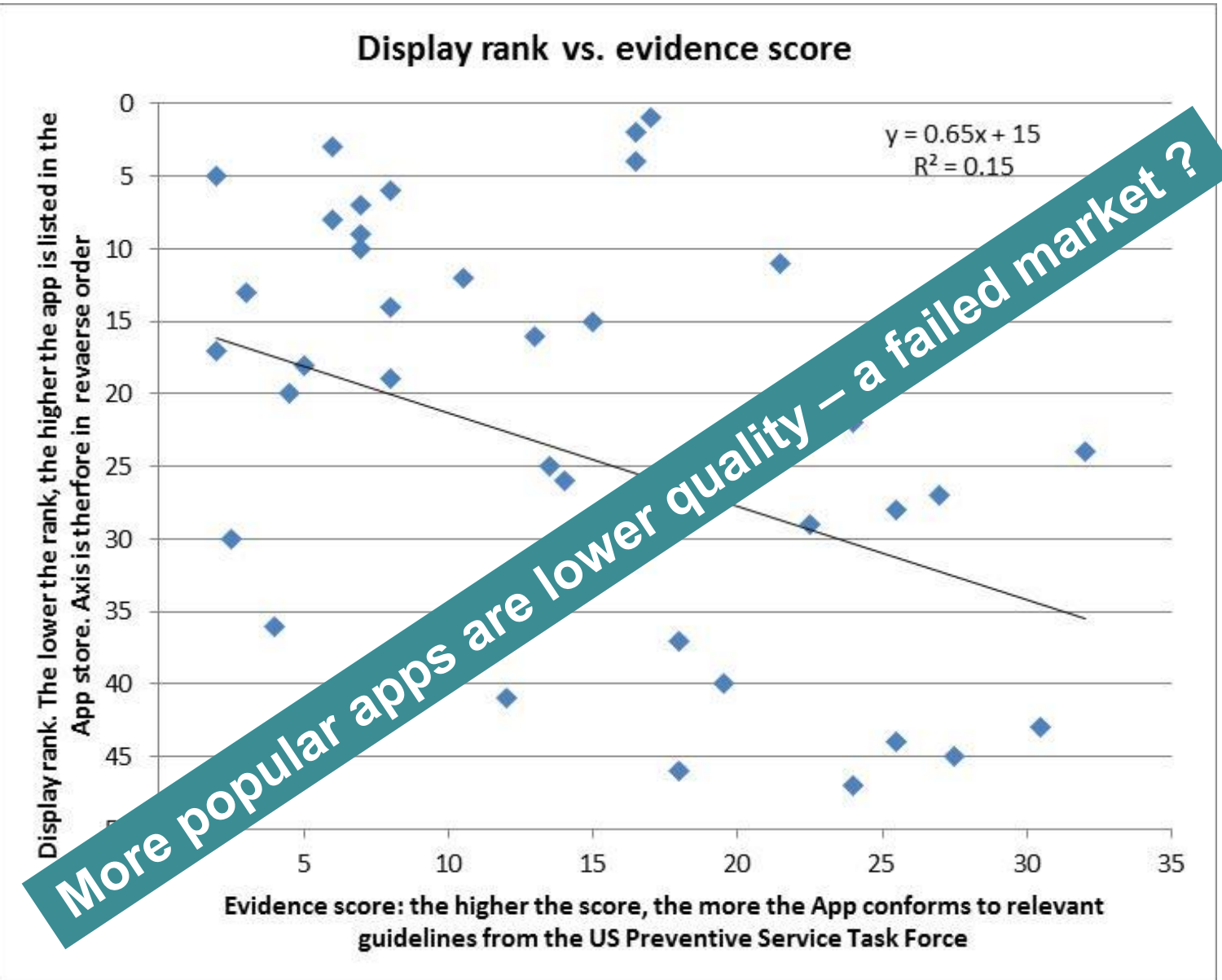
Results:

- 61% of intervention group recalled fruit or veg on 3 or more occasions in last 24hr vs. 32% of controls (**90% more**, p = 0.002)
- FFQ: intervention 5.2 fruit or veg servings / day vs. 3.7 for controls (**41% more**, p <0.001)

Source: Miller et al. Nutrition J 2008

2. User ratings: app display rank versus adherence to evidence

UNIVERSITY OF LEEDS



Redrawn from study of 47 smoking cessation apps (Abroms et al, 2013)

3. Leeds study of the accuracy of CVD risk calculation apps

UNIVERSITY OF LEEDS

19 cardiovascular risk prediction iPhone apps (paid or free) for public use

15 scenarios: true 10-year risk varied from 1% to 96%

Results:

- Some apps limited age to 74, ignored diabetes
- Estimated risk on scenario with correct risk of 96% varied from 19% to ***137%*** !
- None used the "*X out of 100 people*" method to express risk (Gigerenzer)

Heart Health App

With Hannah Cullumbine & Sophie Moriarty, Leeds medical students

Intervention modelling experiments

UNIVERSITY OF LEEDS

Aim: to check intervention before expensive large scale study (MRC Framework: Campbell BMJ 207)

What to measure:

- acceptability, usability
- accuracy of data input by users, accuracy of output
- whether users correctly interpret output
- stated impact of output on decision, self efficacy, action
- users' emotional response to output
- user impressions & suggested improvements

4. How to make prescribing alerts more acceptable to doctors ?

UNIVERSITY OF LEEDS

Background: interruptive alerts annoy doctors

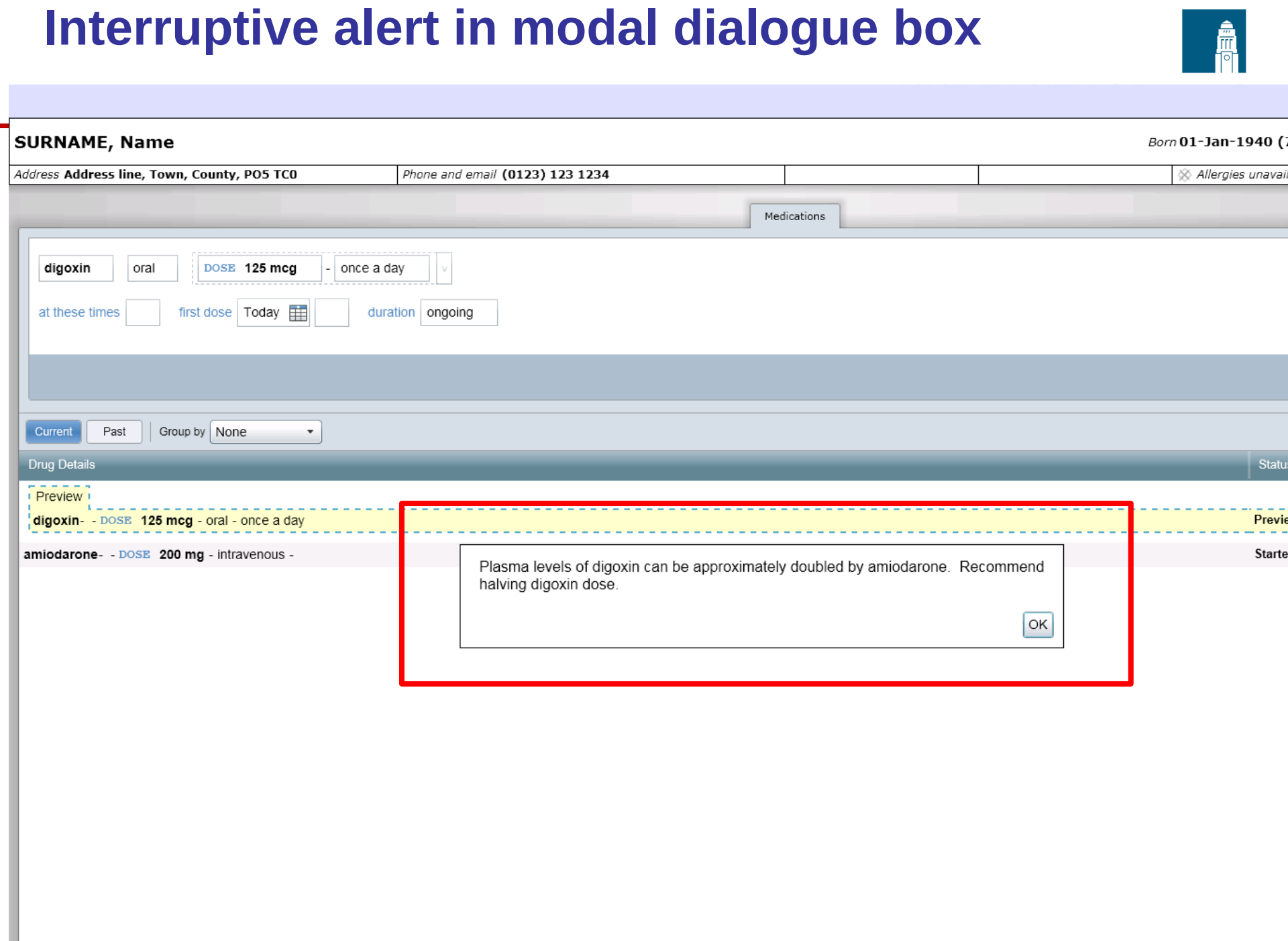
Randomised IME in 24 junior doctors, each viewing 30 prescribing scenarios, with prescribing alerts presented in two different ways

Same alert text presented as modal dialogue box (interruptive) or on ePrescribing interface (non-interruptive)

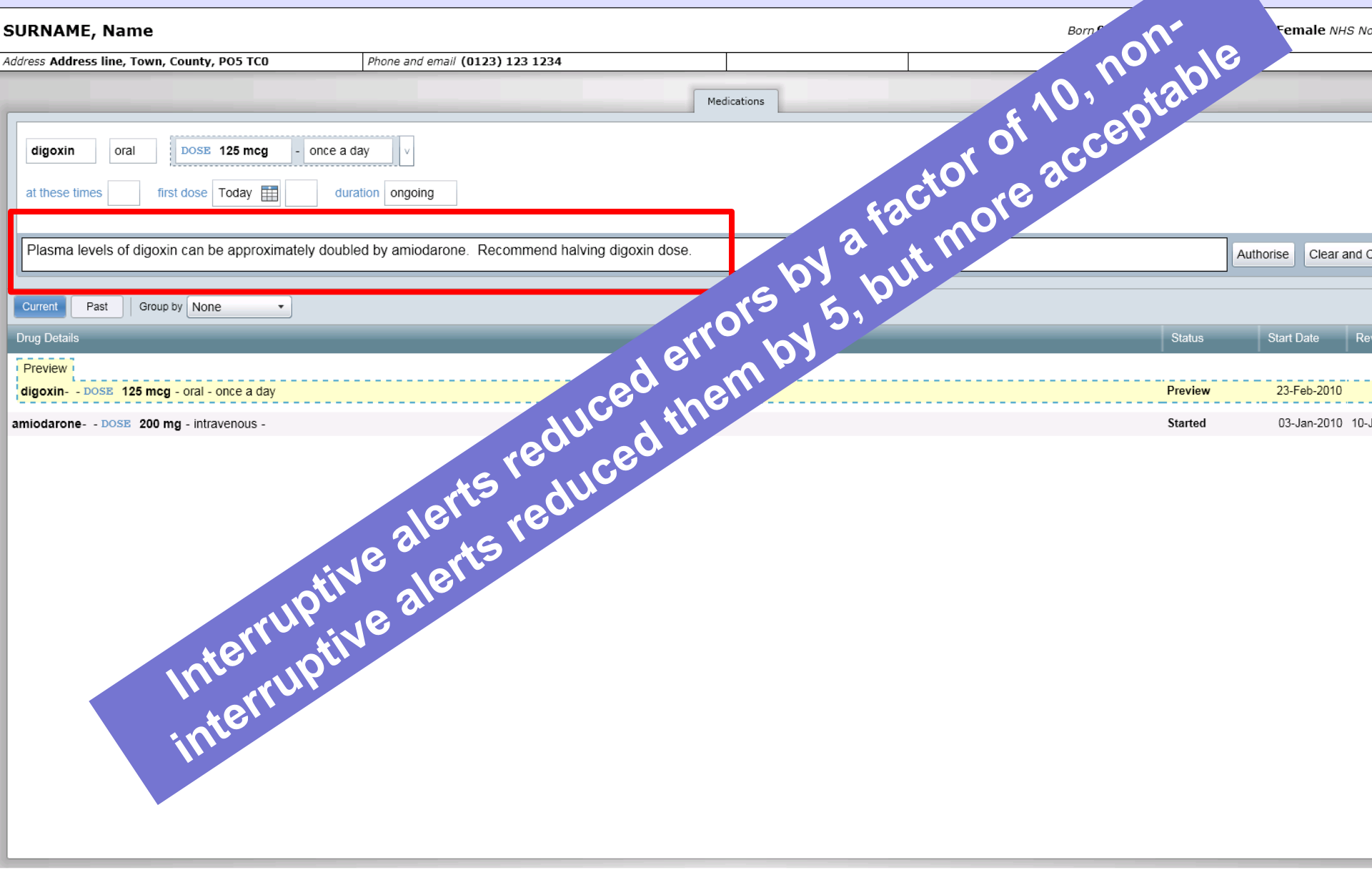
Funded by Connecting for Health, carried out by Academic F2 doctor

Published as Scott G et al, JAMIA 2011

Interruptive alert in modal dialogue box



Non-interruptive alert – same text



Interruptive alerts reduced errors by a factor of 10, non-interruptive alerts reduced them by 5, but more acceptable

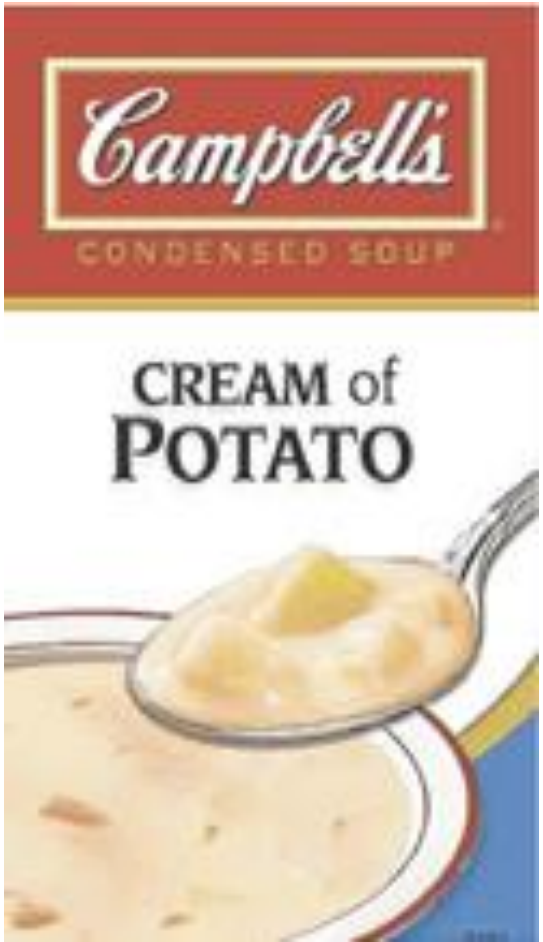
Neuromarketing in the food industry

UNIVERSITY OF LEEDS

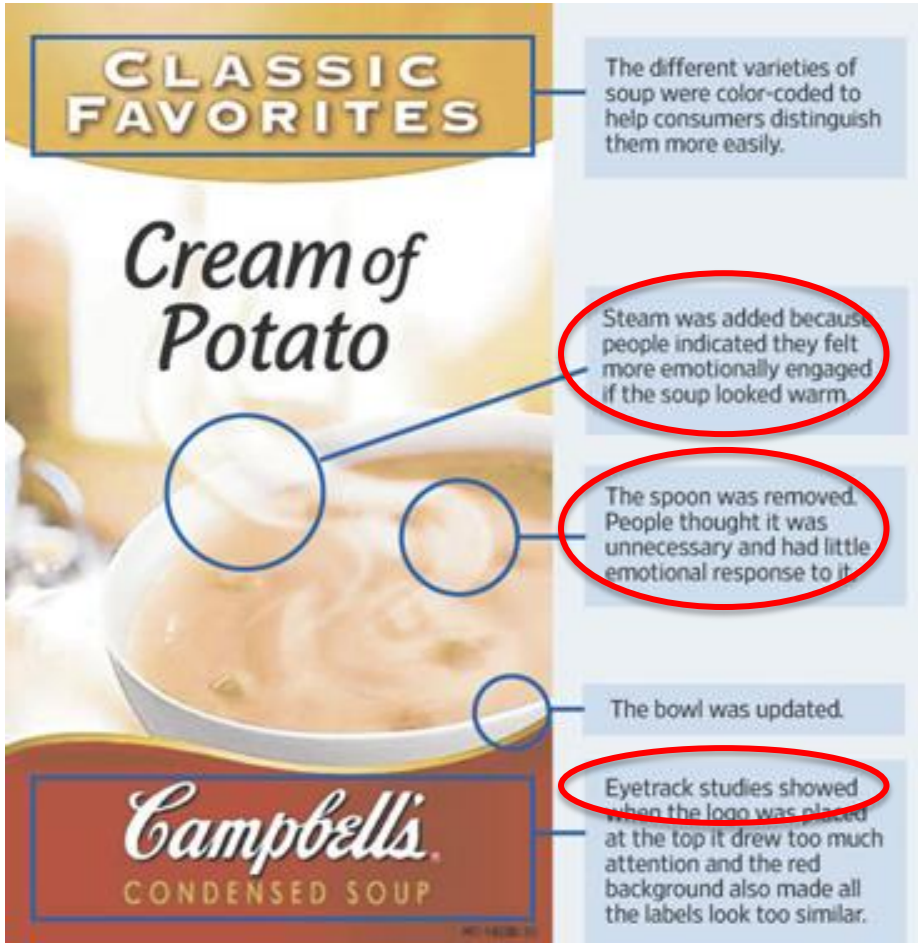
Theory: for behaviour change, emotion >> information (Kahneman's System 1)

Methods: FMRI; EDA; facial EMG; web-cam facial expression recognition

Old label



New label



5. Health promotion neuromarketing / psychophysiology IME study

UNIVERSITY OF LEEDS

Aim: to develop more effective SMS msgs for health promotion, by:

- Developing a reliable method to capture electrodermal activity (EDA), facial electromyogram (EMG)
- Validate these against words & phrases of known emotional impact
- Use methods to screen new phrases and txt msgs before an RCT

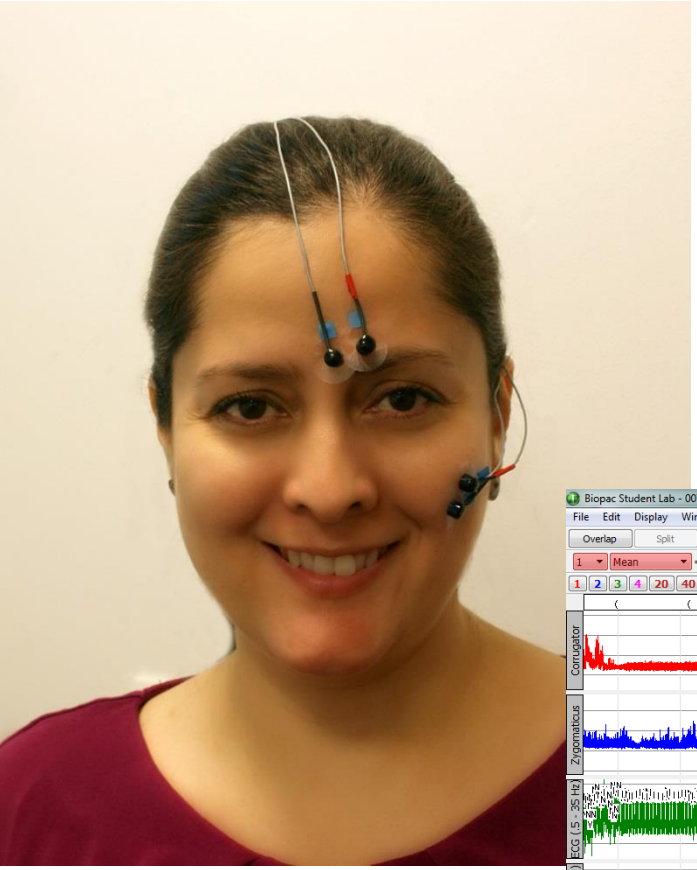
Methods - 40 volunteers:

- Expose them to 20 words of known emotional import, 5 words about exercise, 5 nonsense words & their own name in random order
- Measure EDA and facial EMG

Work of Gabriel Mata, Leeds PhD student funded by CONACYT, Mexico

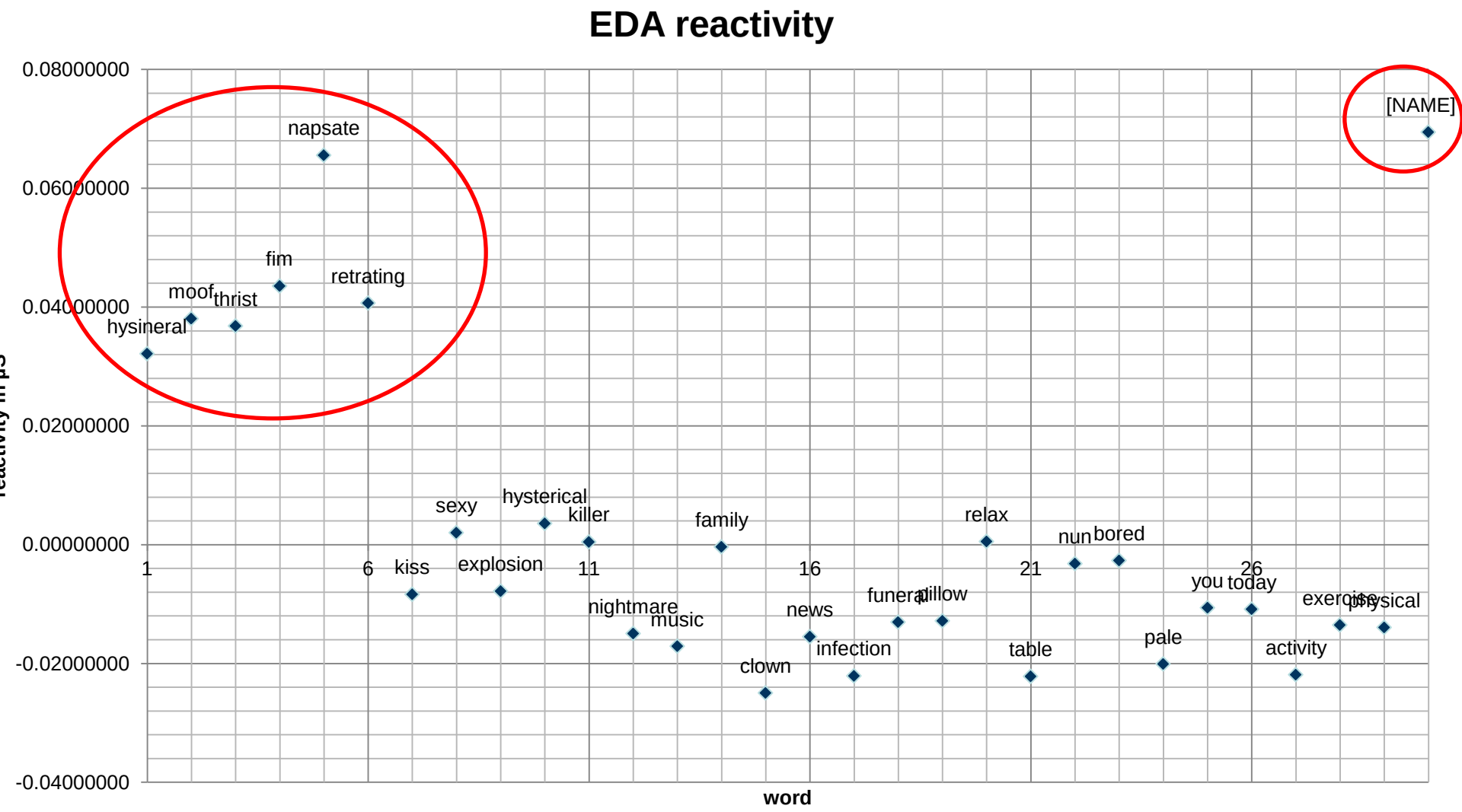
Experimental set up

UNIVERSITY OF LEEDS



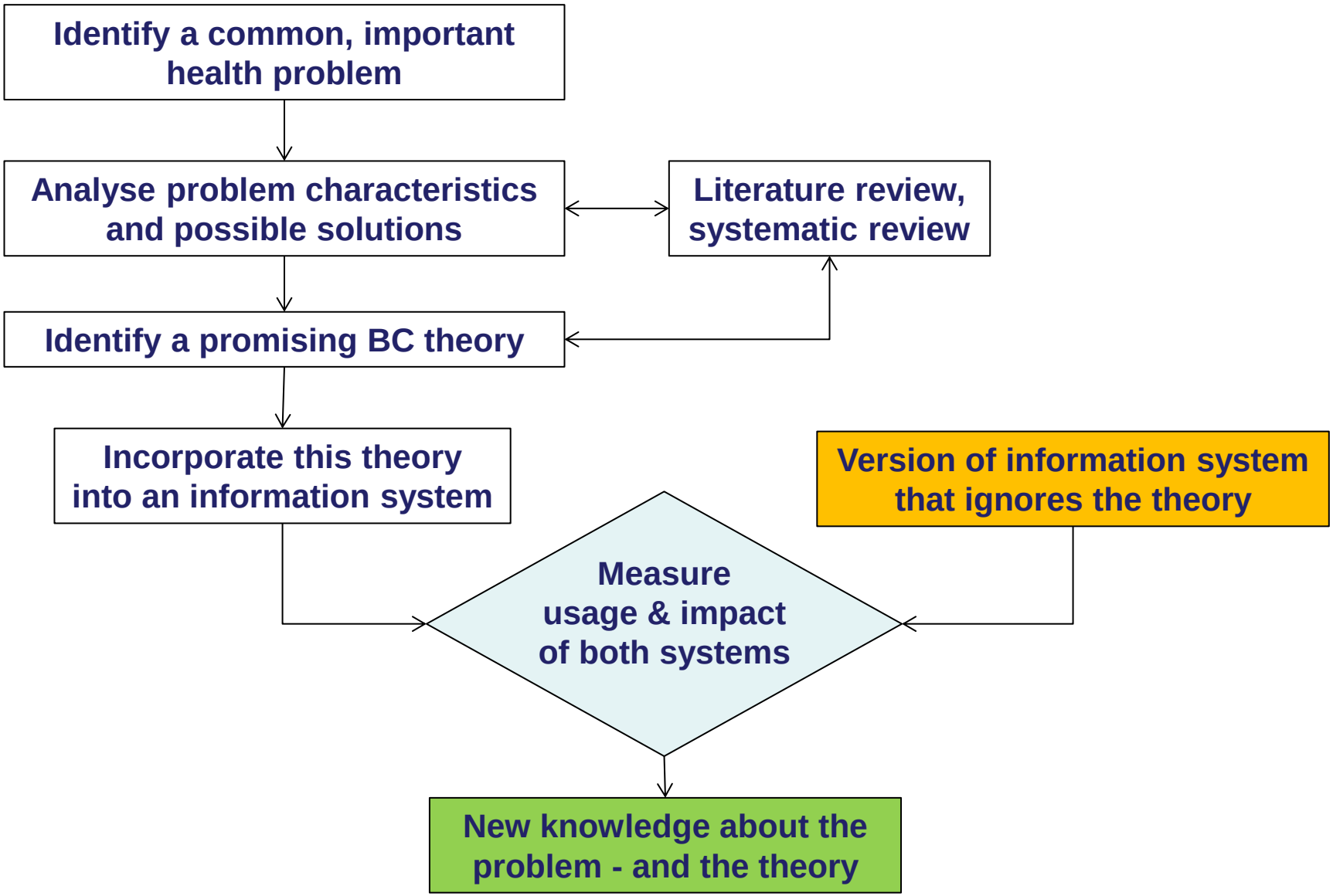
Mean results for electro dermal activity

UNIVERSITY OF LEEDS



How to study behaviour change theories ?

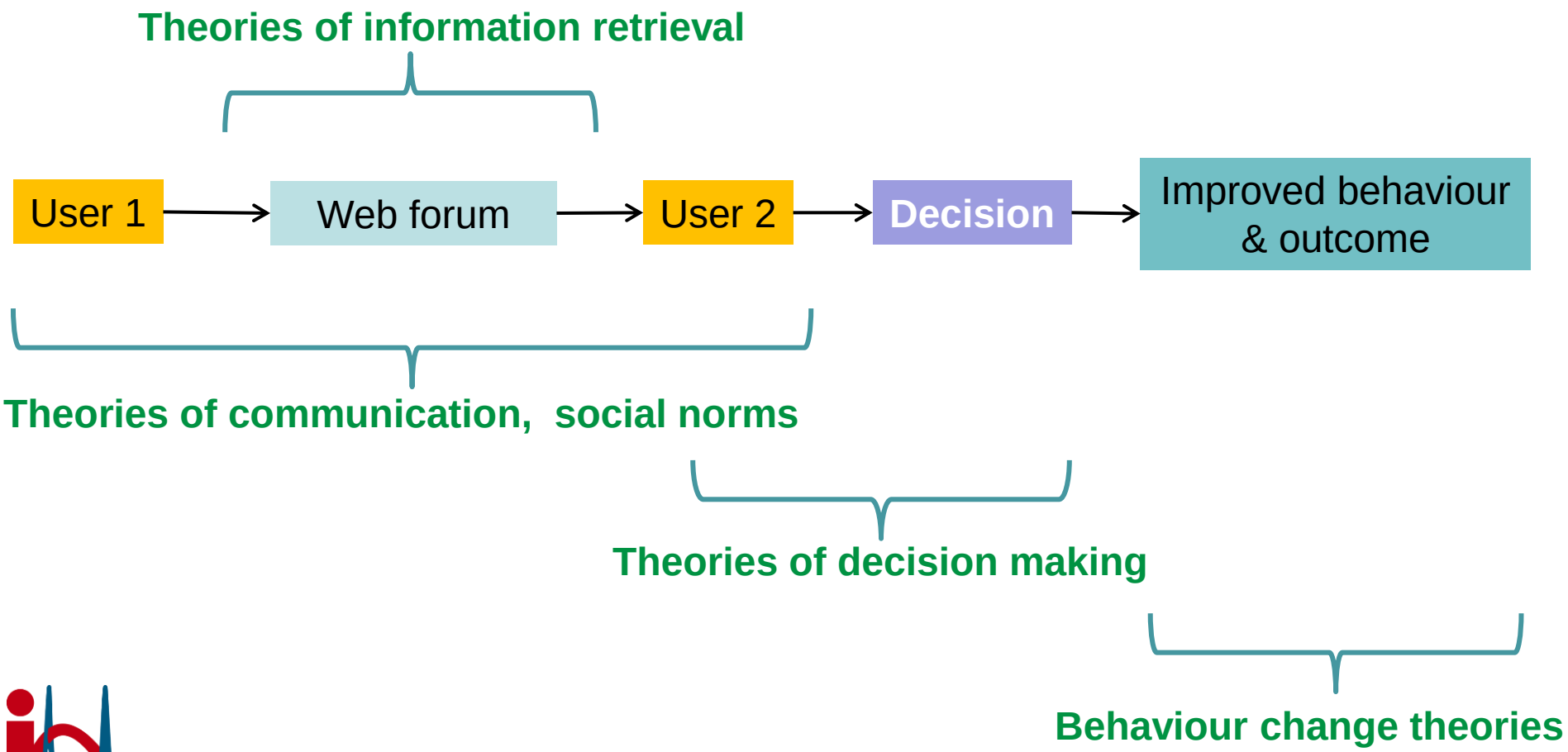
UNIVERSITY OF LEEDS



What kinds of theory are relevant to digital behaviour change?

UNIVERSITY OF LEEDS

Consider a simple digital behaviour change intervention, eg. a web forum to support increased exercise



6. Does group obligation motivate people to exercise more ?

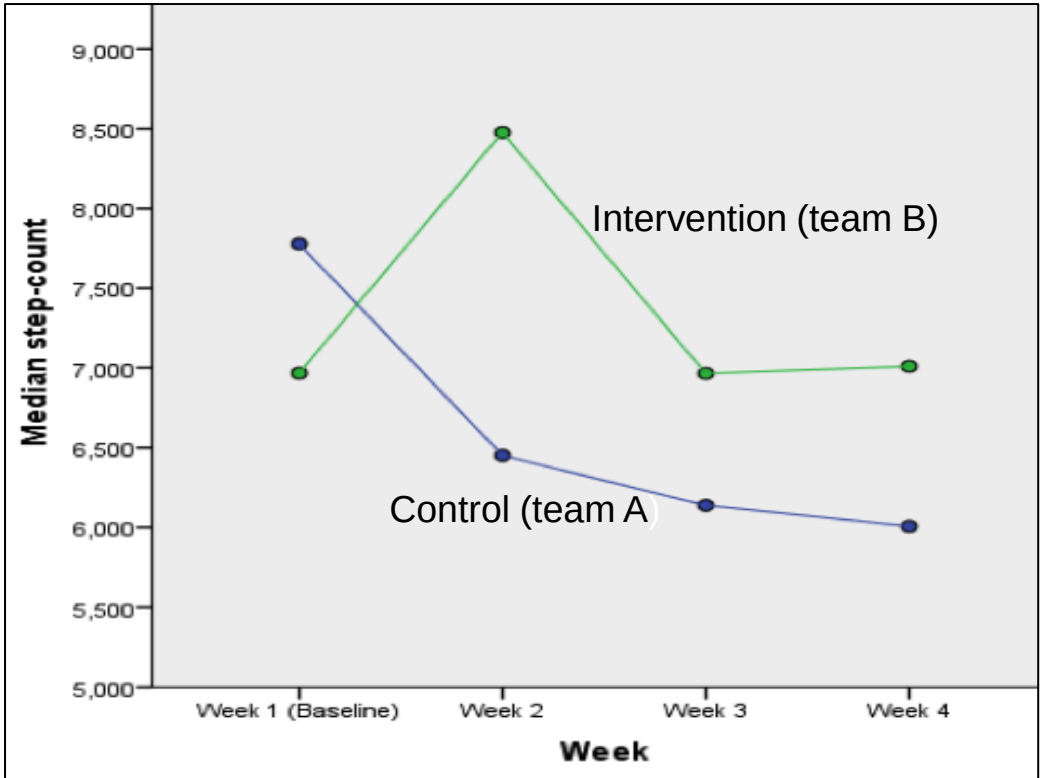
UNIVERSITY OF LEEDS

Theory: feedback about progress towards a **group** target motivates people to exercise more than **individual** feedback

Study: RCT with 32 students. All sent us daily pedometer step count as txt msg. Intervention group ("team B") also got daily feedback on progress towards that week's target for "their" group vs. control group

Results: modest support for "group obligation" theory

Contrast with "*Converging to the Lowest Common Denominator in Physical Health*" (John & Norton, Health Psychology 2013): feedback included individual step counts for each team member (thx, Michael Hallsworth, BIT)



Work of Sam Dhesi, Leeds Medical Student

7. Does Fogg's persuasive technology theory apply to NHS organ donation register ?

UNIVERSITY OF LEEDS

Result: 900 students recruited to RCT in 5 days; no difference in NHS organ donation register sign-up rates (38% both groups)

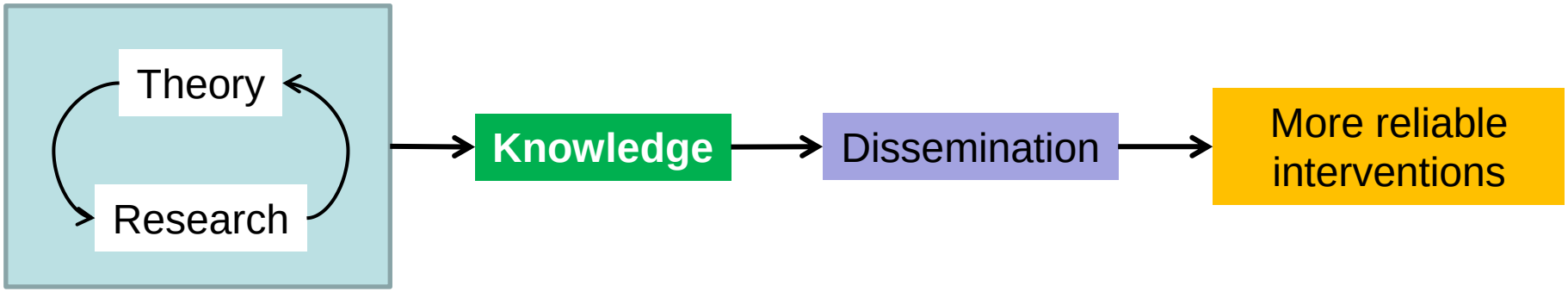
Nind, Sniehotta et al 2010

Persuasive features:

1. URL includes https, dundee.ac.uk
2. University Logo
3. No advertising
4. References
5. Address & contact details
6. Privacy Statement
7. Articles all dated
8. Site certified (W3C / Health on Net)

Benefits of building the behaviour change "theory base"

UNIVERSITY OF LEEDS



Benefits of a sound theory base:

- No more re-invention of ad hoc behaviour change systems – they will be effective & predictable
- No need to trial **every** version of **every** app / website / forum / serious game...
- BC will evolve from an ***intuitive craft*** (reliant on experts and apprenticeship) into a ***professional discipline***, with intervention design based on tested theories

Conclusions

UNIVERSITY OF LEEDS

1. We don't yet know how to change behaviour reliably
2. Experts and theories help, but results of a good empirical study can trump them
3. There are many types of evaluation study
4. Some important study types are:
   - Validation of measurement methods
   - Checking usability & accuracy of prototype interventions
   - Intervention modelling experiments
   - **Testing the impact of a relevant theory on intervention effectiveness**