**MACQUARIE
University**

Translating research into medical practice

Techniques and treatments are improving all the time, but unless doctors and health system managers know about them, patients don't benefit.

Techniques and treatments

3.48

The median number of years it takes regulatory bodies to withdraw drugs that were approved and then found to be unsafe.

8.2

The median number of years it takes for drugs in to reach a stable level of prescription in the Australian population.

21%

The number of US adults who believe certain vaccines cause autism.

Currently there is a disconnect between the evidence available from research, and health policy, practice and public opinion. Three problems create it:
· slow synthesis of evidence
· biases in evidence
· widespread misinformation.

Evidence synthesis is slow and inefficient

In Australia we don't deliver the care that is appropriate in about 57% of cases, according to the AIHI's CareTrack study. One reason is that clinicians are not aware of the latest research. Systematic reviews, which synthesise published research results, take a long time. And as soon as they are published, we know that

7%
are out of date immediately.

15%
are out of date in a year.

23%
are out of date in two years.

'We want to reduce the amount of time it takes to produce a systematic review to about 10 seconds,' says Dr Adam Dunn, of AIHI's Centre for Health Informatics (CHI). 'It is not as crazy an idea as it sounds.' Dr Guy Tsafnat is leading CHI's research into using citation networks and other metadata to automate the process.

85% of biomedical research globally does not make it into practice and is wasted as a consequence of biases.

Clinical evidence can be biased

Half of all clinical trials undertaken are never published. When they are published, about half of the outcomes that were described in the registration are missing or changed. But even if they had been perfectly published, many trials are not designed to be useful: they are flawed in various ways, or designed for purposes other than to add to clinical evidence, such as marketing. That 85% figure represents a loss of about $200bn of the $240 billion spent each year on biomedical research.

Half of the clinical trials funded by the pharmaceutical industry are unlikely to be published. However, when industry sponsored trials are published they are more likely than independent studies to present results that are favourable to pharmaceutical industry products.

When reviewers synthesise the results of many clinical studies in systematic reviews, financial conflicts of interest can influence findings. Our research into the literature on neuraminidase inhibitors (e.g. Tamiflu) found that where such conflicts exist, conclusions are more likely to be favourable (88%) than where there is no conflict (17%).

'Half of the clinical trials funded by the pharmaceutical industry are unlikely to be published.'

Does the choice of what evidence to include influence conclusions? CHI researchers using machine learning to examine selective citation bias, were able to predict favourable conclusions in reviews with 96% accuracy using only the information about what was being cited.
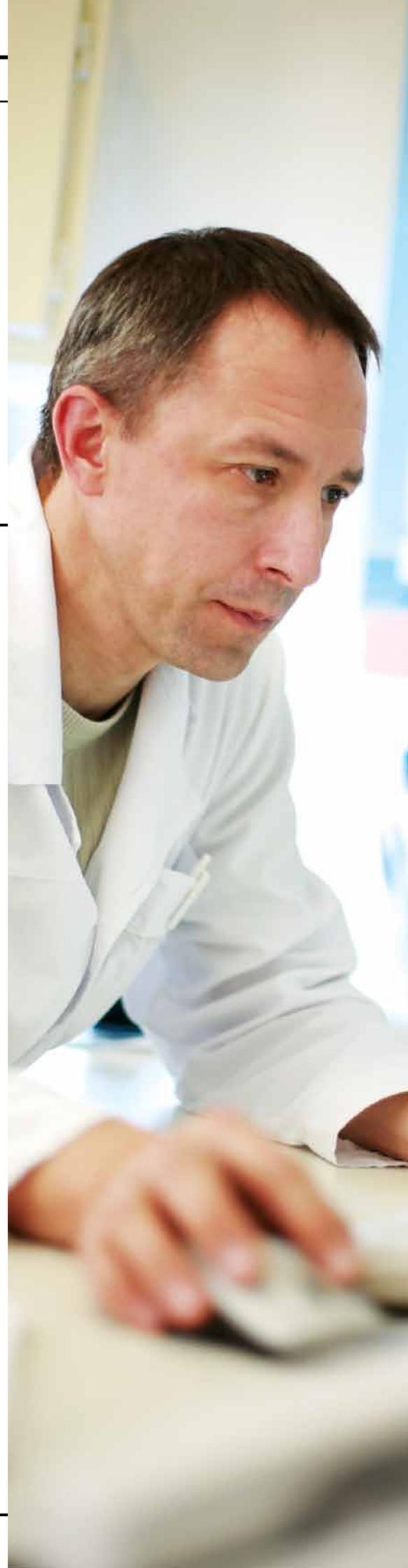
Health behaviour can be based on misinformation

As an example, HPV vaccines are used to prevent cervical cancer, but have been the subject of widespread scare campaigns about side effects. The internet spreads falsehood as easily as fact. A CHI study of Twitter users' comments on HPV vaccines, which used machine-learning classifiers to examine both the text of tweets and the social relationships between Twitter users, was able to predict accurately which tweets would be negative about about HPV vaccines.
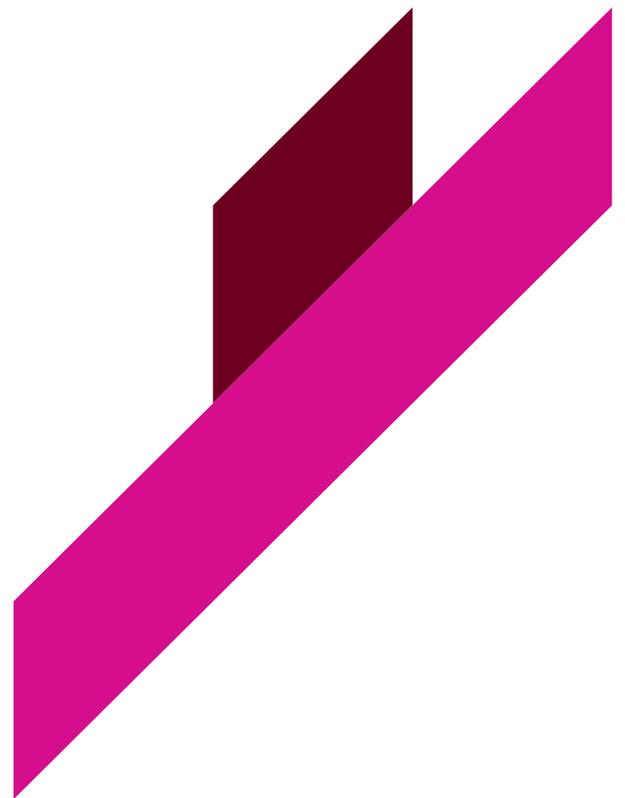
Who are we and what are we doing?

PROFESSOR ENRICO COIERA
DIRECTOR OF AIHI'S CENTRE FOR
HEALTH INFORMATICS

His research focuses on the application of information and communication technologies (e-Health) to solving health ice delivery problems.

DR ADAM DUNN
SENIOR RESEARCH FELLOW

Dr Dunn uses network science, machine learning, and data mining to measure and understand the uptake of new practices, biases that affect clinical evidence, conflicts of interest, and the spread of misinformation online.

**DR GUY TSAFNAT**
SENIOR RESEARCH FELLOW

Dr Guy Tsafnat is interested in novel computational discovery methods to support biomedical research and clinical decision support systems. I apply knowledge discovery and data mining (KDD), literature based discovery (LBD), formal languages and inference to create tools that support scientific discovery.

DR MIEW-KEEN CHOONG
POST-DOCTORAL FELLOW

Dr Choong's research has focused on using evidence-based medicine to support clinical decision. She used information retrieval and extraction to assist in the development of clinical indicators and automating tasks of systematic reviews.

OUR CURRENT WORK:

1 Developing and aggregating technologies for automating systematic reviews to speed up the process of evidence synthesis.

2 Measuring the biases in the production and synthesis of clinical evidence that lead to delays in evidence reversal to catch unsafe interventions earlier.

3 Measuring the spread of misinformation about vaccines online to assist public health organisations deliver better messages.
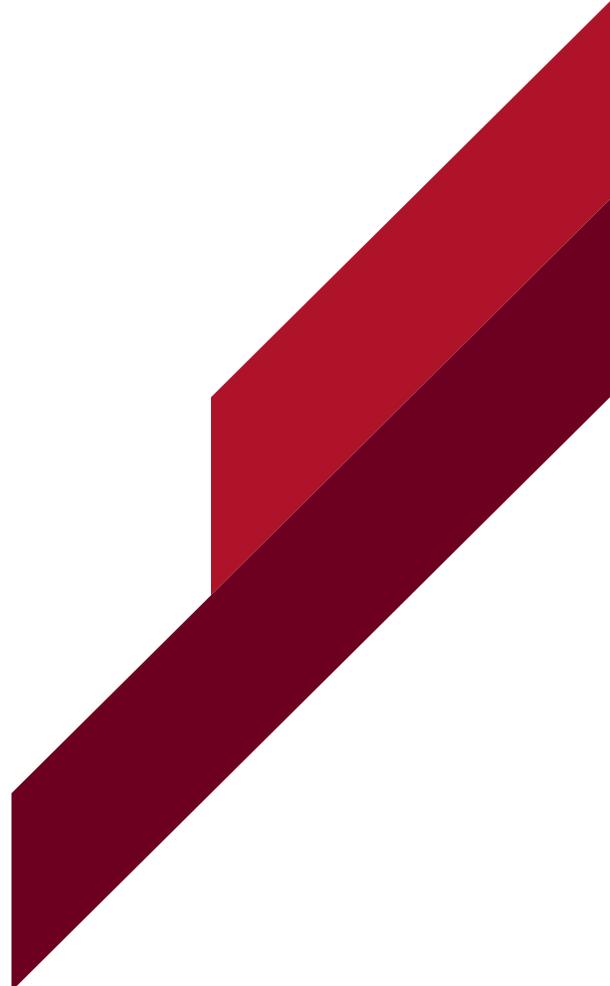
EXAMPLES OF WHAT WE'VE PUBLISHED

1. **Dunn AG, Arachi D**, Hudgins J, **Tsafnat G, Coiera E**, Bourgeois FT. Financial conflicts of interest and neuraminidase inhibitors for influenza: An analysis of systematic reviews. *Annals of Internal Medicine* 2014;161(7):513-18.

2. **Tsafnat G, Dunn AG**, Glasziou P, **Coiera E**. The automation of systematic reviews. *BMJ* 2013;346:f139.

3. **Tsafnat G**, Glasziou P, **Choong M, Dunn AG**, Galgani F, **Coiera E**. Systematic review automation technologies. *Systematic Reviews* 2014;3(1):74.

4. **Dunn AG**, Day RO, Mandl KD, **Coiera E**. Learning from hackers: Open-source clinical trials. *Science Translational Medicine* 2012;4(132cm5).

5. **Choong MK, Galgani F, Dunn AG, Tsafnat G**. Automatic evidence retrieval for systematic reviews. *Journal of Medical Internet Research* 2014;16(9):e223.

6. Zhou X, Wang Y, **Tsafnat G, Coiera E**, Bourgeois FT, **Dunn AG**. Citations alone were enough to predict favourable conclusions in reviews of neuraminidase inhibitors. *Journal of Clinical Epidemiology* 2014;68(1):87-93.

7. **Dunn AG, Coiera E**. Should comparative effectiveness research ignore industry-funded data? *Journal of Comparative Effectiveness Research* 2014; 3(4):317-320.

8. **Dunn AG, Coiera E**, Mandl KD. Is Biblioleaks inevitable? *Journal of Medical Internet Research* 2014;16(4):e112.

9. Robinson K, **Dunn AG, Tsafnat G**, Glasziou P. Citation networks of related trials are often disconnected: Implications for bidirectional citation searches *Journal of Clinical Epidemiology* 2014;67(7):793-99.

10. **Dunn AG**, Mandl KD, **Coiera E**, Bourgeois FT. The effects of industry sponsorship on comparator selection in trial registrations for neuropsychiatric conditions in children. *PLoS ONE* 2013;8(12):e84951.

11. **Dunn AG**, Bourgeois FT, **Coiera E**. Industry influence in evidence production. *Journal of Epidemiology and Community Health* 2013;67:537-38.

12. **Dunn AG, Gallego B, Coiera E**. Industry influenced evidence production in collaborative research communities: A network analysis. *Journal of Clinical Epidemiology* 2012;65(5):535-43.

13. **Dunn AG**, Bourgeois FT, Murthy S, Mandl KD, Day RO, **Coiera E**. The role and impact of research agendas on the comparative effectiveness research amongst anti-hyperlipidemics. *Clinical Pharmacology & Therapeutics* 2012;91(4):685-91.

14. **Dunn A, Braithwaite J, Gallego B**, Day R, **Runciman WB, Coiera E**. Nation-scale adoption of new medicines by doctors: An application of the Bass diffusion model. *BMC Health Services Research* 2012;12(1):248.

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