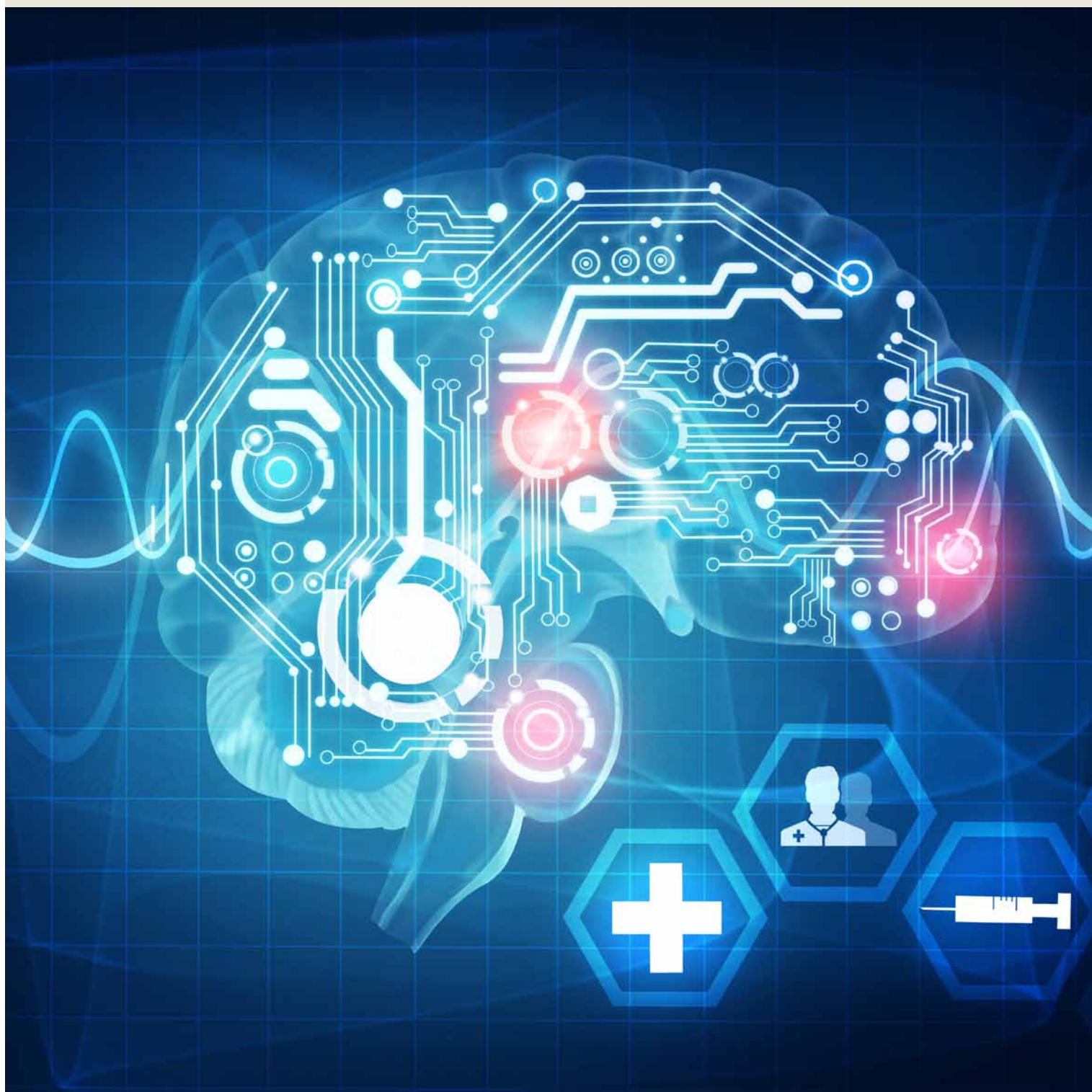


Digital health

USING TECHNOLOGY TO DRIVE HEALTH INNOVATION





Digital health is the delivery of health services using digital technologies. It has the potential to reshape existing health services, making them safer, more efficient, flexible and personalised.

Digital health

Digital health provides consumers with new tools to support self-management, and new ways of collaboratively engaging with health services.

With this singular potential to enhance and accelerate the quality, safety and effectiveness of health services, digital health is now attracting multi-billion dollar investments from the public and private sectors, nationally and internationally. We now have an Australian Digital Health Agency, and each state has its own e-health programs focussing on the public hospital system. Internationally, digital health is considered crucial to health service modernisation.

Digital health however is hard. It is much more than simply building 'apps', but rather covers everything from simple consumer products through to complex whole of nation systems. There is clear evidence that, despite huge investments by government and service providers, when implemented, many real world e-health systems fail to deliver the improvements expected. They create additional workloads, disrupt workflows, and introduce new classes of error.

Many nation-scale programs, end up being scrapped altogether at great cost to the public. E-health services are also notoriously

complex, with significant unintended consequences if poorly conceived, designed, implemented or managed. Thus, while much focus remains on the development of technology, attention must also be paid to the very real implementation challenges faced by digital health.

To be effective, digitally enabled health services and e-health policy must be founded upon world-class research evidence to guide investment and service-delivery decisions. Research organisations like the Australian Institute of Health Innovation's Centre for Health Informatics (CHI) are a major incubator of new ideas, technologies and the trained people who will participate in the digital health revolution and respond to our growing national health service needs.

Researchers at CHI are working on several major digital health challenges, including the design of new tools to empower consumers to actively participate in their care, to use 'big data' to develop powerful new tools to help with decision making, and to make sure when digital health is used, it contributes to health improvement and not patient harm.



Further reading

1. **Coiera E.** *Guide to Health Informatics (3rd Edition)*. 3rd ed. London: CRC Press, 2015.
2. **Coiera E.** Why e-health is so hard. *The Medical Journal of Australia* 2013;198(4):178

Helping orthopaedic patients help themselves

Surgery is just the first step in repairing serious injuries. Weeks of physiotherapy and other treatment are also needed to ensure the best outcome, and this requires significant commitment from patients. However, many orthopaedic patients find it difficult to follow the complex instructions after surgery and therefore re-injure themselves.

The Centre for Health Informatics (CHI) is developing and testing new technologies that should help make it easier for patients to follow their post-op treatment plan and recover sooner. “This project was launched following conversations with patients and orthopaedic surgeons who were having problems with rotator cuff repairs after shoulder injuries,” explains Dr Lau, who leads the Consumer Informatics stream at CHI.

After patients have surgery to repair their shoulder, they should follow a rehabilitation protocol that involves wearing a sling for six weeks and doing exercises for 12 weeks. “But the re-tear rate is 30 percent because some patients have difficulty remembering the instructions,” Dr Lau says. “Nurses already explain why exercises are an important part of the recovery process but the problem persists.”

Dr Lau’s team has developed a mobile app that explains different exercises with explanatory videos. “A questionnaire takes a minute each day, measures patients’ progress and provides patients with feedback on their progress.” The team is now testing whether the app increases compliance and reduces shoulder re-tear rates.

The team has developed and successfully tested many similar interventions in the past to help with issues such as influenza vaccination, mental well-being and encouraging young adults to screen for sexually transmitted diseases.



Further reading

1. **Mortimer NJ**, Rhee J, Guy R, Hayen A, **Lau AY**. A web-based personally controlled health management system increases sexually transmitted infection screening rates in young people: a randomized controlled trial. *Journal of the American Medical Informatics Association*. 2015; 22(4):805-14.
2. **Lau AY**, Sintchenko V, Crimmins J, **Magrabi F**, **Gallego B**, **Coiera E**. Impact of a web-based personally controlled health management system on influenza vaccination and health services utilization rates: a randomized controlled trial. *Journal of the American Medical Informatics Association*. 2012; 19(5):719-27.

Making digital health safe

Digital health is revolutionising healthcare. It plays a mission critical role in hospitals and more than 96 per cent of GPs use electronic records¹. “IT can improve the quality and safety of healthcare, but we need to understand its risks as well,” explains Associate Professor Farah Magrabi, who leads the Centre for Health Informatics research program on Patient Safety Informatics.

“How many times have you hit the send button on your email and said ‘oops’, or mistakenly picked the wrong option when shopping online? It’s easy to do, but when that happens in health there can be real consequences,” she says. Her team has pioneered the study of IT-related harms by looking at data sets¹ from Australia, the USA and England. IT incidents are a concern because a single problem has the potential to expose many patients to the risk of harm.

“Our analysis also show that human factors are a problem. For example, if prescribing

systems require users to scroll through too many options, or they are not arranged intuitively, then patients may end up being prescribed the wrong medication.” Risks also arise when technology does not work as intended, for example, patients can be harmed when a prescribing system fails to display important allergy information.

“From our analysis, we have developed a new classification system for IT risks in healthcare and this has become the de facto international standard for analysing IT safety events. Our work is also shaping policy to govern IT safety in Australia and overseas.”

It’s an issue we need to take seriously, she adds. “We need to be actively managing the risks of digital health alongside our efforts to introduce technology. By better understanding the origins of this risk, problems can be detected early and we can mitigate hazards ahead of harming patients.”

¹ Britt H, Miller GC, Henderson J, Bayram C, Harrison C, Valenti L et. al. General practice activity in Australia 2014–15. General Practice series no. 38. Sydney: Sydney University Press, 2015.

Further reading

1. **Coiera E, Magrabi F.** Information system safety. *Guide to Health Informatics*. Boca Raton, FL, USA: CRC Press, Taylor & Francis Group, 2015:195-220.
2. **Magrabi F, Ong MS,** Runciman W, **Coiera E.** (2012) Using FDA reports to inform a classification for health information technology safety problems. *Journal of the American Medical Informatics Association*. Jan 19(1):45-53.
3. **Magrabi F,** Liaw T, **Arachi D,** Runciman WB, **Coiera E,** Kidd MR. Identifying patient safety problems associated with Information Technology in general practice: an analysis of incident reports. *BMJ Quality & Safety*. (published online 5 Nov 2015).



Reducing hospital deaths

Knowing which patients are more likely to die during a hospital stay or shortly after discharge can help medical staff plan ahead and result in better patient outcomes. However, until recently, predicting death for hospitalised patients beyond 24 hours was more art than science.

“Serious adverse events, including deaths, will always happen in hospitals. In many instances they can now be predicted and, if appropriate, prevented,” explains Dr Blanca Gallego Luxan, a Senior Research Fellow in the Centre for Health Informatics. “Depending on the specific circumstances, these predictions can trigger escalated levels of patient care, or sometime initiate end of life discussion amongst the patient, family and their carers.”

Dr Gallego Luxan started research in this field back in 2012, when little work was being done. “We were among the first to use electronic patient records to predict

whether hospitalised patients would survive the next days or weeks.” She says that “The field has advanced tremendously, and today it is surprisingly easy to predict short-term death in hospitalised patients using hospital electronic records.

“We can predict the most likely trajectory for a patient over the next few days, for example calculating the likelihood that they will be discharged, have to stay in hospital, or die. The team’s methods collected data as part of routine care, such as pathology results, surgical interventions and ward movements. As more information becomes available we are able to refine our predictions in a similar way to meteorologists using weather prediction systems.”

Dr Gallego Luxan and her team are currently working with St Vincent’s Hospital, Sydney to translate these models into clinical practice to saving lives and improving the outcomes of hospitalised patients.

Further reading

1. Cai X, **Perez-Concha O**, **Coiera E**, Martin-Sanchez F, Day R, Roffe D, **Gallego B**. Real-time prediction of mortality, readmission, and length of stay using electronic health record data. *Journal of the American Medical Informatics Association*. 2015;ocv110.
2. **Perez-Concha O**, **Gallego B**, Hillman K, Delaney GP, **Coiera E**. Do variations in hospital mortality patterns after weekend admission reflect reduced quality of care or different patient cohorts? A population-based study. *BMJ quality & safety*. 2014; 23(3):215-22.
3. **Coiera E**, **Wang Y**, **Magrabi F**, Concha OP, **Gallego B**, Runciman W. Predicting the cumulative risk of death during hospitalization by modeling weekend, weekday and diurnal mortality risks. *BMC health services research*. 2014; 14(1):1.



Digital health needs digital tools

E-health is helping our health services deliver better and safer clinical decision-making. To achieve this, new computer services and apps are being built that can work hand-in-hand with patients, clinicians and researchers to support many different daily tasks.

Researchers at the Centre for Health Informatics have built many such tools over the last 15 years. We have developed a range of clinical tools and resources that are either freely available or undergoing ongoing development. Some have been commercialised and others are available free to the community. Here are three examples of our public tools.

HEALTHY.ME



Healthy.me is our personal health management system designed especially for patients, developed with the support of the HCF Research Foundation. It allows individuals to connect with health services, peers, information sources, and tools to manage their health. It is also a research platform, available in web-based and mobile app platform (iOS, Android) and is used by different research groups to test the impact of mobile (or e-health) apps.

Contact Dr Annie Lau for a demonstration of Healthy.me and for more information.

QUICK CLINICAL



Quick Clinical is a free search engine designed for clinicians and researchers. Quick Clinical is a meta-search engine (it connects to other search engines, queries each in parallel, and collates the results). Quick Clinical includes a specialised query interface which can display pre-specified templates to tailor search strategies for common clinical queries such as 'therapies', 'diagnostics', 'treatment options' and 'patient education'. Try Quick Clinical here qc.aihi.mq.edu.au/

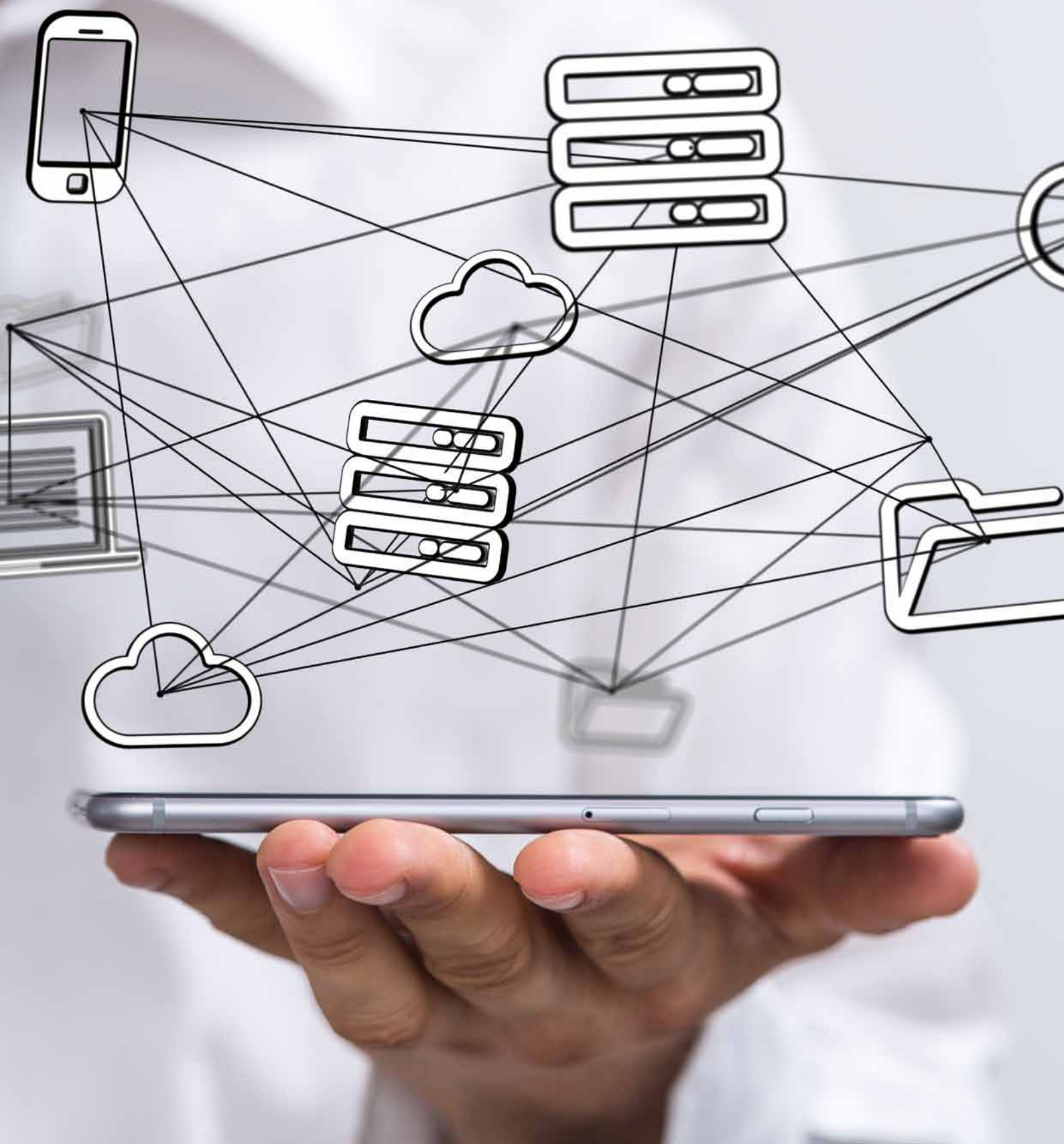
Contact Dr Guy Tsafnat for more information on Quick Clinical.

TECHWATCH



TechWatch is an online system for general practitioners to report problems with digital health in their practice that might create risks for patient care. TechWatch was deployed to general practices across Australia over a 19-month period between 2012-2013 and is currently under further development.

Contact Associate Professor Farah Magrabi for more information on TechWatch.



Who are we?



DIGITAL HEALTH

Professor Enrico Coiera

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Professor Coiera is an internationally recognised research leader focussed on the application of information and communication technologies to solving health service delivery problems and creating sustainable health systems. Professor Coiera is currently working on topics in patient safety, implementation science, consumer e-health, evidence-based decision support, and clinical communication.



E-HEALTH SAFETY

Associate Professor Farah Magrabi

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Associate Professor Magrabi is internationally recognised for her work on investigating the patient safety risks of information technology (IT). She takes a cross-disciplinary approach to develop and publicise methods to monitor IT risks, design safe IT systems and develop models for the safety governance of IT. Her research has shaped policy to address IT safety and has changed practice to detect risks in Australia and overseas.



HEALTH ANALYTICS

Dr Blanca Gallego Luxan

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Dr Gallego Luxan is a Senior Research Fellow leading the Health Analytics Lab, which focuses on developing and testing new analytic tools to support learning health care systems. Trained as a physicist, she has extensive international research experience in data analysis and computational modelling and has made significant and innovative contributions to the design, analysis and development of models derived from complex empirical data for a wide range of applications such as patient safety, bio-surveillance, corporate sustainability reporting, ecological footprint analysis and climate variability.

**CONSUMER INFORMATICS****Dr Annie Lau****T:** +612 9850 2436 **E:** annie.lau@mq.edu.au

Dr Lau is a Senior Research Fellow leading the Consumer Informatics team which focusses on those with the highest stake in our healthcare system – patients and healthcare consumers. Her research program investigates the ‘impact’, ‘design’, and ‘science’ of Information and Communications Technology (ICT) on consumers, patients and their carers. She has a national and international profile for her expertise in consumer e-health. Her interests lie in e-health consumer informatics, health service engagement, social computing and human behaviour modelling.

**TEXT MINING AND EVIDENCE TOOLS****Dr Guy Tsafnat****T:** +612 9850 2430 **E:** guy.tsafnat@mq.edu.au

Dr Tsafnat is a Senior Research Fellow leading the Computable Evidence Lab which researches, develops and tests software tools that help clinicians make effective and evidence-based decisions. The lab uses natural language processing, machine learning and domain-specific heuristics to improve processes and to automate the identification, gathering, synthesizing and dissemination of evidence and evidence summaries to provide up -to-date relevant information for clinicians.

WHO SHOULD YOU CONTACT?**Professor Enrico Coiera**

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