

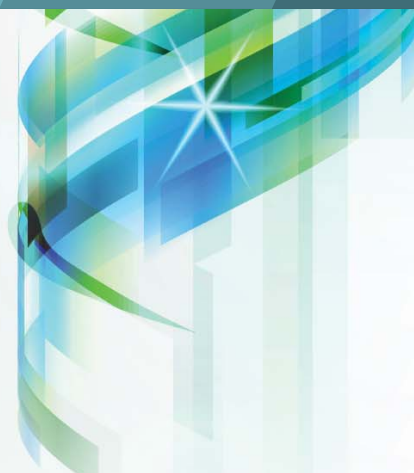


Centre for Health Systems and Safety Research Annual Report 2012

Never Stand Still

UNSW Medicine

Centre for Health Systems and Safety Research



CHSSR



CENTRE FOR HEALTH SYSTEMS
AND SAFETY RESEARCH

Better Health Care Through Communication



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Centre for Health Systems and Safety Research
Australian Institute of Health Innovation
UNSW Medicine
University of New South Wales, NSW 2052
Australia

Level 1, AGSM Building
Gate 11, Botany St
UNSW Sydney, NSW 2052

Telephone: + 61 (0)2 9385 3165
Website: www.aihi.unsw.edu.au

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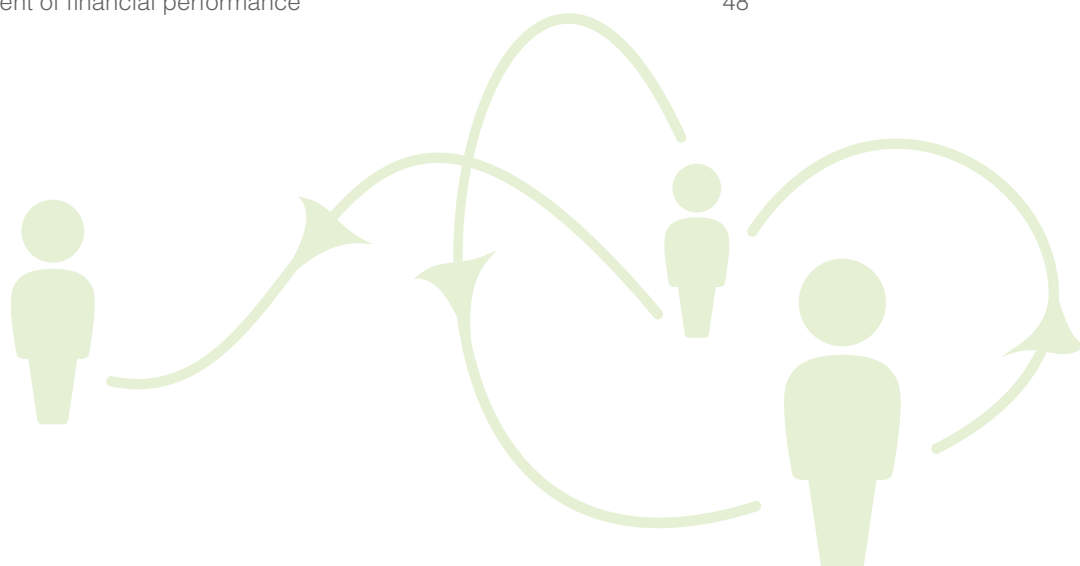


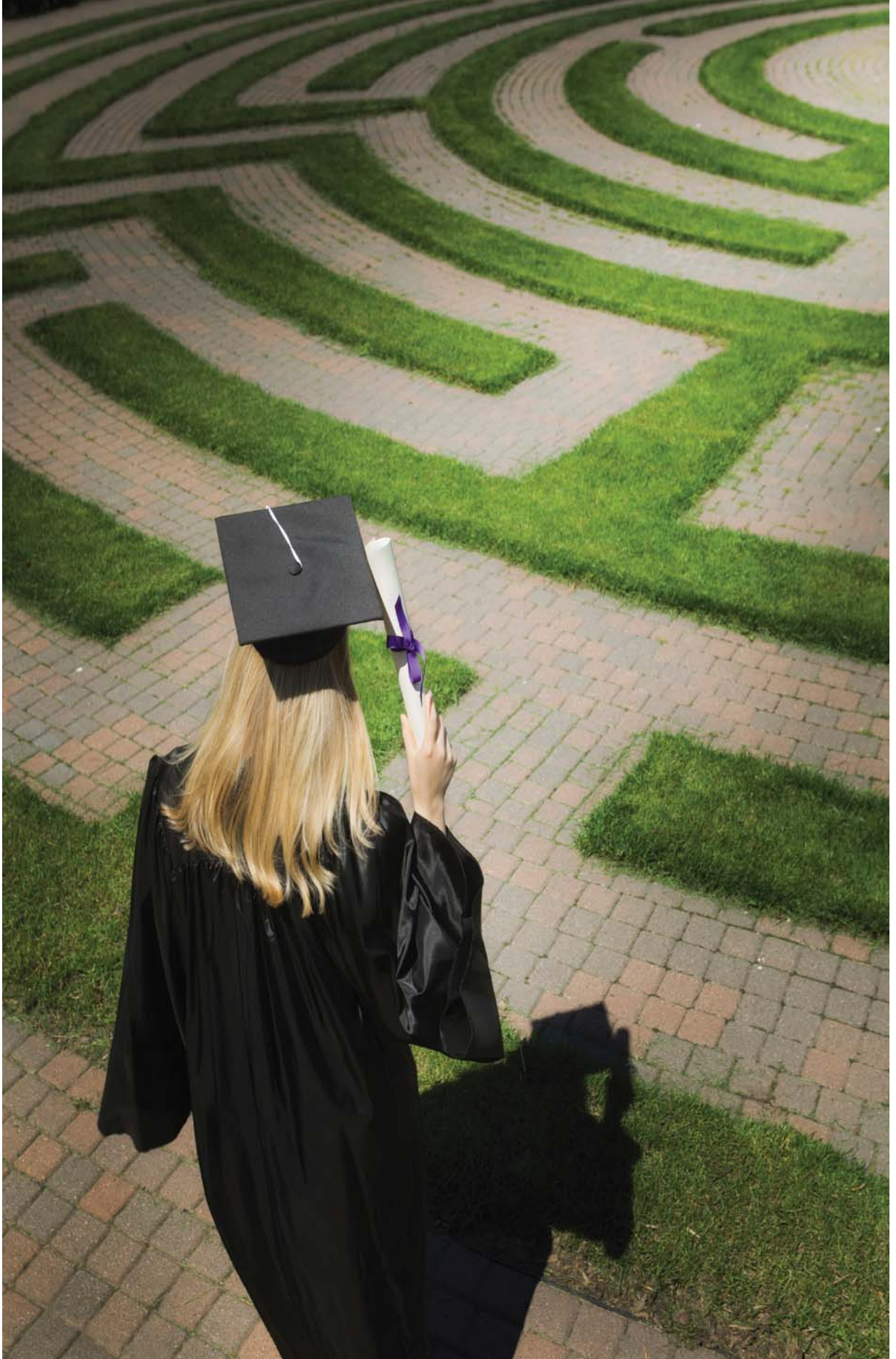
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Mission statement

Vision

To lead in the design and execution of innovative health systems research.

Mission

To produce a world-class evidence base which informs policy and practice, focusing on patient safety and the evaluation of information and communication technologies in the health sector.

Aims

The Centre's research is underpinned by a systems perspective, exploiting highly innovative and wide-ranging research methods. Its research team is characterised by its talent and enthusiasm for working within and across discipline areas and sectors. The Centre has a focus on translational research, aimed at turning research evidence into policy and practice, while also making fundamental contributions to international knowledge.

The Centre's research program has four central aims:

- Produce research evidence of the impact of information and communication technologies (ICT) on the efficiency and effectiveness of health care delivery, on health professionals' work and on patient outcomes
- Develop and test rigorous and innovative tools and approaches for health informatics evaluation
- Design and apply innovative approaches to understand the complex nature of health care delivery systems and make assessments of health care safety
- Disseminate evidence to inform policy, system design, practice change and the integration and safe and effective use of ICT in health care

Functions and Goals

The functions of the Centre are to:

- Build capacity and research capability in health systems research, patient safety and health informatics
- Deliver research output in the form of grants, publications and presentations
- Participate in the development and sharing of infrastructure and research expertise for research across the Centres of the Australian Institute of Health Innovation (AIHI)
- Encourage and support collaboration across the Centres
- Forge relationships between the Centres and other entities within and external to UNSW
- Continue to build and consolidate an international reputation in health systems and safety research

This is achieved through:

- Strong collaborative research programs supported by continued peer-reviewed grants and commissioned research
- Extensive linkages with industry, practitioners and policy makers at local, state and national levels to improve the relevance and impact of research
- Increased numbers of skilled researchers undertaking research and evaluation activities in the area of health systems and safety research
- Increased numbers of post graduate research students
- Exercising influence via dissemination and transfer of research findings through publications, presentations and forums with a focus on academic, industry, practitioner and policy maker audiences



Director's report



With the introduction of the Personally Controlled Electronic Health Record (PCEHR) in July 2012, the field of research interest of the Centre for Health Systems and Safety Research has never been more in focus or more relevant to the consumer. The Centre – the largest health informatics evaluation research team in Australia – studies how health systems work, and how information systems can improve patient safety and deliver higher-quality, more effective and efficient care.

Our team has particular expertise in evaluating how information technologies can support health care, and ascertaining what information is needed and how best to deliver it. We also study the clinical environments in which clinicians work and patients receive care.

For the Centre, 2012 began well when our five-year study showing electronic prescribing systems were associated with a greater than 50% reduction in prescribing errors was published in the prestigious journal *PLoS Medicine*. This is the first large-scale Australian study of how effective electronic prescribing systems are in reducing errors. The paper aroused considerable interest both in Australia and overseas. Media coverage included an article in *The New York Times* and items on ABC radio's AM and on ABC television's evening and morning news. The results of the study have informed hospital and state government plans to purchase and implement these systems.

Researchers from the Centre, working with a multi-disciplinary team of clinicians, managers and IT staff from St Vincent's Health, won a St Vincent's Health Australia Quality award in March for their efforts relating to the introduction of medication information technology and research demonstrating the significant improvements it brings to patient safety.

In June the Centre commercialised its Work Observation Method By Activity Timing (WOMBAT) software. WOMBAT makes it easier to conduct sophisticated time-and-motion studies of the ways health professionals work together and communicate. Using software on a handheld computer, observers capture multi-dimensional aspects of their work and communication patterns. WOMBAT automatically captures all time data related to tasks and also details interruptions to work and multi-tasking.

The Centre has developed the software over several years. With support from an ARC Discovery grant, WOMBAT – first written for PDA format – was revised in 2011–12 for use on a tablet platform. The move has given the software greater flexibility: a new web application now allows the data collection tool to be tailored for a range of different studies. The Centre has been contacted by several research teams around the world seeking to use WOMBAT.

Our aged-care informatics research accelerated in 2012 with the award of an ARC Linkage grant in partnership with UnitingCare Ageing, one of Australia's largest providers of aged and community care services. This four-year project will evaluate an integrated community care model – in particular, how well it improves service performance and clients' experience of care. This project complements other research the Centre has undertaken in residential aged-care facilities in NSW and Victoria into medication management processes which has highlighted the many challenges facilities face in delivering medication safely to residents.

Understanding test follow-up patterns and the potential role of information technology was a focus of several important papers published in 2012 by the Centre which received media coverage in Australia and overseas.

Receiving the St Vincent's Health Australia Quality award ... Dr Melissa Baysari, Research Fellow, CHSSR, Ms Kate Richardson, eMedicines Management Pharmacist, and Silvia Fazekas, Clinical Information System Manager, with Jonathan Anderson, St Vincent's Hospital's Executive Director.



The Centre published substantial research reports during 2012. One investigated how introducing clinical information systems affects hospital pathology services. Another – for the National eHealth Transition Authority – assessed how medication reconciliation and review processes improve health outcomes, with a particular focus on the implications for the PCEHR, launched by the Australian Government in July. The Centre was also commissioned by HealthDirect to conduct a review of secondary ambulance triage service models and outcomes.

The Centre is growing. Its staff expanded in 2012 with the appointment of three more biostatisticians, Diane Hindmarsh, Scott Walter and Sharyn Lymer who work across a range of projects. Congratulations too to Dr Andrew Georgiou who has been promoted to Associate Professor in the last promotions round.

The Centre's output has also increased. We published 47% more papers and reports in 2012 than the year before – demonstrating our continuing commitment to make the results of funded research widely available. We are doing more, too, to increase media coverage of key research results so the community knows the value of our work. Our engagement with a wider range of health professionals, managers and health care organisations also expanded during the year – links which are vital if our research results are to be translated into practice and policy.

It has been a busy year for me as Director. At the *Information Technology in Aged Care Conference* in Melbourne in April I gave a keynote address – The use of information technology to support improvements in quality and work efficiency: Implications of findings in hospitals for the aged care sector.

The Centre was well represented at the *National Medicines Symposium* in May. I gave a keynote address, Does technology lead to improvements in medication safety? and the Centre's Dr Elin Lehnbo presented the results of a survey about the Personally Controlled Electronic Health Record.

At the *11th International Congress on Nursing Informatics* in Montreal, Canada in June, I presented a workshop as part of the Nursing Informatics International Research Network. I also presented a paper and was part of a panel on decision support and medication safety.

Our work would not be possible without the active cooperation of the many health care organisations and government and other agencies with whom we worked this year. We value highly their contributions of time, effort and ideas, and the generosity with which health care professionals allow us to study their work. I would like to thank them, and of course the Centre's hard-working staff, for all their efforts throughout the year.

Management board



Role of the management board

The management board's role is to monitor the Centre's financial performance, assist with development of strategy and ensure that the objectives of the Centre are pursued in accordance with its terms of reference.

Management Board Members

Professor Denis Wakefield (Chair)

Associate Dean Research
Director of Office of Medical Research
UNSW Medicine

Professor Ann Williamson

Professor of Aviation Safety
Department of Aviation
Faculty of Science, UNSW

Professor Ken Hillman

Director
Simpson Centre for Health Services Research
Australian Institute of Health Innovation
Professor of Intensive Care, UNSW

Professor Ric Day

Professor of Clinical Pharmacology
St Vincent's Clinical School, UNSW

Dr George Margelis

General Manager
Care Innovations - an Intel GE Company

Mr Greg Wells

Chief Information Officer
NSW Health

Professor Johanna Westbrook

Director
Centre for Health Systems and Safety Research

Collaborating Organisations

Austin Centre for Applied Clinical Informatics, Melbourne
Austin Hospital, Victoria
Australian Catholic University
Bankstown Hospital, NSW
Campbelltown Hospital, NSW
Cancer Institute of NSW (CINSW)
Concord Repatriation General Hospital, NSW
Department of Health and Ageing
Flinders University
Harvard Medical School
HTR Business and Technology Services Pty Ltd
Liverpool Hospital, NSW
Mater Hospital, QLD
National e-Health Transition Authority (NeHTA)
HealthDirect
National Health Foundation
National Prescribing Service
NSW Health Ministry
Pathology North, NSW
Prince of Wales Hospital, NSW
Royal Adelaide Hospital, SA
Royal College of Pathologists of Australia Quality Assurance Programs
Royal North Shore Hospital, NSW
Royal Prince Alfred Hospital, NSW
Sir Moses Montefiore, NSW
South Eastern Area Laboratory Services (SEALS), NSW
Southern Cross Care, NSW & ACT
St Vincent's Hospital, NSW
Sydney South West Pathology Services, NSW
The University of Sydney, NSW
UnitingCare Ageing, NSW & ACT
University of Leeds, UK
University of Melbourne, VIC
University of Newcastle, NSW
University of Southern Queensland, QLD
University of Tasmania, TAS
University of Technology Sydney, NSW
Veteran Affairs Hospital, Houston, Texas, USA

Year at a glance

- 109 peer-reviewed research publications
- CHSSR researchers are chief investigators on research grants to the value of \$16.5 million
- 46 conference presentations
- The Centre received several awards for research publications and activities
- The Centre's work received considerable national and international media coverage with articles published in *The Sydney Morning Herald*, *The Australian*, *Newcastle Herald*, *The West Australian* and *The New York Times*, segments on ABC TV news and ABC Radio's *AM* and *PM*, and items on websites including *The Conversation*, *Medscape*, and *International Herald Tribune*.

The Human Factors and Ergonomics Society of Australia awarded the 2012 Alan Welford Award for the best paper on a human factors and ergonomics topic published in a peer-reviewed journal in 2011 to the paper 'Baysari MT, Westbrook JI, Richardson KL, Day RO Influence of computerized decision support on prescribing during ward rounds: Are the decision-makers targeted? *Journal of the American Medical Informatics Association* 2011; 18:754-759. doi: 10.1136/amiajnl-2011-000135.'

At the 11th International Congress on Nursing Informatics, Montreal, Canada, the Best Paper Award was presented to the paper 'Westbrook JI, Creswick N, Duffield C, Li L, Dunsmuir WTM. Changes in nurses' work associated with computerised information systems: Opportunities for international comparative studies using the revised Work Observation Method By Activity Timing (WOMBAT). 2012.'

CHSSR staff members Melissa Baysari, Johanna Westbrook, Ling Li and Margaret Reckmann, with Ric Day, Kate Richardson, Silvia Fazekas, David Roffe and Sandy Beveridge were part of the team that received an award for 'Exceptional Care: A culture of no harm' from St Vincent's Health Australia based upon their contribution to 'Transforming medication safety through information technology (eMMS)'.

- Several large competitive research grants – including an Australian Research Council Linkage Project grant worth \$1.25 million in partnership with UnitingCare Ageing to develop an evaluation model for assessing the effectiveness of ICT to integrate services and improve service performance and the experience of clients.







Research programs

Medication safety and ehealth systems



Medication error and inappropriate medication therapy are two of the oldest, most costly and least tractable safety problems which health systems face. Information technology (IT) has the potential to make medication management safer and more effective. With that expectation, health systems worldwide are making vast investments in IT. In the next decade nearly all prescribing will rely on an electronic system. Our research is investigating the ways in which information technology can reduce medication errors and support improved medication therapy decisions and outcomes.

Electronic medication management systems significantly reduce prescribing errors

Electronic medication management systems (eMMS) have been heralded as one of the most effective ways of reducing prescribing errors and improving patient safety. In 2012 we published the results of a five-year study to assess whether the introduction of an eMMS at two major teaching hospitals resulted in fewer prescribing errors.

Using a controlled before-and-after study, we reviewed 3,291 patient medical records to identify prescribing error rates before and after the introduction of an eMMS. At both hospitals, prescribing error rates declined by more than 50%. Importantly, we found that the rate of serious prescribing errors decreased by 44%, from 25 serious errors per 100 admissions to 14 per 100 admissions.

Use of eMMS was associated with a greater than 50% reduction in prescribing errors and a 44% reduction in serious prescribing errors

Selected publication

Westbrook JI, Reckmann M, Li L, Runciman W, Burke R, Lo C, **Baysari MT,** Braithwaite J, Day RO. Effects of two commercial electronic prescribing systems on prescribing error rates in hospital inpatients: A before and after study. *PLoS Medicine*. 2012; 9 (1):e1001164.

Doctors in hospitals on average receive very limited feedback regarding the types of prescribing errors which occur. Good data about the types of errors which occur are not readily available because identifying them requires very resource-intensive audits of medication charts. We used interviews to investigate prescribers' views about the problem of medication errors. These revealed that prescribers believed they rarely made prescribing errors, and as a result failed to see the need for an eMMS to reduce them. Keeping prescribers informed about their prescribing errors and the quality improvement benefits of eMMS may lead to greater acceptance of and satisfaction with eMMS, including the computerised alerts embedded within them. Electronic medication management systems provide new opportunities for extracting and monitoring prescribing errors compared to traditional paper-based medication charts. However, research to investigate the best mechanisms for this is required.

Selected publication

Baysari MT, Westbrook JI, Day RO. *Understanding doctors' perceptions of their prescribing competency and the value they ascribe to an electronic prescribing system.* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information.* Amsterdam: IOS Press; 2012. (178) p. 1-6.

New errors associated with the use of eMMS

It is now well recognised that clinical information systems have unintended consequences, one of which is the introduction of new types of errors. We have led important work to identify and quantify new errors associated with the use of eMMS. This has included the development of a classification to recognise both the manifestations and mechanisms of such errors. Comparing two commercial eMMS we found that system-related errors are frequent and few are detected. Selecting incorrectly from a drop-down menu is a frequent error. Many system-related errors can be avoided by making changes to eMMS software or design features. For example, changing the position

of frequently-used medications on drop-down menus, and reducing opportunities for selection errors via the use of pre-populated detailed order sentences rather than having clinicians enter orders from scratch.

Selected publication

Westbrook JI, Baysari MT, Li L, Burke R, Richardson K, Day RO. The safety of electronic prescribing: Rates, manifestations and mechanisms of system-related errors associated with two commercial systems in hospitals. *Journal of the American Medical Informatics Association.* 2013; (Accepted 12 May).

Incorrectly selecting from a drop-down menu is a frequent source of error

Clinical Decision Support for Medication Safety

One of the important features of electronic clinical information systems is the capacity to embed decision support systems to guide decision making. However, research is vital so we can understand when and how to provide alerts to clinicians. There is a great risk of alert fatigue – where alerts are so frequent that system users start to ignore them.

An innovative study published in 2012 looked at the different ways a doctor uses an eMMS to find out how those differences change the number of alerts received. We found a large proportion of computerised alerts were triggered because prescribers were not using all functions of the eMMS. The results highlighted the need for the system to be redesigned, and its users trained, to ensure doctors receive fewer but more meaningful alerts.

We found that a large proportion of computerised alerts were being triggered because prescribers were not using all functions of the eMMS

Following on from our research exploring the effect of decision support on prescribing during ward rounds, in 2012 we completed a study of junior doctors' prescribing decisions after hours (5pm–10pm daily). We found junior doctors at night read computerised alerts and used on-line reference material to support their decision making.

“...junior doctors at night read computerised alerts and used on-line reference material to support their decision making”

Selected publications

Baysari MT, Reckmann MH, Li L, Day RO, Westbrook JI. Failure to utilise functions of an electronic prescribing system and the subsequent generation of ‘technically preventable’ computerised alerts. *Journal of the American Medical Informatics Association.* 2012; 19:1003-10.

Jaensch SL, **Baysari MT, Day RO, Westbrook JI.** Junior doctors' prescribing work after-hours and the impact of computerised decision support. *International Journal of Medical Informatics.* 2013; (Accepted 30 June).

The value of medication reconciliation and review

Medication safety relies on accurate information about an individual's medication history. Medication reconciliation and medication review are terms for the documenting and evaluation of a patient's current medications at each point of contact with the health system. To be effective, these processes require information that is complete and up-to-date. Here electronic health record (EHR) systems have a major role, allowing medication information to move with the patient between different health care providers.

An extensive review of current evidence on this topic conducted by the Centre for the National e-Health Transition Authority (NeHTA) provided insights into the effect of medication reconciliation and review on health outcomes. The evidence shows medication reconciliation and review can identify a high

proportion of medication discrepancies and detect inappropriate prescribing, but whether they improve health outcomes is less clear. Evidence showing EHRs improve both medication reconciliation and review, and also subsequent health outcomes, is very limited.

Selected publication

Lehnbom EC, Stewart MJ, Wiley J, Manias E, Westbrook JI. *Do medication reconciliation and review improve health outcomes? A review of the evidence and implications for the impact of the Personally Controlled Electronic Health Record (PCEHR).* Sydney, Australia: Australian Institute of Health Innovation, University of New South Wales, July 2012.

Improving antibiotic prescribing in hospitals



Antibiotic resistance resulting from inappropriate use of antibiotics is a worldwide health problem. Hospitals rely on stewardship guidelines to ensure the most effective use of antibiotics. Our research aims to establish how to ensure such guidelines are effective and to investigate strategies to support their easy integration into clinical practice.

In a study completed in 2012, we interviewed hospital prescribers and policy makers to explore what helps or hinders compliance with an institutional policy on prescribing antibiotics. We identified several barriers to compliance, such as poor knowledge of policy details, and the existence of medical hierarchies

which may result in junior doctors knowingly not complying with hospital policies because of instructions from senior doctors. Even though they reported they knew of the antibiotic prescribing policy, most prescribers did not comply with the policy when completing patient case-scenarios during the interviews.

In an innovative study designed to investigate ways to improve compliance with antibiotic prescribing policy, we provided individualised weekly feedback to doctors about their recent compliance with an antibiotic policy. We observed no change in compliance with the policy following feedback, but we did identify several practical problems with the policy and the associated approval process which were not known before the trial. These included that the antibiotic policy written into the decision support of the hospital's eMMS was not consistent with hospital policy, causing confusion. The findings prompted action to address these issues. Many of the problems we identified are generic issues of importance to all organisations seeking to integrate antimicrobial stewardship into electronic prescribing systems.

In a multi-site survey, we set out to determine whether Australian hospitals had implemented effective systems for monitoring aminoglycosides, as recommended in the recent Therapeutic Guidelines. Thirty-one stakeholders (pharmacists, laboratory scientists, clinicians) from 18 hospitals participated in a brief telephone survey. We discovered participants from only five hospitals were using the recommended computerised methods for monitoring, with implementation elsewhere prevented chiefly by a lack of resources. While stakeholders were generally aware of the revised aminoglycoside guidelines, they also felt left in the lurch.

We also conducted a retrospective review of the charts of adults with community acquired pneumonia (CAP) admitted through an emergency department for a period of six months. The purpose was to evaluate the use of pneumonia severity scores for patients diagnosed with CAP, and to assess whether the antibiotics prescribed for them followed the guidelines for the calculated severity of the disease. Of the 69 patients who had radiographic evidence and symptoms of CAP, we found a severity score had been calculated for just one. We calculated severity for the remaining 68 patients using several of the

recommended scoring systems. Compliance with the guidelines on appropriate prescribing was poor in our sample, but we also found that compliance varied with the scoring system used. This study highlights the need for a single, simple and easy-to-use pneumonia severity score to guide choice of the appropriate antibiotic.

Selected publications

Baysari MT, Tang T, Brett J, Day RO. Implementation of revised aminoglycoside guidelines in Australia: Hospitals 'left in the lurch' to implement appropriate monitoring [Editorial]. *Journal of Pharmacy Research and Practice*. 2012; 42(3):178-9.

Brett J, Lam V, **Baysari MT**, Milder T, Killen L, Chau AMT, McMullan B, Harkness J, Marriot D, Day RO. Use of pneumonia severity scores and antibiotic prescribing in the management of community-acquired pneumonia at an Australian tertiary teaching hospital. *Journal of Pharmacy Practice and Research*. 2013; (Accepted 16 May).

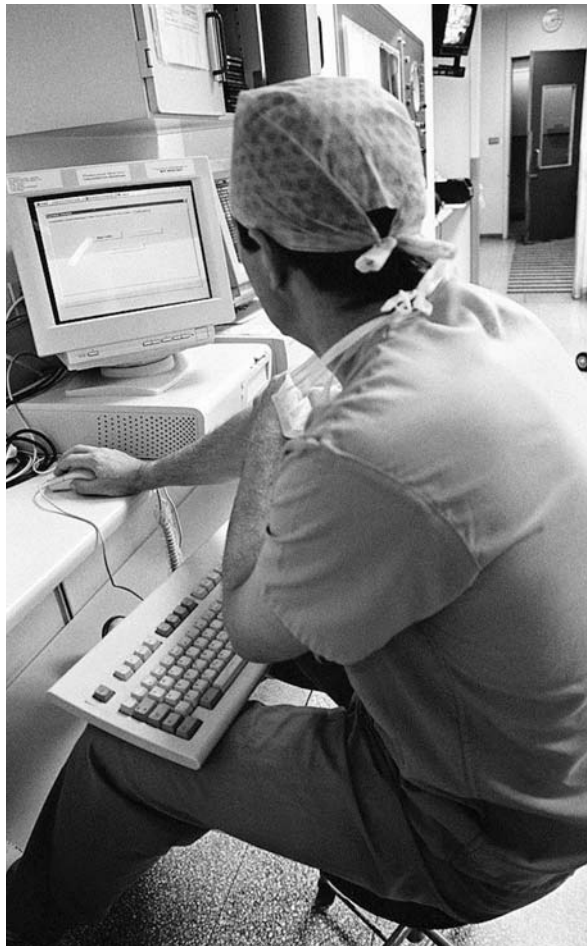
Teo CK, **Baysari MT**, Day RO. Understanding compliance to an antibiotic prescribing policy: Perspectives of policymakers and prescribers. *Journal of Pharmacy Practice and Research*. 2013; 43:32-6.



Innovation in clinical work practices and information technology

Information Technology (IT) is considered essential to improving the efficiency of health systems and to enhancing care delivery and patient safety. An Australian Research Council (ARC) Linkage Grant has supported our research partnership with local health districts which involves a large group of teaching hospitals in the Sydney metropolitan area. The research has investigated how clinical information systems can be used as an agent of change and innovation.

The project has provided a unique opportunity to generate valuable evidence about the ways IT is used in different sites, clinical settings (for example, emergency departments, outpatients, critical care) and departments (pathology and medical imaging). The project also investigates different clinical systems including Computerised Provider Order Entry (CPOE), and information systems for emergency departments (EDs) and pathology and medical imaging.



The quality of care in emergency department settings

Emergency medicine is an ideal place to study the application of information and communication technology and its effect on physicians and nurses. Our systematic review of the effect of CPOE systems (often with decision support capabilities) in EDs showed they brought a number of tangible benefits. For example, the support such systems provide for clinical decisions was related to significant decreases in prescribing errors (which in one study fell from 222 to 21 errors per 100 orders), and potential adverse drug events (from 3.7 to 2.8 per 100 orders).

Our qualitative work involved four urban EDs and 97 participants from among physicians and nurses. The results highlighted ED clinicians' perspectives on how ED information systems can provide faster and synchronous access to information about patients, conditions and treatments. They were perceived to improve the coordination of care, communication and clinical documentation.

"No matter where you are, on whatever ward, or if you're seeing someone else, you can still pull it up and talk about a patient you may have seen, you know, on the other side of the hospital."

Selected publications

Callen J, Paoloni R, **Li J**, **Stewart M**, Gibson K, **Georgiou A**, Braithwaite J, **Westbrook JI**. Perceptions of the effect of information and communication technology on the quality of care delivered in Emergency Departments: A cross-site qualitative study. *Annals of Emergency Medicine*. 2013; 61(2):131-44.



Creswick N, Callen J, Li J, Georgiou A, Isedale G, Robertson L, Paoloni R, Westbrook JI. A qualitative analysis of emergency department nurses' perceptions of the effects of an integrated clinical information system. *Electronic Journal of Health Informatics*. 2012; 7(1):e4.

Georgiou A, Prgomet M, Paoloni R, Creswick N, Hordern A, Walter SR, Westbrook J. The effect of Computerized Provider Order Entry systems on clinical care and work processes in emergency departments: A systematic review of the quantitative literature. *Annals of Emergency Medicine*. 2013; 61(6):644-53.

Georgiou A, Westbrook JI, Braithwaite J. An empirically-derived approach for investigating Health Information Technology: The Elementally Entangled Organisational Communication (EEOC) framework. *BMC Medical Informatics and Decision Making*. 2012; 12(1):68.

Li J, Westbrook JI, Callen J, Georgiou A. The role of ICT in supporting disruptive innovation: A multi-site qualitative study of nurse practitioners in emergency departments. *BMC Medical Informatics and Decision Making*. 2012; 12(1):27.

Westbrook JI, Li L, Georgiou A, Paoloni R, Cullen J. Impact of an electronic medication management system on hospital doctors' and nurses' work: A controlled pre post, time and motion study. *Journal of the American Medical Informatics Association*. 2013; (Accepted 7 May).

Socio-technical perspective to the evaluation of IT in ICUs

Socio-technical research perspectives draw attention to the interfaces between the technical features of health IT and the particular social and human context in which they are situated. Our work on the effect of health IT in Intensive Care Units (ICUs) has applied socio-technical approaches to understanding how it affects nursing work practices, clinical decision making and collaborative practices associated with ward rounds.

We studied four ICUs to compare their different IT systems, work practices and cultures. We found that while clinicians perceived clear benefits associated with health IT, there were major differences between the ICUs. This evidence showed that many factors can affect the way IT is implemented and used within ICUs. These can be attributed to aspects of the team climate and culture of the ICU, and also to clinical work practices both within the ICU and across the hospital.

"I think it* increases the ability for us to actually get through the ward round and it makes sure we actually see what we need to see and it also means that the patients are safe because everyone's on the same page."

* Picture Archiving Communication System

Selected publications

Georgiou A, Hains IM, Milliss D, Ridley L, Westbrook JI. *Integrating PACS and CPOE in the ICU – the challenge of delivering health information technology-enabled innovation.* *Critical Care Ultrasound*: Elsevier; 2013. (Accepted 5 December 2012).

Hains IM, Creswick N, Milliss D, Parr M, Westbrook JI. *An ICU clinical information system – clinicians' expectations and perceptions of its impact.* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information.* Amsterdam: IOS Press; 2012. (178) p. 64-70.

Hains IM, Creswick N, Westbrook JI. *Does PACS facilitate work practice innovation in the intensive care unit?* In: Moen A, Andersen SK, Aarts J, Hurlen P, editors. *User Centred Networked Health Care - Proceedings of MIE 2011.* Amsterdam: IOS Press; 2011. (169) p. 397-401.

Hains IM, Georgiou A, Westbrook JI. The impact of PACS on clinician work practices in the intensive care unit: A systematic review of the literature. *Journal of the American Medical Informatics Association.* 2012; 19(4):506-13.

Evaluating the impact of an electronic Drug Monitoring System (eDMS) in outpatients

Although medication monitoring for chronic rheumatology disease patients is critically important given the potential toxicity of anti-rheumatic drugs, monitoring practices vary widely. Monitoring long-term medications in the laboratory takes time, and involves cumbersome paper-based communication between physicians, nurses and laboratories. Following up abnormal results can be delayed as a result. The medication monitoring of chronic rheumatology disease patients is thus a critical safety issue.

Our work in this area centred on evaluating the effect of an electronic drug monitoring system for outpatient rheumatology patients. We investigated the role of information technology in supporting nurses who monitor patients' medication in terms of the time spent on drug monitoring, documentation and communication. Our findings revealed that following the introduction of eDMS nurses spent significantly less time on medication monitoring tasks (pre-eDMS 33.1% versus post-eDMS 26.4%) and significantly more time on patient care (pre-eDMS 6.5% versus post-eDMS 18.1%). Nurses reported that the eDMS also helped to standardise monitoring – which was perceived to improve efficiency and care safety.

Selected publications

Callen J, Hordern A, Gibson K, Li L, Hains IM, Westbrook JI. Can technology change the work of nurses? Evaluation of a drug monitoring system for ambulatory chronic disease patients. *International Journal of Medical Informatics.* 2013; 82:159-67.

Hordern A, Callen J, Gibson K, Robertson L, Li L, Hains IM, Westbrook JI. *Use of an electronic drug monitoring system for ambulatory patients with chronic disease: How does it impact on nurses' time spent documenting clinical care?* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information.* Amsterdam: IOS Press; 2012. (178) p. 71-6.



Failure to follow-up test results – a critical patient safety issue



Australia spends over \$1 billion a year on medical tests, a cost that is rising steadily as new technology offers ever more sophisticated ways of identifying diseases and health risks, and as ageing populations develop ever more complex medical needs. Yet a systematic review produced by our team has shown that up to 62 per cent of laboratory tests and up to 36 per cent of radiology tests for patients attending GPs, clinic or hospital outpatient departments are never reviewed by doctors. These unread reports included tests which had returned positive findings for cancer.

Technological solutions have a role in enhancing the safety and effectiveness of test result management. However, the evidence suggests that health IT solutions need to be:

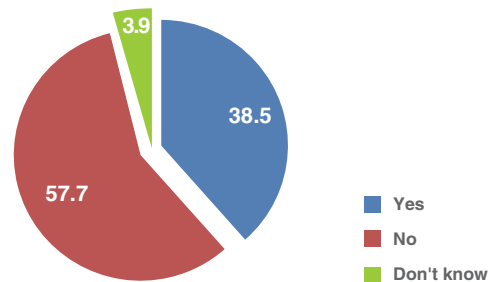
- informed by careful planning that accounts for existing multi-disciplinary processes and practices
- underpinned by clear operational standards and definitions
- enhanced by a commitment to monitoring and evaluating change as an essential part of the dynamic process of continuous quality improvement.

The Centre is using an ARC Discovery grant to examine whether electronic test management systems produce measurable improvements in test result follow-up and communication between clinicians, pathology laboratories and medical imaging departments. The project includes a collaboration

with researchers in the US to investigate the barriers and facilitators to providing direct notification of significantly abnormal test results to patients.

In 2012 we surveyed emergency department physicians. Responses to the survey (10 staff specialists and 9 registrars) showed that only 38.5% were comfortable with notifying patients of their test results. Key concerns related to perceptions of patient anxiety (88.5%), confusion (92.3%) and a perceived lack of expertise necessary to interpret results (88.5%).

Are doctors comfortable with notifying patients of their results? (%)



Selected publications

Callen J, Georgiou A, Paoloni R, Stewart M, Westbrook JI. Direct notification of abnormal test result to patients: What do emergency department clinicians think? [Abstract]. *National Health Information Management Conference*; 29-31 October; Gold Coast, Australia. 2012.

Callen J, Georgiou A, Westbrook JI. Evaluation of solutions aimed at reducing the incidence of missed test results: Can technology assist? [Abstract]. *14th Asian Oceanian Congress of Radiology (AOCR)*; 30 August-2 September; Sydney, Australia. 2012.

Callen JL, Westbrook JI, Georgiou A, Li J. Failure to follow up test results for ambulatory patients: A systematic review. *Journal of General Internal Medicine*. 2012; 27(10):1334-48.

Georgiou A, Prgomet M, Toouli G, Callen J, Westbrook JI. What do physicians tell laboratories when requesting tests? A multi-method examination of information supplied to the Microbiology laboratory before and after the introduction of electronic ordering. *International Journal of Medical Informatics*. 2011; 80(9):646-54.

The impact of information technology systems on the effectiveness of pathology and medical imaging services



Pathology and medical imaging services generate extensive volumes of information which underlie clinical decisions about patient admission, treatment, medication choice and discharge. Information technology is widely seen as a way to support more efficient use of pathology and medical imaging, informing decision-making within primary, secondary and tertiary care.

Pathology

In 2012 we undertook a project funded by an Australian Department of Health and Ageing Quality Use of Pathology Program grant to investigate the electronic ordering of hospital pathology services. This research evaluated the ordering of pathology services at six hospital sites – to our knowledge, one of the largest evaluations of its kind.

The project investigated the effect of electronic ordering on the legibility and completeness of laboratory test orders, the volume and mix of tests, the timeliness of the pathology laboratory process and its effect on patient outcomes.

Comparisons before (2008) and after (2011) an electronic ordering system was implemented showed a significant decrease in the average number of tests ordered in each test order episode at each hospital.

Our comparisons of laboratory turnaround time (the time taken by the laboratory to complete the entire testing process) revealed a significant three-minute difference for data entry between electronic orders and handwritten orders in the Central Specimen Reception area, which helped lower median test turnaround times by up to 12 minutes per test.

Selected publications

Aller RD, **Georgiou A**, Pantanowitz LJ. *Electronic health records*. In: Pantanowitz L, Tuthill MJ, Balis Ulysses G, editors. *Pathology Informatics – Theory and Practice*. Canada: American Society for Clinical Pathology Press; 2012. p. 217-30.

Georgiou A, Lam M, Allardice J, Hart GK, **Westbrook JI**. Troponin testing in the emergency department – a longitudinal study to assess the impact and sustainability of decision support strategies. *Journal of Clinical Pathology*. 2012; 65(6):546-50.

Georgiou A, **Vecellio E**, **Toouli G**, Eigenstetter A, **Li L**, Wilson R, **Westbrook JI**. The impact of the implementation of electronic ordering on hospital pathology services. *Report to the Commonwealth of Australia, Department of Health and Ageing, Quality Use of Pathology Committee*. 2012; Australian Institute of Health Innovation, University of New South Wales, Sydney. ISBN: 978-0-7334-3194-4.

Li L, Georgiou A, Vecellio E, Eigenstetter A, Toouli G, Wilson R, Westbrook JI. Impact of the performance of pathology service on patient length of stay in emergency department, using a multilevel regression model [Abstract and Oral presentation]. *Australasian Applied Statistics Conference*; 3-7 December; Queenstown, New Zealand. 2012.

Toouli G, Georgiou A, Westbrook JI. Changes, disruption and innovation - an investigation of the introduction of new health information technology in a microbiology laboratory. *Journal of Pathology Informatics*. 2012; 3:16.

Vecellio E, Georgiou A, Toouli G, Westbrook JI. Volume, rates, source and types of add-on pathology test requests across five hospitals. *Clinical Chemistry and Laboratory Medicine*. 2012; 50(6):1041-8.

Imaging

In imaging our work has focused on the effect of Picture Archiving Communication Systems (PACS) on clinical work, communication and organisation in intensive care units (ICU). The Centre published a systematic review of research evidence in 2012, showing PACS is associated with faster access to images and improvements in the availability of images by up to 30 minutes for routine examinations. In addition, survey evidence showed 90% of users believed images were available sooner, and 72% reported there were no longer problems with lost images.



The evidence also showed major gaps in the literature relating to the effect of PACS on the way clinical work is planned, coordinated and synchronised. One of our recent qualitative studies investigated ward-round work practices associated with PACS in the ICU. It concluded that the availability of PACS at bedside computers did not automatically lead to its integration into ward-round discussions and decision making. The factors that could have influenced this finding included issues related to computer screen resolution and contextual factors (the make-up of the particular unit, its size, location and patient intake) that may be unique to each setting.

Selected publications

Creswick N, Callen J, Li J, Georgiou A, Isedale G, Robertson L, Paoloni R, Westbrook JI. A qualitative analysis of emergency department nurses' perceptions of the effects of an integrated clinical information system. *electronic Journal of Health Informatics*. 2012; 7(1):e4.

Georgiou A, Prgomet M, Markewycz A, Adams E, Westbrook JI. The impact of computerized provider order entry systems on medical-imaging services: a systematic review. *Journal of the American Medical Informatics Association*. 2011; 18(3):335-40.

Hains IM, Georgiou A, Westbrook JI. The impact of PACS on clinician work practices in the intensive care unit: A systematic review of the literature. *Journal of the American Medical Informatics Association*. 2012; 19(4):506-13.

Stewart M, Georgiou A, Hordern A, Dimigen M, Westbrook JI. *What do radiology incident reports reveal about in-house communication processes and the use of health information technology?* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p.213-8.

Communication and work patterns



We are investigating patterns of clinicians' work, how best to capture complex work patterns including interruptions and the extent of multi-tasking undertaken. Through grants from the Australian Research Council and the National Health and Medical Research Council, we are assessing how large-scale interventions such as the implementation of clinical information systems drive changes in patterns of work.

Measuring how the introduction of computerised clinical systems changes doctors' and nurses' work

How far computerised clinical information systems hinder or help the efficiency of doctors and nurses has been a subject of debate and investigation for more than 20 years. Yet evidence remains sparse.

We investigated the work patterns of 129 doctors and nurses before and after an electronic medication management system (eMMS) was introduced at a major teaching hospital. Doctors and nurses on wards with an eMMS spent similar proportions of time on medication and direct patient care tasks compared to their colleagues on wards with no eMMS.

However doctors on wards with an eMMS spent significantly less time alone and more time with other doctors and patients. Nurses on the wards with eMMS spent significantly less time with doctors compared to nurses on wards with no eMMS. Importantly, we showed that on these same wards with eMMS the prescribing error rate significantly declined by over 50%.

Thus eMMS do not appear to increase time on medication tasks and do not take doctors and nurses away from direct patient care activities.

Selected publication

Westbrook JI, Li L, Georgiou A, Paoloni R, Cullen J. Impact of an electronic medication management system on hospital doctors' and nurses' work: A controlled pre post, time and motion study. *Journal of the American Medical Informatics Association*. 2013; (Accepted 7 May).

How do junior doctors spend their time at night?

In 2012, we conducted one of the first studies to track how junior doctors spend their time while on night duty. We undertook a time-and-motion study of doctors' work between 10pm and 8am. We found that doctors spent 72% of the night shift alone. Compared with doctors during the day, night-time doctors spent greater proportions of time engaged in social/personal tasks (e.g. sleeping, eating) and indirect care, but a similar proportion of time engaged in direct patient care.

Selected publication

Arabadzhiyska P, **Baysari M, Walter S**, Day RO, **Westbrook JI**. Shedding light on junior doctors' work practices after hours. *Internal Medicine Journal*. 2013; (Accepted 18 June).



Use of WOMBAT to monitor Doctors' work

WOMBAT tool accurately observes health professionals' work



The Work Observation Method by Activity Timing (WOMBAT) technique, developed by the Centre, is used to conduct observational time-and-motion studies of health professionals' work using software on a handheld computer. It allows us to capture multiple dimensions of work including what tasks are completed, with whom, and what information and other tools are involved in the task. It also concurrently collects the number of interruptions to work and how frequently health professionals multi-task.

In 2012 with the support of Intersect (an eResearch services organisation) we updated our WOMBAT software, converted it to the Android platform and developed a web application to allow us to adapt the tool for a wider range of studies of different professional groups. We also made the WOMBAT software available by licence to other research teams. As a result, new studies of the work of ophthalmologists in the UK and of the work of intensive care staff in the US are under way using WOMBAT.

We presented an overview of the new WOMBAT application at the 11th International Congress on Nursing Informatics in Montreal in Canada, where the paper received a best paper award.

Selected publication

Westbrook JI, Creswick N, Duffield C, Li L, Dunsmuir WTM. Changes in nurses' work associated with computerised information systems: Opportunities for international comparative studies using the revised Work Observation Method By Activity Timing (WOMBAT). *11th International Congress on Nursing Informatics*; June 23-27; Montreal, Canada. Bethesda, USA: American Medical Informatics Association; 2012. p. 448-52.

Examination of medication advice seeking networks on hospital wards

Our research on social networks in health continued: a new paper examined how medication information is communicated among staff on hospital wards. We compared who clinicians seek medication advice from on hospital wards, and the rates at which prescribing errors occurred on those wards. Medication advice-seeking amongst staff on hospital wards was limited. Key hubs of medication information included pharmacists, junior doctors and senior nurses. This innovative study found the ward with stronger networks had a significantly lower rate of prescribing errors – suggesting that the more clinicians discuss medication tasks the lower the prescribing error rate. This association indicates a promising area for further investigation.

Selected publications

Creswick NJ, Westbrook JI. Who do hospital doctors and nurses go to for advice about medications? A social network analysis and examination of prescribing error rates. *Journal of Patient Safety*. 2013; (Accepted 29 April).

Cunningham F, Ranmuthugala G, Plumb J, **Georgiou A, Westbrook J**, Braithwaite J. Health professional networks as a vector for improving health care quality and safety. A systematic review. *BMJ Quality & Safety*. 2012; 21(3):239-49.

Cunningham F, Ranmuthugala G, **Westbrook JI**, Braithwaite J. Net benefits: Assessing the effectiveness of clinical networks in Australia through qualitative methods. *Implementation Science*. 2012; 7:108:doi: 10.1186/748-5908-7-108.

Westbrook JI. Interruptions to clinical work: How frequent is too frequent? [Commentary]. *Journal of Graduate Medical Education*. 2013; 5 (Accepted 18 December).



Enhancing the coordination, continuity and quality of aged and community care services



Delivering quality home, community and residential services to older people is a growing challenge in Australia and internationally. To be successful, aged and community care must ensure proper access to services, support appropriate independence for individuals, and provide smooth transitions between different types and levels of care.

Information and communication technologies (ICT) can help meet these challenges by offering direct assistance (e.g. telehealth), by promoting people's engagement and social connection and, through large-scale systems, by enhancing the integration and coordination of care.

Integrating services to improve service performance and client experience

In 2012 the Centre was awarded a large-scale Australian Research Council Linkage Grant with UnitingCare Ageing, the largest single provider of aged and community care services in NSW and the ACT, to evaluate an innovative community-care service model underpinned by sophisticated ICT infrastructure which supports the delivery of integrated aged-care services. The research program will generate valuable

evidence about the performance of the community-care service model and its value to clients, its effect on organisational work practices and management, and its benefits to the broader community.

Selected publications

Georgiou A, Marks A, Braithwaite J, Westbrook JI. Gaps, disconnections, and discontinuities—the role of information exchange in the delivery of quality long-term care. *The Gerontologist*. 2013; (First published online: 26 October 2012).

Lyhne S, Georgiou A, Marks A, Tariq A, Westbrook JI. Towards an understanding of the information dynamics of the handover process in aged care settings - a prerequisite for the safe and effective use of ICT. *International Journal of Medical Informatics*. 2012; 81(7):452-60.

Stewart MJ, Georgiou A, Westbrook JI. Successfully integrating aged care services: A review of the evidence and tools emerging from a long-term care program. *International Journal of Integrated Care*. 2013; 13(Jan-Mar):URN:NBN:NL:UI:10-1-114280.

Medication safety in residential aged-care facilities

Medication safety in aged-care facilities is a major problem for health and aged-care services world-wide. Studies show that up to 70% of residents have experienced at least one medication error. The most commonly identified problems involve polypharmacy, excessive use of tranquilisers, and the administration of medications by untrained or unqualified staff. It is estimated that up to 30% of hospital admissions for people aged 75 years and over are due to adverse events, the great majority of which are considered preventable.

Our research in this area includes qualitative and quantitative projects designed to identify the risk factors underlying prescribing errors in residential aged-care facilities. These factors include major problems associated with the storage and communication of information. One of our studies surveyed the communication practices of staff at three residential aged-care facilities. It found that for every shift they complete by hand a median of six forms, and spend 30 minutes transferring information from paper to computer systems. These findings provide valuable evidence that can help to promote more efficient and safer information exchange about medication and care processes within facilities and across the community.

“Studies show that up to 70% of residents have experienced at least one medication error.”

Selected publications

Gaskin S, Georgiou A, Barton D, Westbrook JI. Examining the role of information exchange in residential aged care work practices – a survey of residential aged care facilities. *BMC Geriatrics*. 2012; 12(1):40.

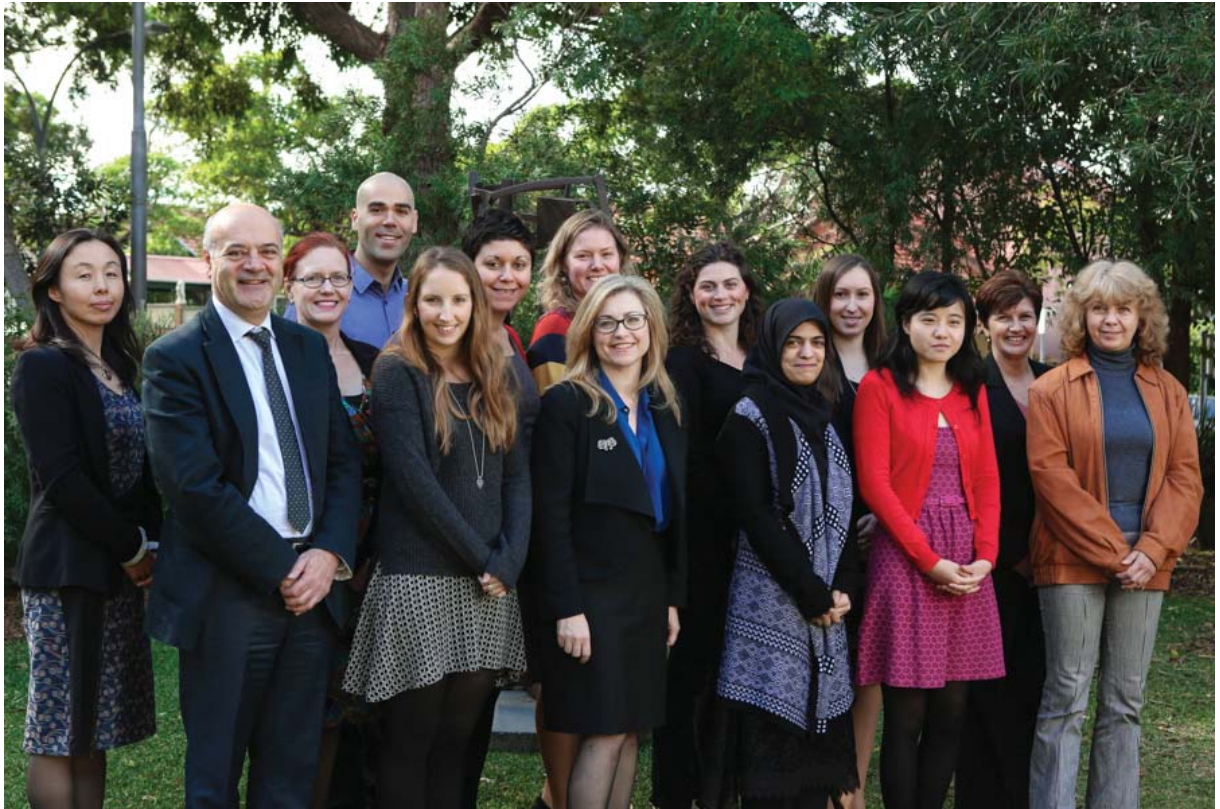
Tariq A, Georgiou A, Westbrook JI. Medication incident reporting in residential aged care facilities: Limitations and risks to residents' safety. *BMC Geriatrics*. 2012; 12(1):67.

Tariq A, Georgiou A, Westbrook JI. Medication errors in residential aged care facilities: A distributed cognition analysis of the information exchange process. *International Journal of Medical Informatics*. 2013; 82(5):299-312





Staff



Director



Professor Johanna Westbrook

BAppSc (MRA) Distinc. Cumb, MHA UNSW, GradDipAppEpid NSW VETAB, PhD Sydney, FACHI, FACMI

Professor Westbrook is Director of the Centre for Health Systems and Safety Research (CHSSR),

Australian Institute of Health Innovation (AIHI), UNSW Medicine, University of New South Wales. Her research expertise centres on the design and execution of complex multi-method evaluations in the health sector with a particular focus on the effective use of information and communication technologies. The CHSSR is the largest health informatics evaluation research team in Australia and the team's work is highly competitive with international

groups. Professor Westbrook has undertaken leading research on medication safety, the effectiveness of electronic medication management systems to reduce errors and safe work and communication practices in hospitals. Prior to her research in patient safety and informatics, Professor Westbrook undertook and published a body of research reporting large epidemiological studies including population based surveys, analyses of large administrative datasets, and cohort studies of patients with dyspepsia and reflux disease. This includes the first study to demonstrate a birth cohort effect among Australians with peptic ulcer disease. She has an extensive publication record which includes over 200 refereed publications, has attracted in excess of \$34M in research funding and won several awards for her research.

Senior Research Fellows



Associate Professor Joanne Callen
BA UNSW, DipEd SydTeachColl, MPH (Research) Sydney, PhD UNSW

Associate Professor Callen's research centres on exploring how information and communication technology (ICT) can improve health outcomes for patients and support health professionals in the delivery of high quality, safe and efficient patient care. Her work encompasses the qualitative exploration of facilitators and barriers to the implementation of clinical information systems. A particular area of interest is the use of ICT to improve the safety of test result management. This research explores how ICT can improve communication between patients, clinicians and laboratory staff regarding laboratory and radiology test results. Prior to her role at the CHSSR, Associate Professor Callen was Head of the Health Informatics Discipline at the University of Sydney. She is currently Editor-in-Chief of the *Health Information Management Journal*.



Associate Professor Andrew Georgiou
BA LaTrobe, DipArts Sydney, MSc Southampton, PhD Sydney, FCHSM, FACHI

Associate Professor Andrew Georgiou is a Senior Research Fellow at the Centre for Health Systems and Safety Research. He was awarded his PhD in 2009 and is currently investigating the impact of electronic ordering systems in acute care settings and their contribution to innovation in work practices and improvements in the safety and quality of patient care.

Associate Professor Georgiou has worked as a senior researcher in a number of areas including primary care, health informatics and outcomes measurement. He spent eight years (1993 – 2001) working in the National Health Service (NHS) including as the Assistant Director of Classifications for the NHS Centre for Coding and Classifications (1995 – 1997) and as Co-coordinator for the Coronary Heart Disease Programme for the Royal College of Physicians in London (1999 – 2002).

He has a broad range of research interests and has published widely in the areas of aged care, pathology and health informatics, evaluation, quality of care and health outcomes measurement. He is currently a member of the Editorial Board of the, *Journal of Pathology Informatics* and the *International Journal of Medical Informatics* and the immediate past chair of the Health Informatics Society of Australia (NSW Branch 2010 – 2011).

Research Fellows



Dr Melissa Baysari
BPsych, PhD Sydney

Dr Baysari is a 'human factors' researcher with experience in both qualitative and quantitative evaluations of health information technology. In addition to her role at the Centre for Health Systems and Safety Research, she is located within the Department of Clinical Pharmacology and Toxicology at St Vincent's Hospital. Dr Baysari is currently involved in a research program investigating the decision making process of selecting medicines for prescription. Her research focuses on reducing prescribing errors in hospitals, in particular on identifying the factors necessary for effective clinical decision support for prescribers.



Ms Elena Gospodarevskaya
*MEcon LMSU,
 PostGradDip.Bus (FM&Ec)
 Curtin, PostGradDip.HEcEv
 Monash*

Ms Elena Gospodarevskaya is a health economist with 14 years of experience with leading health

economics groups in Australia and UK. She acquired a professional qualification while working at the Centre for Health Economics, Monash University and specialising in cost-effectiveness analysis of public health interventions for childhood immunisation, infection control, drug addiction and child mental health. She is experienced in health services research and health technology assessment (pharmaceuticals, diagnostic and surgical procedures). She has also conducted economic evaluations alongside clinical trials, including the Victorian government award-winning multi-centre longitudinal RCT of opioid substitutes and the International trial of new treatments for multi-drug resistant tuberculosis. She is currently using her professional expertise in evaluating outcomes of health informatics projects. Since 2001 she has published 20 papers in international peer-reviewed journals.



Dr Isla Hains
BSc (Hons1), PhD Heriot-Watt

Dr Hains' research involves examining the use of ICT in supporting work practice innovation in the health care system. She is leading a project to investigate the role of ICT, such as clinical information systems,

computerised provider order entry systems, picture archiving and communication systems, in intensive care units and how these systems can innovate and impact on clinician work practices. Dr Hains has also been involved in studies to investigate the impact of ICT in medical imaging departments and on non-emergency patient transport services.



Ms Diane Hindmarsh
MScAgr, MBiostat Sydney

Since commencing with the Centre for Health Systems and Safety Research in November 2011, Diane has been involved with the analysis of data from the CareTrack study, funded by an NHMRC Program Grant. Diane previously worked in

various roles within the NSW Ministry of Health and as project officer in the Women's Health Unit with the former South Eastern Sydney and Illawarra Health Area. Her interests are in mixed models and small area estimation methods for data from survey and routinely collected data sources.



Dr Ling Li
*BEcon Beijing Wuzi,
 MComBus, MComIT Macq,
 MBiostats Syd, PhD Macq*

Dr Ling Li is a biostatistician with extensive experience in dealing with complex health datasets. She has participated in several large-scale studies analysing medication error

data and the effects of information technologies on changes in error rates and clinicians' work patterns. Dr Li has led analyses of large epidemiological studies on cardiovascular disease, cancer, sports injury and drinking water. Her research interests include methodology development and application of longitudinal and correlated data analysis, survival analysis, and linked data analysis.



Dr Sharyn Lymer
*BA Macq, BPhy UQ,
 MBiostats Sydney, PhD UC*

Dr Sharyn Lymer is a Research Fellow with the Centre for Health Systems and Safety Research. She is a biostatistician with particular expertise in microsimulation modelling applied to the Australian

health system. She is participating in the evaluation of ICT in aged care, particularly its impacts on integration of care. She was involved in the evaluation of electronic medical ordering and results reporting systems with particular interest in imaging, evaluation of graphical presentation of quality indicators and evaluation of test acknowledgement.

In 2011, she completed her PhD, looking at the projected costs of health care in an ageing Australia over the next 50 years, using dynamic microsimulation. This research explored beyond the concerns of ageing and considered the impacts of health behaviour changes on future health expenditure. She has participated in the development of various static microsimulation models of the Australian health system including the Medical Benefit Scheme and Pharmaceutical Benefits Scheme. She also has an interest in spatial microsimulation particularly looking at local-level aged care needs in Australia.

Dr Zahra Niazkhani
MD UUMS, MSc, PhD EUR

Dr Zahra Niazkhani is a research fellow in the Centre for Health Systems and Safety Research. She is a physician specialized in the field of Health/Medical Informatics. She received her MD in 1999 and worked as a general practitioner in public and private sectors for four years. She then pursued her research interest in Health/Medical Informatics domain and received a Master's degree (2006) and a PhD (2009) both from Erasmus University Rotterdam (EUR), The Netherlands. Before joining the Centre, she was working as an assistant professor of Medical Informatics at Urmia University of Medical Sciences. Since January 2010, she has been an associate research fellow at the Institute of Health Policy and Management (iBMG), EUR, The Netherlands.

Her main research interests are, but not limited to, the deployment of health information technology in health care organizations and evaluating its impact on clinical workflow, patient safety, and patient outcomes.

Her main research focus is on evaluating the impact of health information technology on the medication process in hospitals and aged care facilities.

Postdoctoral Research Fellows



Dr Nerida Creswick
BAppSc(HIM)(Hons1), PhD Sydney

Prior to her role in the Centre, Dr Creswick was a Postdoctoral Fellow in the Health Informatics Research and Evaluation Unit at the University of Sydney. She completed her PhD at the University of Sydney in

2008, examining the problem-solving, medication advice-seeking and socialising networks of hospital staff. She has continued this work in her post-doctoral position and is examining the changes in these networks over time. She is also working on a project examining work practice innovation in intensive care units, medical imaging departments and emergency departments. Dr Creswick also worked on redesigning the tool used for the Work Observation Method By Activity Timing (WOMBAT) technique, for measuring clinicians' work patterns.



Dr Elin Lehnbom
BScPharm Linköping, MPharmSc, MClinPharm Uppsala, PhD Sydney

Dr Elin Lehnbom originally trained and worked as a pharmacist in Sweden before moving to Sydney in 2008. Her PhD research investigated and compared Australians' and Swedes'

opinions about Personally Controlled Electronic Health Records (PCEHR). Upon completion of her PhD, Elin joined the Centre for Health Systems and Safety Research as a Postdoctoral Research Fellow. Her research focuses on the use of e-Health and its impact on patient outcomes, with a particular focus on PCEHR and Quality Use of Medicines (QUM).

Research Officers



Ms Kate Oliver
BPharm UTAS, MPH Sydney

Kate Oliver is a Senior Research Officer in the Centre for Health Systems and Safety Research working with Professor Johanna Westbrook. She is a registered pharmacist with clinical experience both in Australia and overseas and

has worked on a number of national and state-based projects with a focus on Quality Use of Medicines (QUM). Recently completing her Master of Public Health degree, Ms Oliver joined the Centre earlier this year and now combines research interests in QUM and Electronic Medication Management systems.



Ms Magda Raban
PhD candidate (Public Health), MIPH (Honours), BPharm Sydney

Magda Raban is a Senior Research Officer and PhD candidate and has over four years' experience in public health research. Prior to working in research, Ms Raban worked

professionally as a pharmacist in Australia and overseas. Magda's research focuses on improving medication safety and quality use of medicines through various interventions.

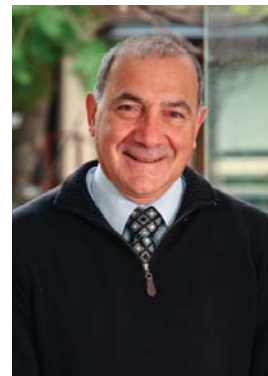


Ms Margaret Reckmann
BSc, BPharm UTAs, TTC

As a Clinical Pharmacist Researcher, Ms Reckmann contributes to research projects focused around medication safety and is responsible for undertaking medication error data collection within nominated

study sites. She is involved in a series of studies assessing the safety and effectiveness of two electronic prescribing systems (e-PSs) in reducing prescribing errors in two Australian teaching hospitals.

Ms Reckmann has a broad professional base spanning pharmacy, teaching and medical publishing. She is a registered pharmacist who has experience in public and private hospitals and in community pharmacy. She spent a number of years as Pharmacist in Charge of the Tasmanian Drug Information Centre and as Deputy Editor at MIMS Australia Pty Limited.



Mr George Toouli
BSc UNSW, MPH UWS

George Toouli has over 40 years' experience as the Laboratory Manager of the Microbiology Department at Liverpool Hospital and also in a large microbiology department in New Zealand. He is now a consultant microbiologist advising on

the introduction of LEAN processes in the laboratory setting. Mr Toouli is also a casual academic tutoring and lecturing in microbiology at UNSW. As a research officer, Mr Toouli's interests are in pathology and the impact of ICT in health care systems. His current project is to look at the impact of direct reporting of results to patients.



Mr Scott Walter
BA Adel, GradDipEd Melb, MBiostat Sydney

Scott Walter is a biostatistician and PhD candidate whose current research focuses on the analysis of clinical work practices, in particular examining the patterns and impacts of interruptions

and multitasking in the clinical setting. In parallel he is also developing statistical methods for the analysis of continuous-time observational data to enable enhanced understand of clinical work. He recently completed the Biostatistical Officer Training Program with NSW Health during which time he worked in a range of fields including infectious diseases, injury research and spatial epidemiology.

Research Assistants



Ms Sarah Gaskin
*BA, BSc (Hons1) UNSW,
MPH Sydney*

Sarah Gaskin is a research assistant in the Centre of Health Systems and Safety Research, working on a study which examines work and information processes in residential aged care facilities.

She graduated from UNSW with a Bachelor of Science/Arts in 2006. In her final year of study, she completed an honours project at the Oncology Research Centre (POWH), where she undertook a year of laboratory research in prostate cancer. She subsequently worked as a laboratory research assistant at the Westmead Institute of Cancer Research (USyd), working on a project studying the familial inheritance of melanoma.

Ms Gaskin also recently completed a Master of Public Health at the University of Sydney.



Ms Toni Hordern
*BAppSc(HIM),
MHLthSc(CDM) Sydney*

Toni Hordern is a Research Assistant in the Centre for Health Systems and Safety Research and was previously a Research Assistant in the Health Informatics Research and Evaluation Unit, University

of Sydney. She is currently involved in a number of studies under the Australian Research Council Linkage project, one of which specifically focuses on the impact and uptake of a Radiology Notification System within a Medical Imaging Department in a large Sydney teaching hospital. She has also recently been involved in a project whereby ICU clinician's work processes are quantitatively measured using a hand-held time and motion tool, with a focus on quantifying the type of information that clinicians, specifically registrars, access daily and the time spent accessing it.

She has successfully completed her Master's Degree in Health Science (Clinical Data Management) through the University of Sydney. Preceding this, Ms Hordern completed her Bachelor's Degree in Applied Science (Health Information Management), also through the University of Sydney.



Ms Yu Jia Julie Li
*BAppSc (HIM) (Hons1)
Sydney*

Julie Li is a Research Assistant and PhD Candidate in the Centre for Health Systems and Safety Research, and previously at the Health Informatics Research & Evaluation Unit

at the University of Sydney. In addition to providing general research assistance on a number of projects, she is completing a PhD on the role of Information Communication Technology in facilitating the role of Nurse Practitioners in the Emergency Department.

Ms Li completed her Bachelor's Degree in Applied Science (Health Information Management) with Honours, which investigated the impact of Computerised Provider Order Entry on clinician work practices. She currently occupies a student position on the Editorial Board of an international Informatics journal.



Ms Mirela Prgomet
BAppSc(HIM)(Hons) Sydney

Mirela Prgomet is a Research Assistant and PhD Candidate in the Centre for Health Systems and Safety Research. She provides assistance on a number of projects in the Centre, including systematic reviews of literature on the impact

of clinical leadership on health information technology adoption and the impact of computerised provider order entry on patient outcomes in the ICU.

Ms Prgomet's research interests are in health informatics evaluation. Her honours project investigated information and communication processes in a hospital ancillary setting. Her PhD aims to contribute knowledge about the selection of hardware computing devices and how they support clinical work practices, with a particular focus on mobile computing within the context of hospital settings.



Mr Michael Stewart
BIntS, MIPH Sydney

Mr Stewart works across a number of key research areas within the Centre. He has been involved in the five-year ARC Linkage Project with Sydney and Western Sydney Local Health Districts, specifically focusing on work practice

change in the Emergency Department. He also contributed to research investigating the integration of aged care services, clinical governance challenges facing telehealth providers, and information technology-related errors in radiology. He has also been involved in the Centre's ARC Discovery Project, led by Associate Professor Joanne Callen.



Mr Elia Vecellio
*BPsych(Hons),
MSc(Research) UNSW*

Elia Vecellio is a Research Assistant at the Centre for Health Systems and Safety Research, within the University of New South Wales. Mr Vecellio's research focuses on the monitoring and evaluation

of pathology and imaging services, with a particular interest in assessing the impact of systems changes. He is experienced in research methodology, data management, data validity checking, and statistical data analyses. Mr Vecellio has peer-reviewed publications in health systems research and in his previous work doing experimental research in psychology.

Business Manager



Ms Sheree Crick

Sheree Crick is Business Manager of the Australian Institute of Health Innovation and the Centre for Health Systems and Safety Research. She is responsible for management and coordination of the Centre's activities, including financial management of projects, human resource

management, coordination and support of funding proposal submissions, expense management, travel arrangements, resource management, communication and marketing activities and day-to-day support.

In addition, Ms Crick contributes to the goals and activities of the Australian Institute of Health Innovation, supporting the Directors and Administrative Manager in varied aspects of the Institute's management, including financial management and marketing and communications activities.

PhD Candidates



Dr George Larcos
MB BS (Hons) Sydney, FRACP, DDU ASUM, MPH UNSW, ThC (Hons) MTC

Supervisor: Professor Johanna Westbrook

Co-supervisor: Associate Professor Andrew Georgiou

PhD topic: An analysis of the Australian Radiation Incident Register (ARIR)



Mr Hamish Robertson
BA (Hons) Otago

Joint Supervisors: Associate Professor Andrew Georgiou and Associate Professor Julie Johnson

PhD topic: The geography of Alzheimer's disease: Using spatial science to investigate social and systemic effects



Ms Yu Jia Julie Li
BAppSc(HIM)(Hons1) Sydney

Supervisor: Professor Johanna Westbrook

Co-supervisors: Associate Professor Joanne Callen, Associate Professor Andrew Georgiou, Associate Professor Richard Paoloni

PhD topic: Innovation in the ED: An exploration of the impact of Information Communication Technology in facilitating the role of Nurse Practitioners.



Ms Amina Tariq
MSc (BITS) Strathclyde, BEng (Software) NUST

Supervisor: Professor Johanna Westbrook

Co-supervisor: Associate Professor Andrew Georgiou

PhD topic: An investigation of the information exchange process between residential aged care facilities (RACFs) and pharmacies for residents' medication management



Ms Mirela Prgomet
BAppSc(HIM)(Hons) Sydney

Supervisor: Professor Johanna Westbrook

Co-supervisors: Associate Professor Joanne Callen, Associate Professor Andrew Georgiou

PhD topic: An investigation of the selection, use, and impact of mobile information and communication technology on hospital wards



Mr Scott Walter
BA Adel, GradDipEd Melb, MBiostat Sydney

Joint Supervisors: Professor Johanna Westbrook and Professor William Dunsmuir

PhD topic: Understanding work management strategies in the clinical setting

Research Students

2013

Kristian Adams

Supervisor: Dr Melissa Baysari

Co-supervisors: Professor Ric Day,
Dr Elin Lehnbohm

Program/course: Bachelor of Advanced
Science (Honours)

Topic: The impact of health information
technology on the doctor-patient relationship

Natasha Diasinos

Supervisor: Dr Melissa Baysari

Co-supervisor: Professor Ric Day

Program/course: Bachelor of Science
(Honours)

Topic: Understanding and improving
aminoglycoside use

Bella St. Clair

Supervisor: Dr David Greenfield

Co-supervisor: Associate Professor Andrew
Georgiou

Program/course: Masters of Public Health

Topic: Linking accreditation to funding
incentives: The impact on organisation
performance and attitudes to accreditation

2012

Petya Arabadzhiyska

Supervisor: Dr Melissa Baysari

Co-supervisor: Professor Ric Day

Program/course: Bachelor of Advanced
Science (Honours)

Topic: A time and motion study of doctors'
work after-hours

Olivia Missiakos

Supervisor: Dr Melissa Baysari

Co-supervisor: Professor Ric Day

Program/course: Independent Learning
Project - ILP

Topic: Exploring effective strategies for
reducing drug-drug interactions

Reuben Tang

Supervisor: Associate Professor Andrew
Georgiou

Co-supervisors: Dr Geetha Ranmuthugala,
Dr Frances Cunningham

Program/course: Independent Learning
Project - ILP

Topic: Implementation of Surgical Safety
Checklists in Metropolitan Sydney

Refereed Journal Articles

2013 (January – June)

Arabadzhiyska P, **Baysari M, Walter S**, Day RO, **Westbrook JI**. Shedding light on junior doctors' work practices after hours. *Internal Medicine Journal*. 2013; (Accepted 18 June).

Bates DW, **Baysari MT**, Dugas M, Haefeli WE, Kushniruk AW, Lehmann CU, Liu J, Mantas J, Margolis A, Miyo K, Nohr C, Peleg M, de Quiros FG, Slight SP, Starmer J, Takabayashi K, **Westbrook JI**. Discussion of "Attitude of physicians towards automatic alerting in computerized physician order entry systems". *Methods of Information in Medicine*. 2013; 52(2):109-27.

Baysari MT. Separating fact from opinion: A response to 'The Science of Human factors: separating fact from fiction' [Correspondence]. *BMJ Quality & Safety*. 2013; (doi:10.1136/bmjqs-2013-002096).

Braithwaite J, Westbrook M, Nugus P, Greenfield D, Travaglia J, Runciman W, Foxwell AR, Boyce RA, Devinney T, **Westbrook JI**. Continuing differences between health professions' attitudes: The saga of accomplishing systems-wide interprofessionalism. *International Journal for Quality in Health Care*. 2013; 25(1):8-15.

Brett J, Lam V, **Baysari MT**, Milder T, Killen L, Chau AMT, McMullan B, Harkness J, Marriot D, Day RO. Use of pneumonia severity scores and antibiotic prescribing in the management of community-acquired pneumonia at an Australian tertiary teaching hospital. *Journal of Pharmacy Practice and Research*. 2013; (Accepted 16 May).

Callen J, Hordern A, Gibson K, **Li L, Hains IM, Westbrook JI**. Can technology change the work of nurses? Evaluation of a drug monitoring system for ambulatory chronic disease patients. *International Journal of Medical Informatics*. 2013; 82:159-67.

Callen J, Paoloni R, **Li J, Stewart M**, Gibson K, **Georgiou A**, Braithwaite J, **Westbrook JI**. Perceptions of the effect of information and communication technology on the quality of care delivered in Emergency Departments: A cross-site qualitative study. *Annals of Emergency Medicine*. 2013; 61:131-44.

Creswick NJ, Westbrook JI. Who do hospital doctors and nurses go to for advice about medications? A social network analysis and examination of prescribing error rates. *Journal of Patient Safety*. 2013; (Accepted 29 April).

Georgiou A, Marks A, Braithwaite J, **Westbrook JI**. Gaps, disconnections, and discontinuities—the role of information exchange in the delivery of quality long-term care. *The Gerontologist*. 2013; (First published online: 26 October 2012).

Georgiou A, Prgomet M, Paoloni R, **Creswick N, Hordern A, Westbrook JI**. The effect of computerized provider order entry on clinical care and work processes in Emergency Departments: A systematic review. *Annals of Emergency Medicine*. 2013; (Accepted 22 January 2013).

Mumford V, Greenfield D, Hinchcliff R, Moldovan M, Forde K, **Westbrook JI**, Braithwaite J. Economic evaluation of Australian acute care accreditation (ACCREDIT-CBA [Acute]): Study protocol for a mixed-method research project. *BMJ Open*. 2013; 3(2):e002381.

Ong MS, Magrabi F, Post J, Morris S, **Westbrook J**, Wobcke W, Calcroft R, Coiera E. Communication interventions to improve adherence to infection control precautions: A randomised crossover trial. *BMC Infectious Diseases*. 2013; 13(1):72.

Park S, Parwani A, Aller RD, Lech M, Banach L, Becich MJ, Borkefeld S, Carter AB, Friedman BA, Rojo MG, **Georgiou A**, Kayser G, Kayser K, Legg M, Naugler C, Sawai T, Weiner H, Winsten D, Pantanowitz L. The history of pathology informatics: A global perspective. *Journal of Pathology Informatics*. 2013; 4(1):7.

Rowlands S, **Callen J**. A qualitative analysis of communication between members of a hospital based multidisciplinary lung cancer team. *European Journal of Cancer Care*. 2013; 22(1):20-31.

Stewart MJ, Georgiou A, Westbrook JI. Successfully integrating aged care services: A review of the evidence and tools emerging from a long-term care program. *International Journal of Integrated Care*. 2013; 13(1).

Tariq A, Georgiou A, Westbrook JI. Medication errors in residential aged care facilities: A distributed cognition analysis of the information exchange process. *International Journal of Medical Informatics*. 2013; 82(5):299-312.

Teo CK, **Baysari MT**, Day RO. Understanding compliance to an antibiotic prescribing policy: Perspectives of policymakers and prescribers. *Journal of Pharmacy Practice and Research*. 2013; 43:32-6.

Walter SR, Olivier J, Grzebieta R, Churches T. The impact of compulsory helmet legislation on cyclist head injuries in New South Wales, Australia: A response. *Accident Analysis and Prevention*. 2013; 52:204-9.

Walter SR, Rose N. Random property allocation: A novel geographic imputation procedure based on a complete geocoded address file. *Spatial and Spatio-temporal Epidemiology*. 2013; (Accepted 18 April).

Westbrook JI, Baysari MT, Li L, Burke R, Richardson K, Day RO. The safety of electronic prescribing: Rates, manifestations and mechanisms of system-related errors associated with two commercial systems in hospitals. *Journal of the American Medical Informatics Association*. 2013; (Accepted 12 May).

Westbrook JI, Li L, Georgiou A, Paoloni R, Cullen J. Impact of an electronic medication management system on hospital doctors' and nurses' work: A controlled pre post, time and motion study. *Journal of the American Medical Informatics Association*. 2013; (Accepted 6 May).

Westbrook JI, Li L. Interruptions are significantly associated with the frequency and severity of medication administration errors [Letter]. *Research in Nursing and Health*. 2013; 36(2):116-9.

Westbrook JI. Interruptions to clinical work: How frequent is too frequent? [Commentary]. *Journal of Graduate Medical Education*. 2013; 5(Accepted 18 December).

2012

Baysari MT, Day RO, **Westbrook JI**. Consistency or efficiency? A dilemma for designers. [Letter]. *Journal of the American Medical Informatics Association*. 2012; 19:1119-20.

Baysari MT, Reckmann MH, Li L, Day RO, **Westbrook JI**. Failure to utilise functions of an electronic prescribing system and the subsequent generation of 'technically preventable' computerised alerts. *Journal of American Medical Informatics Association*. 2012; 19:1003-10.

Baysari MT, Tang T, Brett J, Day RO. Implementation of revised aminoglycoside guidelines in Australia: Hospitals 'left in the lurch' to implement appropriate monitoring [Editorial]. *Journal of Pharmacy Research and Practice*. 2012; 42(3):178-9.

Braithwaite J, Shaw CD, Moldovan M, Greenfield D, Hinchcliff R, Mumford V, Kristensen MB, **Westbrook J**, Nicklin W, Fortune T, Whittaker S. Comparison of health service accreditation programs in low- and middle-income countries with those in higher income countries: A cross-sectional study *International Journal for Quality in Health Care*. 2012; 24(6):568-77.

Braithwaite J, Westbrook M, Nugus P, Greenfield D, Travaglia J, Runciman W, Foxwell AR, Boyce RA, Deviney T, **Westbrook J**. A four-year, systems-wide intervention promoting interprofessional collaboration. *BMC Health Services Research*. 2012; 12:99.

Callen JL, Westbrook JI, Georgiou A, Li J. Failure to follow up test results for ambulatory patients: A systematic review. *Journal of General Internal Medicine*. 2012; 27(10):1334-48.

Chew DP, Brieger D, Astley CM, **Georgiou A**, Board N, Foreman R, Wilson J, Toohey C. Measuring performance of ACS management and outcome in Australia: A cornerstone of clinical effectiveness in ACS care. *Medical Journal of Australia*. 2012; 197(3):140.

Creswick N, Callen J, Li J, Georgiou A, Isedale G, Robertson L, Paoloni R, **Westbrook JI**. A qualitative analysis of emergency department nurses' perceptions of the effects of an integrated clinical information system. *Electronic Journal of Health Informatics*. 2012; 7(1):e4.

Cunningham F, Ranmuthugala G, Plumb J, **Georgiou A, Westbrook JI**, Braithwaite J. Health professional networks as a vector for improving health care quality and safety. A systematic review. *BMJ Quality and Safety*. 2012; 21(3):239-49.

Cunningham F, Ranmuthugala G, **Westbrook JI**, Braithwaite J. Net benefits: assessing the effectiveness of clinical networks in Australia through qualitative methods. *Implementation Science*. 2012; 7(108):doi: 10.1186/748-5908-7-108.

Gaskin S, Georgiou A, Barton D, **Westbrook JI**. Examining the role of information exchange in residential aged care work practices – a survey of residential aged care facilities. *BMC Geriatrics*. 2012; 12(1):40.

Georgiou A, Lam M, Allardice J, Hart GK, **Westbrook JI**. Troponin testing in the emergency department – a longitudinal study to assess the impact and sustainability of decision support strategies. *Journal of Clinical Pathology*. 2012; 65(6):546-50.

Georgiou A, Westbrook JI, Braithwaite J. An empirically-derived approach for investigating Health Information Technology: The Elementally Entangled Organisational Communication (EEOC) framework. *BMC Medical Informatics and Decision Making*. 2012; 12(1):68.

Greenfield D, Hinchcliff R, Moldovan M, Mumford V, Pawsey M, **Westbrook JI**, Braithwaite J. A multimethod research investigation of consumer involvement in Australian health service accreditation programmes: The ACCREDIT-SCI study protocol. *BMJ Open*. 2012; 2(5):e002024.

Greenfield D, Hinchcliff R, Westbrook M, Jones D, Low L, Johnston B, Banks M, Pawsey M, Moldovan M, **Westbrook J**, Braithwaite J. An empirical test of accreditation patient journey surveys: Randomized trial. *International Journal for Quality in Health Care*. 2012; 24(5):495-500.

Greenfield D, Moldovan M, Westbrook M, Jones D, Low L, Johnston B, Clark S, Banks M, Pawsey M, Hinchcliff R, **Westbrook JI**, Braithwaite J. An empirical test of short notice surveys in two accreditation programs. *International Journal for Quality in Health Care*. 2012; 24(1):65-71.

Hains IM, Georgiou A, Westbrook JI. The impact of PACS on clinician work practices in the intensive care unit: A systematic review of the literature. *Journal of the American Medical Informatics Association*. 2012; 19(4):506-13.

Hinchcliff R, Greenfield D, Moldovan M, Pawsey M, Mumford V, **Westbrook JI**, Braithwaite J. Evaluation of current Australian health service accreditation processes (ACCREDIT-CAP): Protocol for a mixed-method research project. *BMJ Open*. 2012; 2(4):pii: e001726.

Hinchcliff R, Greenfield D, **Westbrook JI**, Moldovan M, Pawsey M, Mumford V, Braithwaite J. Narrative synthesis of health service accreditation literature. *BMJ Quality & Safety*. 2012; 21:979-91.

Hinchcliff R, **Westbrook JI**, Greenfield D, **Baysari MT**, Moldovan M, Braithwaite J. Analysis of Australian newspaper coverage of medication errors. *International Journal for Quality in Health Care*. 2012; 24(1):1-8.

Hunt T, Ramanathan SA, Hannaford NA, Hibbert PD, Braithwaite J, Coiera E, Day RO, **Westbrook JI**, Runciman WB. CareTrack Australia - assessing the appropriateness of adult healthcare: Protocol for a retrospective medical record review. *BMJ Open*. 2012; 2:e000665.

Li J, Westbrook JI, Callen J, Georgiou A. The role of ICT in supporting disruptive innovation: A multi-site qualitative study of nurse practitioners in emergency departments. *BMC Medical Informatics and Decision Making*. 2012; 12(1):27.



Lyhne S, Georgiou A, Marks A, Tariq A, Westbrook JI. Towards an understanding of the information dynamics of the handover process in aged care settings - a prerequisite for the safe and effective use of ICT. *International Journal of Medical Informatics*. 2012; 81(7):452-60.

Lymer S, Brown L. Developing a dynamic microsimulation model of the Australian health system: A means to explore impacts of obesity over the next 50 years. *Epidemiology Research International*. 2012; 2012(132392):13.

Olivier J, **Walter SR**, Grzebieta R. Long term bicycle related head injury trends for New South Wales, Australia following mandatory helmet legislation. *Accident Analysis and Prevention*. 2012; 50:1128-34.

Rowlands S, **Callen J, Westbrook J**. Are General Practitioners getting the information they need from hospitals to manage their lung cancer patients? A qualitative exploration. *Health Information Management Journal*. 2012; 41(2):4-13.

Runciman WB, Coiera E, Day RO, Hannaford NA, Hibbert PD, Hunt TD, **Westbrook JI**, Braithwaite J. Toward the delivery of appropriate healthcare in Australia. *Medical Journal of Australia*. 2012; 197(2):78-81.

Runciman WB, Hunt TD, Hannaford NA, Hibbert PD, **Westbrook JI**, Coiera E, Day RO, **Hindmarsh DM**, McGlynn EA, Braithwaite J. CareTrack: Assessing the appropriateness of healthcare delivery in Australia. *Medical Journal of Australia*. 2012; 197(2):100-5.

Taib IA, McIntosh AS, Caponecchia C, **Baysari MT**. Comparing the usability and reliability of a generic and a domain-specific medical error taxonomy. *Safety Science*. 2012; 50(9):1801-5.

Tariq A, Georgiou A, Westbrook JI. Medication incident reporting in residential aged care facilities: Limitations and risks to residents' safety. *BMC Geriatrics*. 2012; 12(1):67.

Thein HH, **Walter SR**, Gidding HF, Amin J, Law MG, George J, Dore GJ. Survival after diagnosis of hepatocellular carcinoma and potential impact of treatment in a hepatitis B or C infected cohort. *Hepatology Research*. 2012; 42:1175-86.

Toouli G, Georgiou A, Westbrook JI. Changes, disruption and innovation - an investigation of the introduction of new health information technology in a microbiology laboratory. *Journal of Pathology Informatics*. 2012; 3:16.

Travaglia JF, Nugus PI, Greenfield D, **Westbrook JI**, Braithwaite J. Visualising differences in professionals' perspectives on quality and safety. *BMJ Quality & Safety*. 2012; 21(9):778-83.



Vecellio E, Georgiou A, Touli G, Westbrook JI. Volume, rates, source and types of add-on pathology test requests across five hospitals. *Clinical Chemistry and Laboratory Medicine*. 2012; 50(6):1041-8.

Westbrook JI, Reckmann M, Li L, Runciman W, Burke R, Lo C, Baysari MT, Braithwaite J, Day RO. Effects of two commercial electronic prescribing systems on prescribing error rates in hospital inpatients: A before and after study. *PLoS Medicine*. 2012; 9(1):e1001164.

Books and book chapters

2013 (January – June)

Georgiou A, Hains IM, Milliss D, Ridley L, Westbrook JI. Integrating PACS and CPOE in the ICU – the challenge of delivering health information technology-enabled innovation. *Critical Care Ultrasound: Elsevier*; 2013. (In press: Accepted 5 December 2012).

2012

Aller RD, **Georgiou A, Pantanowitz LJ.** *Electronic health records*. In: Pantanowitz L, Tuthill MJ, Balis Ulysses G, editors. *Pathology Informatics – Theory and Practice*. Canada: American Society for Clinical Pathology Press; 2012. p. 217-30.

Baysari MT, Westbrook JI, Day RO. *Understanding doctors' perceptions of their prescribing competency and the value they ascribe to an electronic prescribing system*. In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p. 1-6.

Callen J, Georgiou A, Li J, Westbrook JI. *The value of sociotechnical theories for implementation of clinical information systems*. In: Vaidya K, editor. *Inter-Organizational Information Systems and Business Management: Theories for Researchers*. Hershey, Pennsylvania: IGI Global; 2012. p. 229-45.

Caponecchia C, **Baysari MT, McIntosh AS.** *Development, use and usability of TRACER-RAV (Technique for retrospective analysis of cognitive errors for rail, Australian Version)*. In: Wilson JR, Mills A, Clarke T, Rajan J, Dadashi N, editors. *Rail Human Factors Around the World: Impacts on and of People for Successful Rail Operations*: CRC Press; 2012. p. 85-93.

Georgiou A, Hains IM, Milliss D, Ridley L, Westbrook JI. *Integrating PACS and CPOE in the ICU – the challenge of delivering health information technology-enabled innovation*. *Critical Care Ultrasound: Elsevier*; 2012. (In press: Accepted 5 December 2012).

Hains IM, Creswick N, Milliss D, Parr M, Westbrook JI. *An ICU clinical information system – clinicians' expectations and perceptions of its impact*. In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p. 64-70.

Hordern A, Callen J, Gibson K, Robertson L, Li L, Hains IM, Westbrook JI. *Use of an electronic drug monitoring system for ambulatory patients with chronic disease: How does it impact on nurses' time spent documenting clinical care?* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p. 71-6.

Lehnbom EC, McLachlan AJ, Brien JE. *A qualitative study of Australians' opinions about Personally Controlled Electronic Health Records*. In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p. 105-10.

Spring P, McIntosh AS, Caponecchia C, **Baysari MT.** *Level of Automation: Effects on train driver vigilance*. In: Wilson JR, Mills A, Clarke T, Rajan J, Dadashi N, editors. *Rail Human Factors Around the World: Impacts on and of People for Successful Rail Operations*: CRC Press; 2012. p. 792-801.

Stewart M, Georgiou A, Hordern A, Dimigen M, Westbrook JI. *What do radiology incident reports reveal about in-house communication processes and the use of health information technology?* In: Maeder AJ, Martin-Sanchez FJ, editors. *Health Informatics: Building a Healthcare Future Through Trusted Information*. Amsterdam: IOS Press; 2012. (178) p. 213-8.

Tariq A, Georgiou A, Westbrook JI. *Complexity of collaborative work in residential aged care facilities: An analysis of information exchange for medication management*. In: Sprague RH, editor. *45th Annual International Conference on System Sciences*; 4-7 January; Maui, USA. Institute of Electrical and Electronics Engineers Computer Society Press; 2012. p. 915-24.

Refereed conference papers (full papers)

2013 (January – June)

Georgiou A, Lang S, **Toouli G**, Timmins W, Robertson L, Gibson K, **Westbrook JI**. Health information technology and work practice innovation in hospital pathology services. *Cerner Regional User Group and Leadership Forum*; Sydney, Australia. 2013. p. 22-4 May.

Robertson H, Nicholas N, Travaglia J, **Georgiou A**, Johnson J. Globalising the study and analysis of Alzheimer's disease: A digital earth model. *Twentieth International Association of Gerontology and Geriatrics (IAGG)*; 23-27 June (Accepted 28 March 2013); Seoul, South Korea. 2013.

2012

Cunningham F, Ranmuthugala G, **Georgiou A**, **Westbrook JI**, Braithwaite J. Why leadership and management matter to clinical networks. *Australasian College of Health Service Management 2012 International Annual Congress: Inspiring Concepts in Health Management - Surfing the Crest of the Wave*; 15-17 August 2012; Surfers Paradise, Australia. 2012.

Cunningham FC, Ranmuthugala G, **Westbrook JI**, Braithwaite J. Net benefits: Assessing the effectiveness of clinical networks in Australia. *8th International Organisation Behaviour in Healthcare Conference*; 15-18 April; Dublin, Ireland. 2012.

Dimigen M, Zogovic B, Saks A, **Georgiou A**, **Hordern A**, Schlaphoff G. 'Tsunami' Radiology Notification System: A Low Cost Method in Improving Communication between the Imaging Department and Clinicians. *Radiological Society of North America 2012 Scientific Assembly and Annual Meeting*; 27 November-2 December; Chicago, USA. 2012.

Gaskin S, **Georgiou A**, Barton D, **Westbrook JI**. A survey comparing information exchange amongst staff in residential aged care facilities. *Health Informatics Conference*; 30 July-2 August 2012; Sydney, Australia. 2012.

Tariq A, **Georgiou A**, **Westbrook JI**. Complexity of collaborative work in residential aged care facilities: An analysis of information exchange for medication management. In: Sprague RH, editor. *45th Annual International Conference on System Sciences*; Maui, USA. Institute of Electrical and Electronics Engineers Computer Society Press; 2012. p. 915-24.

Westbrook JI, **Creswick N**, Duffield C, **Li L**, Dunsmuir WTM. Changes in nurses' work associated with computerised information systems: Opportunities for international comparative studies using the revised Work Observation Method By Activity Timing (WOMBAT). *11th International Congress on Nursing Informatics*; June 23-27; Montreal, Canada. Bethesda, USA: American Medical Informatics Association; 2012. p. 448-52.

Published refereed abstracts, posters and letters

2012

Baysari MT, **Reckmann M**, **Li L**, Day R, **Westbrook JI**. The generation of 'technically preventable' computerised alerts in an electronic prescribing system [Abstract and Poster]. *National Medicines Symposium*; 24-25 May; Sydney, Australia. 2012.

Baysari MT, **Westbrook JI**, Day R. Understanding doctors' perceptions of their prescribing competency and the value they ascribe to an electronic prescribing system [Abstract]. *Health Informatics Conference*; 30 July-2 August; Sydney, Australia. 2012.

Bennett A, **Lehnbom E**, Davidson P, Brien J, Clark R, McLachlan A. Medication support service ACTivities in Australian outreach cardiovascular programs: Are there missing ACTions? [Abstract]. *38th SHPA National Conference*; 1-4 November; Canberra, Australia. 2012.

Callen J, **Georgiou A**, Paoloni R, **Stewart M**, **Westbrook JI**. Direct notification of abnormal test result to patients: What do emergency department clinicians think? [Abstract]. *National Health Information Management Conference*; 29-31 October. 2012.

Callen J, **Georgiou A**, Paoloni R, **Vecellio E**, **Westbrook JI**. Missed imaging results: Physicians' views about direct notification to emergency department patients [Abstract]. *The Australasian Conference on Error in Medical Imaging*; 16-17 November; Melbourne, Australia. 2012.

Callen J, **Georgiou A**, **Westbrook JI**. Evaluation of solutions aimed at reducing the incidence of missed test results: Can technology assist? [Abstract]. *14th Asian Oceanian Congress of Radiology (AOCR)*; 30 August-2 September; Sydney, Australia. 2012.

Cunningham F, Ranmuthugala G, **Georgiou A**, **Westbrook JI**, Braithwaite J. Why leadership and management matter to clinical networks? *Australasian College of Health Service Management 2012 International Annual Congress: Inspiring Concepts in Health Management - Surfing the Crest of the Wave*; 15-17 August; Surfers Paradise, Australia. 2012.

Cunningham FC, Ranmuthugala G, **Westbrook JI**, Braithwaite J. An empirical assessment of the effectiveness of two Australian musculoskeletal clinical networks [Abstract]. *ISQua's 29th International Conference: Advancing quality and safety for all: Now and in the future; International Society for Quality in Health Care (ISQua)*; 21-24 October; Geneva, Switzerland. 2012.

Cunningham FC, Ranmuthugala G, **Westbrook JI**, Braithwaite J. Applying network theory to evaluate clinical networks in Australia [Abstract]. *RC33 Eighth International Conference on Social Science Methodology*; 9-13 July; Sydney, Australia. 2012.

Cunningham FC, Ranmuthugala G, **Westbrook JI**, Braithwaite J. Net benefits: Assessing the effectiveness of clinical networks in Australia [Abstract]. *Eighth International Conference on Organisational Behaviour in Health Care (OBHC)*; 15-18 April; Ireland, Dublin. 2012.

Dimigen M, Zogovic B, **Georgiou A**, **Hordern A**, Saks A, Schlaphoff G. Review of the 'Tsunami' radiology notification system: Experience after 2 years implementation [Abstract]. *Royal Australian and New Zealand College of Radiologists Annual Conference*; 30 August-2 September; Sydney, Australia. 2012.

Dowding D, Currie LM, Dykes P, **Westbrook JI**, Favela J. Research priorities in nursing informatics to improve patient care [Abstract]. *11th International Congress on Nursing Informatics [Workshop]*; 23-27 June; Montreal, Canada. 2012.

Gaskin S, **Georgiou A**, Barton D, **Westbrook JI**. A survey comparing information exchange amongst staff in residential aged care facilities [Abstract and Oral Presentation]. *Health Informatics Conference*; 30 July-2 August; Sydney, Australia. 2012.

Georgiou A, **Vecellio E**, **Toouli G**, Eigenstetter A, **Li L**, Wilson R, **Westbrook JI**. The use of data linkage as a tool to evaluate laboratory work processes and patient care performance indicators [Abstract and Oral Presentation]. *Australian Association of Clinical Biochemists conference*; 15-18 November; Melbourne, Australia. 2012.

Georgiou A. "Safety, quality, innovation – the role that an organisational communication perspective can play in enhancing the impact of health information technology" [Abstract and Oral Presentation]. *eHealth Observatory Conference*; 9-10 October; Nyborg, Denmark. 2012.

Georgiou A. Organisational and communication implications of electronic ordering systems for hospital pathology services - lessons for medical imaging [Abstract and Oral Presentation]. *The Australasian Conference on Error in Medical Imaging*; 16-17 November; Melbourne, Australia. 2012.



Hemsley B, **Georgiou A**. Communication in healthcare settings for people with little or no speech: Hospital experiences and patient safety [Abstract and Oral presentation]. *Inaugural School of Medicine and Public Health Conference*; 22 March; The University of Newcastle, Australia. 2012.

Hinchcliff R, Greenfield D, Moldovan M, Pawsey M, Mumford V, **Westbrook J**, Braithwaite J. The Accreditation Collaborative for the Conduct of Research, Evaluation and Designated Investigations through Teamwork (ACCREDIT) project: Developing the evidence base [Abstract]. *GP12 Leading Primary Care; The RACGP Annual Conference, Royal Australian College of General Practitioners*; 25-27 October; Gold Coast, Queensland, Australia. 2012.

Hinchcliff R, Greenfield D, Moldovan M, Pawsey M, Mumford V, **Westbrook J**, Braithwaite J. Consumer involvement in accreditation: Democratisation or tokenism in healthcare? [Abstract & Poster]. *10th Australasian Conference on Safety & Quality in Health Care: Hot topics from the tropics*; 3-5 September; Cairns, Australia. Australasian Association for Quality in Health Care (AAQHC); 2012.

Hinchcliff R, Greenfield D, Moldovan M, Pawsey M, Mumford V, **Westbrook J**, Braithwaite J. Accreditation is a key component of Australian health system reform: What is the evidence-base? [Abstract & Poster]. *10th Australasian Conference on Safety & Quality in Health Care: Hot topics from the tropics*; 3-5 September; Cairns, Australia. Australasian Association for Quality in Health Care (AAQHC); 2012.

Hinchcliff R, Greenfield D, **Westbrook J**, Braithwaite J. The secret to success: Factors that influence the ability of accreditation programs to improve the quality and safety of health services [Abstract]. *ISQua's 29th International Conference: Advancing quality and safety for all: Now and in the future; International Society for Quality in Health Care (ISQua)*; 21-24 October; Geneva, Switzerland. 2012.

Hinchcliff R, Greenfield D, **Westbrook JI**, Pawsey M, Moldovan M, Mumford V, Braithwaite J. The importance of leadership and mutual understanding for effective health services research collaboration [Abstract]. *RC33 Eighth International Conference on Social Science Methodology*; 9-13 July; Sydney, Australia. 2012.

Jaensch S, **Baysari MT**, **Westbrook J**, Day R. Prescribing by junior doctors after-hours and the impact of computerised decision-support [Poster]. *National Medicines Symposium*; 24-25 May; Sydney, Australia. 2012.

Larcos G, Collins LT, **Westbrook JI**, **Georgiou A**. The Australian Radiation Incident Register: lessons about maladministration in nuclear medicine. *The Australian Conference on Error in Medical Imaging*; 16-17 November; Melbourne, Australia. 2012.

Lehnbom E, McLachlan A, Brien J. A qualitative study of Australians' opinions about Personally Controlled Electronic Health Records [Abstract]. *Health Informatics Conference*; 30 July-2 August; Sydney, Australia. 2012.

Lehnbom E, McLachlan A, Brien J. Australians' awareness, knowledge and attitude regarding Personally Controlled Electronic Health Records: A national survey [Abstract and Poster]. *National Medicines Symposium*; 22-25 May; Sydney, Australia. 2012.

Li L, **Georgiou A**, **Vecellio E**, Eigenstetter A, **Toouli G**, Wilson R, **Westbrook JI**. Impact of the performance of pathology service on patient length of stay in emergency department, using a multilevel regression model [Abstract and Oral presentation]. *Australasian Applied Statistics Conference*; 3-7 December; Queenstown, New Zealand. 2012.

Patel VL, **Westbrook JI**, Dowding D, Currie LM, Shortliffe EH. Clinical errors and patient safety: The role of decision support systems [Abstract]. *11th International Congress on Nursing Informatics [Panel]*; 23-27 June; Montreal, Canada. 2012.

Robertson H, Travaglia J, **Georgiou A**, Johnson J, Nicholas N. Territories of vulnerability and reservoirs of risk: A spatial case study in metropolitan Sydney [Abstract & Poster]. *Academy Health Annual Research Meeting*; 24-26 June; Orlando, USA. 2012.

Teo CK, **Baysari MT**, Day RO. Understanding compliance to antibiotic prescribing guidelines [Abstract]. *National Medicines Symposium*; 24-25 May; Sydney, Australia. 2012.

Vecellio E, **Georgiou A**, **Toouli G**, Eigenstetter A, **Li L**, Wilson R, **Westbrook JI**. A benchmark audit of the types and frequency of pathology errors in Central Specimen Reception [Abstract and Oral Presentation]. *Australian Association of Clinical Biochemists Conference*; 15-18 November; Melbourne, Australia. 2012.

Invited presentations

2013 (January – June)

Georgiou A. Critical test results: Test result follow-up and the clinical impact on patients and staff [Keynote Presentation]. *How Effective Communications Improve Clinical Outcomes? Healthcare Seminar*; 19 April 2013; Sydney, Australia. 2013.

Vecellio E, **Georgiou A**, **Toouli G**, Eigenstetter A, **Li L**, Wilson R, **Westbrook JI**. A benchmark audit of the types and frequency of pathology errors recorded in central specimen reception [Invited presentation]. *Australasian Association of Clinical Biochemists NSW/ACT Scientific Meeting*; 21 May 2013; Sydney, Australia, 2013.

Westbrook JI. The effectiveness of electronic medication management systems and their impact on the work of doctors and nurses [Keynote presentation]. *2nd Annual Electronic Medication Management Conference*; 25-26 March; Melbourne, Australia. 2013.

2012

Georgiou A. Safety, quality, innovation – the role that an organisational communication perspective can play in enhancing the impact of health information technology [Invited Presentation]. *eHealth Observatory Conference*; 9-10 October; Nyborg, Denmark. 2012.

Hemsley B, **Georgiou A**. Communication in healthcare settings for people with little or no speech: Hospital experiences and patient safety [Abstract and Oral presentation]. *Inaugural School of Medicine and Public Health Conference*; 22 March; The University of Newcastle, Australia. 2012.

Westbrook JI. Electronic prescribing and errors [Invited Presentation]. *ICU Grand Rounds, Prince of Wales Hospital*; 17 April; Sydney, Australia. 2012.

Westbrook JI. The use of information technology to support improvements in quality and work efficiency: Implications of findings in hospitals for the aged care sector [Keynote address]. *Information Technology in Aged Care Conference*; 19 April; Melbourne, Australia. 2012.

Westbrook JI. Medication administration errors, interruptions and nurse experience [Invited Presentation]. *The Safe Ward Seminar*; 26 March; Melbourne, Australia. 2012.

Westbrook JI. Does technology lead to improvements in medication safety? [Invited Presentation]. *National Medicines Symposium*; 24 May; Melbourne, Australia. 2012.



Grants and finance

Grants held – 2012

Total - \$16,439,350

2012-2016	\$914,043
Funding body:	Australian Research Council; UnitingCare Ageing (UCA)
Subject:	Development of an evaluation model for assessing the effectiveness of ICT to integrate services and improve service performance and the experience of clients
Project type:	ARC Linkage LP120200814 (\$594,043 Partner UCA)
Chief Investigators:	Westbrook JI, Georgiou A
2011-2013	\$512,051
Funding body:	Australian Research Council
Subject:	Advancing understanding of health professionals' work and communication patterns and the effectiveness of work reform initiatives
Project type:	ARC Discovery DP110100090
Chief Investigators:	Westbrook JI , Dunsmuir WT, Duffield CM
2012-2014	\$260,000
Funding body:	Australian Research Council
Subject:	Can technology make communication in complex systems safer and more efficient? Evaluation of an electronic test management system in health care
Project type:	ARC Discovery DP120100297
Chief Investigators:	Callen J, Georgiou A , Runciman W
2012	(£11,620) \$17,764
Funding body:	University of Leeds, UK
Subject:	International network for the improvement of patient care through nursing informatics
Project type:	Fund for International Research Collaborations (FIRC)
Chief Investigators:	Dowding D, Dykes P, Currie L, Westbrook JI , Favela J, Fitzpatrick G, O'Brien A, Hamer S, Chearman T
2011-2012	\$95,465
Funding body:	Department of Health and Ageing
Subject:	The impact of the implementation of electronic ordering on pathology requesting and the quality and effectiveness of hospital pathology services - building a robust evidence base and benefits framework for successful eHealth diffusion.
Project type:	Quality Use of Pathology Program
Chief Investigators:	Georgiou A, Westbrook JI, Callen JL , Wilson R, Horvath R, Taylor P, Eigenstetter A

2011-2012	\$30,000
Funding body:	St Vincent's Clinic Foundation Research Grant
Subject:	Personalised feedback to prescribers as a means of reducing alert fatigue.
Project type:	Research grant
Chief Investigators:	Baysari M , Day RO, Westbrook JI , Reckmann M , Li L
2010-2014	\$2,350,000
Funding body:	Australian Research Council; Aged Care Standards and Accreditation Agency Ltd; Australian Council on Healthcare Standards; Australian General Practice Accreditation Limited
Subject:	Strengthening organisational performance through accreditation research: the ACCREDIT project
Project type:	ARC Linkage LP100200586
Chief Investigators:	Braithwaite J, Westbrook JI
2009-2012	\$2,149,160
Funding body:	Australian Research Council; Sydney South West Area Health Service
Subject:	Use of information and communication technologies to support effective work practice innovation in the health sector: a multi-site study
Project type:	ARC Linkage LP0989144 (\$2,149,160 cash)
Chief Investigators:	Westbrook JI , Braithwaite J, Gibson K, Paoloni R
2009-2013	\$8,400,000
Funding body:	National Health and Medical Research Council (NHMRC)
Subject:	Patient safety: enabling and supporting change for a safer and more effective health system
Project type:	Program grant 568612
Chief Investigators:	Braithwaite J, Westbrook JI , Coiera E, Runciman W, Day R
2009-2013	\$1,580,000
Funding body:	Australian Research Council
Subject:	Evaluating communities of practice and social-professional networks: the development, design, testing, refinement, simulation and application of an evaluation framework
Project type:	Discovery DP0986493
Chief Investigators:	Braithwaite J, Westbrook JI

2012	\$27,027
Funding body:	St Vincent's Health Australia
Subject:	Review of quality and safety indicators
Project type:	Research Grant
Chief Investigators:	Westbrook JI, Lymer S
2012	\$70,200
Funding body:	National E-Health Transition Authority
Subject:	A review of evidence regarding the value of medication reconciliation as a foundation for demonstrating PCEHR benefits
Project type:	Research Grant
Chief Investigators:	Westbrook JI
2012	\$13,640
Funding body:	National Health Call Centre Network
Subject:	Secondary ambulance triage service models and outcomes
Project type:	Research Grant
Chief Investigators:	Westbrook JI
2012	\$20,000
Funding body:	UNSW Medicine
Subject:	Measurement of ICU clinicians' work patterns pre-implementation of a clinical information system
Project type:	Early Career Research Award
Chief Investigators:	Hains IM, Li L

Statement of financial performance

For the year ended 31 December 2012

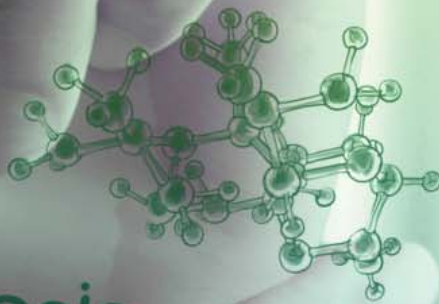
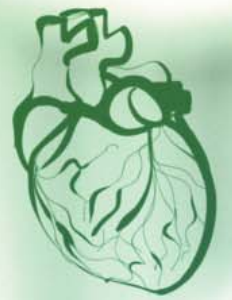
	2012	2011
	\$	\$
Funds		
Research Revenue	1,268,494	1,325,398
Donations	–	–
Fees	–	–
Faculty Funds	20,868	42,937
UNSW Operating Funds	610,186	598,001
Sundry Other Revenue	146,231	119,249
Total Funds	2,045,778	2,085,585
Costs		
People Costs	1,329,611	1,241,542
Scholarship Stipends	28,782	27,544
Contract & Consulting Services	37,477	117,166
Repairs and Maintenance	–	–
Consumables	15,769	10,407
Travel	41,430	60,405
Equipment	3,290	7,489
Other Expenses	7,875	19,597
Contract Research Overheads	23,665	22,657
Internal Expense	2,953	(2,171)
Total Costs	1,490,852	1,504,636
Operating result	554,926	580,949
Opening Balance	442,669	(138,280)
Closing Balance	997,595	442,669

Notes to the Statement of Financial Performance

1. Debtors	Unpaid Invoices	–	219,406
	Movement in outstanding invoices	(219,406)	–



Medical



Diagnosis

Clinica

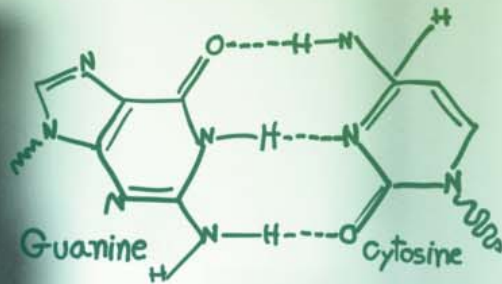




DNA



Science



Syn



practice



Herbal





CHSSR 

CENTRE FOR HEALTH SYSTEMS
AND SAFETY RESEARCH