Institution: Glasgow Caledonian University (GCU)

Unit of Assessment: Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study: Safe at the Point of Care: Reducing the Impact of Healthcare-Associated Infection

1. Summary of the impact

Healthcare Associated Infections (HAI) can be an unintended consequence of healthcare delivery. They are caused by a range of organisms but are often preventable. GCU-led research has reduced avoidable infections in healthcare in the UK and Europe by stimulating policy debate and investment in new healthcare practice and influencing policy decisions, evidence guidelines, and educational practices. Important changes have been made to national and international approaches to meticillin-resistant *Staphylococcus aureus* (MRSA) screening with cost savings of £7.5 million to the NHS. 28 European countries now use the HAI point prevalence survey validation method determined by our research.

2. Underpinning research

HAI research has been undertaken at GCU for 17 years, with outputs of more than a 100 peer reviewed publications over this period. The HAI research team is led by Professor Jacqui Reilly, who has established a strong relationship between HAI laboratory-based research and its application to HAI prevention in the NHS. A strategic partnership with NHS Health Protection Scotland (HPS) has enabled this research to have an impact on national policy in Scotland and in Europe.

In 1996, the first point prevalence survey (PPS) of HAI in the UK indicated that 10% of hospital patients acquired an infection. Reilly's groundbreaking PhD investigated HAI surveillance, identifying the risk factors for surgical site infection, and evaluated a change in practice designed to decrease the incidence of these infections. Subsequent prevalence surveys of HAI were conducted by Reilly et al in 2006[1] [grants (G) 1] and 2011[2] [G2]. The 2006 survey[1] established the cost of HAI to the NHS in Scotland as £183million a year and that *Staphylococcus aureus* (*S. aureus*) was the organism most commonly causing HAI.

Subsequent work evaluating the antimicrobial treatment of *S. aureus* infections (in collaboration with Dr Susan Lang) focused on complex biofilm-associated infections, [G3-5]. This generated important information on the action of antibiotics against these recalcitrant infections[3]. Our research on *S. aureus* was developed further with world-leading research on MRSA screening led by Reilly[4,5] [G6-10]. This included approaches to screening, anatomical sites to screen[4] and investigated the clinical and cost effectiveness of alternate approaches to managing risk of this infection[5]. We discovered that, by using a standard set of questions clinicians could identify those at high risk of being a carrier of the infection. Screening only these high risk patients was more cost effective, and as clinically effective, as screening everyone[4,5]. In 2009, the HAI team evaluated the acceptability of MRSA screening and showed that it was broadly acceptable to patients, staff and the wider public, but that aspects of communication and information could be improved to maximise acceptability[6]. Moreover, we identified the need for national guidance and patient information on MRSA screening.

In 2010, Reilly led a large European-wide study [G11] to evaluate optimal methods for validation of PPS across ten countries in order to provide an evidence base for European policy and practice. The study found concurrent blinded data collection to be the most practical approach and recommended that inter-rater reliability was tested formally prior to conducting validation. These

findings influenced future validation studies and PPS studies in the European Union and have since been adopted by the European Centre for Disease Prevention and Control for the prevention and control of healthcare-associated infections.

Key Researchers
Professor Jacqui Reilly
Dr Lang (Senior Lecturer)
Dr Kay Curry (Reader)
Dr Christina Knussen (Reader)
Dr Lesley Price (Lecturer)

3. References to the research

1. Reilly J, Stewart S, Allardice GA, Noone A, Robertson C, Walker A, S Coubrough S. Results from the Scottish National HAI Prevalence Survey. *Journal of Hospital Infection* (2008); 69(1):62-8. (doi: 10.1016/j.jhin.2008.02.019).

2. Reilly J, Cairns S, Fleming S, Hewitt D, Robertson C, Malcolm W, Nathwani D and Williams C Results from the second Scottish national prevalence survey: the changing epidemiology of healthcare-associated infection in Scotland *Journal of Hospital Infection* (2012); 82: 170-174. (doi: 10.1016/j.jhin.2012.07.024).

3. Smith K, Perez A, Ramage G, Lappin D, Gemmell CG, Lang S. Biofilm formation in Scottish clinical isolates of *Staphylococcus aureus*. *Journal of Medical Microbiology* (2008); 57(8):1018-23. (doi: 10.1099/jmm.0.2008/000968-0).

4. Matheson, A, Christie, P, Stari T. Kavanagh K, Gould IM, Masterton R, Reilly J Nasal Swab Screening for Methicillin-Resistant *Staphylococcus aureus*-How Well Does It Perform? A Cross-Sectional Study *Infection Control and Hospital Epidemiology* (2012); *3*3(8): 803-808. (doi: 10.1086/666639).

5. Reilly J, Stewart S, Christie P, Allardice G, Stari T, Matheson A, Masterton R, Gould IM, Williams C. Universal screening for meticillin-resistant *Staphylococcus aureus* in acute care: risk factors and outcome from a multicentre study. *Journal of Hospital Infection,* (2012); 80(1):31-5. (doi: 10.1016/j.jhin.2011.09.008).

6. Currie K, Knussen C, Price L and Reilly J Methicillin-resistant *Staphylococcus aureus* screening as a patient safety initiative: using patients' experiences to improve the quality of screening practices *Journal of Clinical Nursing* (2013); (doi: 10.1111/jocn.12366).

Key grants

1. Reilly J (CARC appointment in NHS) (2004-2006) Scottish Government Health Directorate, £500,000 National prevalence survey of HAI.
2. Reilly J (CARC appointment in NHS) (2010-2011) Scottish Government Health Directorate, £350,000 National prevalence survey of HAI.
3. Lang S (2006-07) Wyeth, £50,000. Antibiotic-induced stress on pathogenic bacteria capable of forming biofilms on prosthetic devices: implication for therapeutic efficacy.
4. Lang S, Price L (2011) Scottish Infection Research Network, £10,000. To develop an *in vitro* model of nasal colonisation by MRSA to investigate the efficiency of mupirocin decolonisation.
5. Lang S (2013-14) Pfizer, £54,000. The role of linezolid in the treatment of staphylococcal infections; induction of a stress response, impact on virulence and therapeutic options.
6. Reilly J (CARC appointment in NHS) (2008-11) Scottish Government Health Directorate, £7.1 million. Multicentre MRSA screening pathfinder study.
7. Currie K, Price L, Knussen C (2009-11), National Services Scotland, £63,000. The acceptability

of MRSA screening.

8. Christie P, Smith A, Reilly J (CARC appointment in NHS) (2010-12) Scottish Government Health Directorate, £998,000. The effectiveness of MRSA screening: a prospective cohort study of body site screening and clinical risk assessment.
9. Ritchie L, Reilly J, Godwin J (2010-13) Scottish Infection Research Network, £165,000. The effectiveness of admission risk assessment and pre-emptive cohorting of high risk patients to control MRSA.
10. Currie K, Loveday H et al. (2012-13) Department of Health, UK, £65,000. The patient experience of MRSA screening and decolonisation.
11. Reilly J, Price L, Godwin J (2011-13) European Union, £160,000. A validation study of PPS in 10 European countries.

4. Details of the impact

HAI research at GCU has impacted on health and welfare, and public policy and services. It has reduced avoidable infections in healthcare in the UK and Europe by stimulating policy debate on HAI[4-6], investment in MRSA screening and approaches to validation of prevalence surveys. This has resulted in changes to: policy decisions, investment in new healthcare practice, evidence guidelines, and educational practices impacting on patients, clinicians and policy makers [S1-10].

The large scale PPSs led by Reilly *et al* in Scotland in 2006 and 2011[1,2] determined HAI priorities and was a key driver in the decision to invest funds in NHS Scotland to prevent and control infection [S1-2]. Funding of £56million was invested in a number of areas in order to reduce HAI from 2008-11; with £7million of this focussed on MRSA, in recognition of the public health importance of the organism identified in our research [S3].

Our research on MRSA screening[4-6] has stimulated debate on the national policy for screening, which resulted in the introduction of a national strategy for MRSA screening in NHS Scotland [S3]. In addition, it demonstrated that nasal passages and perineum were the most appropriate sites to screen[4]. As a result of the adoption of these practices into the strategy, healthcare practice is therefore now more effective as screening is targeted at those at risk, with resulting cost savings of £7.5million to NHS Scotland annually [S8]. The user (patient) experience has been improved by using the GCU acceptability study findings[6] to improve the national patient information leaflet and videos produced by HPS [S6-7]. These are accessible online and in a range of languages [S7]. Further impact of our innovative research on the acceptability of MRSA screening[6] has been demonstrated by two further research calls by the UK Department of Health [S4].

The findings from GCU research on MRSA have been used to develop a national education programme on MRSA screening [S7]. It is an online short course developed by NHS National Education Scotland in 2011, and is targeted at all healthcare workers in Scotland. By September 2013, 1,456 had completed the course. In evaluations of the course 96% of participants stated that they thought it would have a lot or some positive impact on their day to day work as their knowledge, awareness and understanding of the policy and procedures had increased.

There is evidence from national statistics that our MRSA screening research[4,5] and subsequent change in policy is now having an impact on patient outcomes with reduced infections rates [S5]. HPS noted in the 2012 national statistics for Scotland that 'the proportion of *S. aureus* bloodstream infections, which were MRSA, had significantly reduced in the last year from 19% to 14% [S5]. This compares favourably with other European countries with a similar history of high endemic proportions of this organism and is associated with the introduction of the national policy for MRSA

screening in NHS Scotland.

Investment has also been made in policy to control other HAIs, highlighted by the PPS study[1], including infection control and antimicrobial prescribing guidance and hand hygiene campaigns [S2], and these changes to policy and practice in the intervening period have resulted in a lower prevalence of HAI (9.5% in 2006 versus 4.9% in 2011) [S2].

28 European countries now use the PPS validation method determined by our research [S10]. Each member state in Europe participates in an annual network meeting and the HAI team has presented the findings of the research and worked with the European Centre for Disease Control to change the policy for future validation and point prevalence surveys [S10]. Our research also contributed to a change to the European training programme for PPS (delivered by Reilly with other experts in Europe). To-date the training has been delivered face to face to over 60 national representatives. These national representatives are then responsible for cascaded the training, using web based education, to staff within 1,149 hospitals across the 28 European countries [S10].

5. Sources to corroborate the impact

1. Title: Survey shows hospital infections Date: 11th July 2007
Link: http://news.bbc.co.uk/1/hi/scotland/6290094.stm
2. Title: The Healthcare Associated Infection Task Force: Report on the Scottish Government's Two HAI Programmes Between January 2003 & March 2008
Date: June 2008
Link: http://www.scotland.gov.uk/Resource/Doc/237078/0065031.pdf
3. Title: Routine MRSA screening for Scottish hospitals Date: 23rd February 2011
Link: http://www.bbc.co.uk/news/uk-scotland-12550827
Link: http://www.sehd.scot.nhs.uk/cmo/CNO(2013)01.pdf
4. Title: R&D calls for proposals Date: 15th July 2011
Link:http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Aboutus/Procurementandproposals/rdcallsforproposals/index.htm
5. Title: The Annual Surveillance of Healthcare Associated Infection Report January - December 2011 Date: May 2012
Link: http://www.documents.hps.scot.nhs.uk/hai/annual-report/annual-surveillance-hai-report-2011.pdf
6. Title: MRSA Screening Pathfinder Programme for Public Date: June 2011
Link: http://www.hps.scot.nhs.uk/haiic/sshaip/mrsascreeningpathfinderpublic.aspx
7. Title: MRSA Screening Programme Date: December 2011
Link: http://www.nes.scot.nhs.uk/education-and-training/by-theme-initiative/healthcare-associated-infections/online-short-courses/mrsa-screening-programme.aspx
8. Title: NHS Scotland MRSA Screening Pathfinder Programme: Economic Analyses
Date: February 2011
Link: http://www.documents.hps.scot.nhs.uk/hai/mrsa-screening/pathfinder-programme/mrsa-pathfinder-economic-2011-02-23.pdf (page 17)
9. Title: ECDC PPS of HAI and AM use: pilot validation study Date :November 2011
Link:http://ecdc.europa.eu/en/activities/diseaseprogrammes/ARHAI/Presentations2011Warsaw/ARHAI-networks-meeting_parallel-session-one-4-Jacqui%20Reilly.pdf
10. Title: Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals 2011–2012 (page 22) Date: July 2103
Link: http://www.ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-antimicrobial-use-PPS.pdf