Institution:
Glasgow Caledonian University (GCU)

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

Title of case study:
A reduction in healthcare-associated infections through influencing policy and healthcare practice

Period when the underpinning research was undertaken:
2010-2016

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Jacqui Reilly	Professor & Lead Safeguarding Health through Infection Prevention (SHIP) Research Group	From 2004
Kay Currie	Professor SHIP Research Group	From 1995
Lesley Price	Professor SHIP Research Group	From 2004

Period when the claimed impact occurred:
2016-2020

Is this case study continued from a case study submitted in 2014?
No

1. Summary of the impact

The group's research has changed Scottish healthcare-associated infection screening policy, leading to a year-on-year decrease of 17.1% in the prevalence of infections, following an increased uptake of the policy from 75% to 87%. A pioneering programme of studies has improved the validity of the European Centre for Disease Prevention and Control's healthcare-associated infection survey methodology, resulting in an additional 450,000 (10%) infections being estimated across 28 countries. Globally our research has formed the basis of World Health Organization's guidance that has led to an increase in the proportion of countries, with a national infection prevention programme, from 41% to 63%.

2. Underpinning research

The research team are part of the Scottish Healthcare-associated Infection (HAI) Prevention Institute [G1], a 6-year Scottish Government funded consortium (£4.3M), in which they lead the work-stream generating evidence for the following aspects of infection prevention and control (IPC) practice.

Developing Scottish HAI Screening Practice

In 2016, Currie led the mixed-methods BESH study to investigate why the Scottish Government target of screening 90% of eligible hospitalised patients for carriage or infection with resistant organisms was not being achieved. Funded by Health Protection Scotland (HPS) [G2], BESH identified for the first time barriers and enablers to implementing screening from the perspective of clinical nurses and IPC managers [R1]. Underpinned by the Theoretical Domains Framework and Normalisation Process Theory, this Scottish-wide study produced findings that significantly predicted optimum compliance with the screening policy: i) routinizing screening as part of the admission process; ii) being admitted to some clinical specialities; iii) providing feedback to nurses on their screening compliance.

Developing & Implementing ECDC HAI Survey Methodology

In 2010, Reilly led the first European-wide study [R2] to evaluate optimal methods for validation of HAI point prevalence surveys. Funded by European Centre for Disease Prevention and Control (ECDC) [G3], its recommendations were subsequently incorporated into the ECDC protocol for the 2016 HAI point prevalence survey. Funding of £350K from the Scottish Government [G4] allowed her to develop this programme of research by utilising this protocol in the Scottish HAI point prevalence survey in 2016 [R3]. The results showed that the prevalence of HAI in Scotland was significantly lower in 2016 (4.6%) compared to 2011 (4.9%), however the validation study carried out for the first time in Scotland in 2016, based on the GCU research, demonstrated that the prevalence before adjustment was 4.6% and after adjustment for the estimated under-reporting was 7.7% (95% CI: 5.1 to 15.8) [R4] The study also demonstrated that the population at risk and the most common causative organism had changed: the patients at risk were older and with significantly more co-morbidities, and Escherichia coli had replaced Staphylococcus aureus as the most common causative organism [R4]. These results indicated a need to fundamentally change NHS Scotland policy makers' and practitioners' priorities from surveillance of Staphylococcus aureus to that of Escherichia coli, and to the prevention of urinary infections and pneumonia in older people.

Developing WHO's guidance on national level IPC interventions

A global coordinated approach to IPC by Governments at a national level was found to be lacking during the 2014 Ebola outbreak. To address this fundamental issue, the World Health Organization (WHO) commissioned Price [G5] in 2015, to provide a systematic review of the effectiveness of national level IPC interventions. Using Cochrane's Effective Practice and Organization of Care methodology, the review findings provided the first global evidence of effectiveness of national level IPC interventions [R5]. Critically, the review recommended that to reduce HAI, countries should incorporate education and training, surveillance, monitoring, audit and feedback into their IPC programmes and introduce the use of multimodal patient focused interventions.

3. References to the research

The research underpinning this impact case study includes new knowledge that has informed NHS Scotland policy from a sequential two-stage mixed-methods study, which applied constructs from normalization process theory and the theoretical domains framework to guide data collection and analysis [R1]. Research that has been instrumental in developing optimum methods for the European Centres for Disease Prevention and Control to measure infection across it member states and applied for the first time across Scotland to provide a more accurate estimate of the prevalence of infection [R2,3,4]. A first systematic review of evidence of effectiveness of global national infection prevention and control interventions for the World Health Organization published in Lancet Infectious Diseases [R5].

- [R1] Currie K, King C, McAloney-Kocaman K, Roberts NJ, MacDonald J, Dickson A, et al (2019) Barriers and enablers to methicillin-resistant Staphylococcus aureus admission screening in hospitals: a mixed methods study. 2019 Journal of Hospital Infection 101 (1) pp100-108. https://doi.org/10.1016/j.jhin.2018.08.006

- [R2] Reilly JS, Price L, Godwin J, Cairns S, Hopkins S, Cookson B, et al. A pilot validation in 10 European Union Member States of a point prevalence survey of healthcare-associated infections and antimicrobial use in acute hospitals in Europe, 2011. Eurosurveillance. 2015;20(8):pii=21045. https://doi.org/10.2807/1560-7917.ES2015.20.8.21045

- [R3] Cairns S, Gibbons C, Milne A, King H, Llano M, MacDonald L, Malcolm W, Robertson C, Sneddon J, Weir J, Reilly JS (2018) Results from the third Scottish national prevalence survey: the changing epidemiology of healthcare-associated infection in Scotland Journal of Hospital Infection 2018 99 (3) pp 312-317. https://doi.org/10.1016/j.jhin.2018.03.038

- [R4] Health Protection Scotland (Cairns S, Gibbons C, Hay A, King H, Llano M, MacDonald L, Malcolm W, Robertson C, Sneddon J, Weir J, Reilly JS). National Point Prevalence Survey of Healthcare Associated Infection and Antimicrobial Prescribing 2016. Health Protection Scotland, 2017 [Report]. https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2204/documents/1_PPS%20National%20Report%202016.pdf

- [R5] Price L, MacDonald J, Melone L, Howe T, Flowers P, Currie K, et al Effectiveness of national infection prevention and control interventions: a systematic narrative review. 2018 Lancet Infectious Diseases 18 (5) e159-e171. DOI: https://doi.org/10.1016/S1473-3099(17)30479-6

Key grants

- G1. Reilly J, Currie K, Flowers P, Lang S, Price L. 2015-2021 Consortium bid Chief Scientist Office/Scottish Infection Research Network. Creation of Scottish Healthcare Associated Infection Prevention Institute led by University of Glasgow. Main Collaborators: GCU; University of St. Andrews; & Strathclyde University. Total £4.3M, £1.1M to GCU.

- G2. Currie K, Flowers P, Roberts N, Khanna N, Price L. (2015-2017) Factors affecting the acceptability and implementation of hospital screening policy for antimicrobial resistant organisms: a mixed methods study of staff and public perceptions. Health Protection Scotland/Scottish Infection Research Network. £99,827.

- G3. Reilly J, Godwin J, Price L (2010-13) European Centre Disease Control. Pilot validation study of the ECDC point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. €150,000.

- G4. Reilly J (CARC appointment in NHS) (2016-18) Scottish Government Health Directorate, National prevalence survey of HAI. £350,000.

- G5. Price L, Flowers P, Currie K, Howe T, Reilly J. World Health Organization. (2015-2016) A systematic review of national IPC programmes core components. £14,973.

4. Details of the impact

Impact on Scottish HAI Screening Policy leading to an increase in uptake and a reduction in HAI

Recommendations from the 2016 BESH study [R1] were adopted by HPS to make fundamental changes to the Scottish National HAI screening programme in 2017. The results demonstrated the barriers and enablers to implementation of HAI screening in Scottish hospitals. Recommendations for improving HAI screening were presented by Currie to the Scottish National Antimicrobial Resistance and HAI Committee (August 2017), with Scottish Government HAI policy advisors in attendance [S1]. Consequently, HPS were funded by the Scottish Government to implement the recommendation to enhance feedback to practitioners on their level of compliance with HAI screening policies, across all Scottish Hospitals. This resulted in an increased uptake of MRSA screening policy from 75% in 2017 [S2 figure 19 page 45] to 87% in 2019 [S3 page 4] and an associated year-on-year decrease of 17.1% ($p< 0.001$) in MRSA infections in Scottish hospitalised patients [S2 page 38] in the year following implementation of the policy.

Impact on ECDC's HAI Survey Methodology leading to more robust estimates in 28 European countries

For the first time in 2010 Reilly led a validation of the ECDC HAI point prevalence survey involving five countries. As a result of this study [R2] important changes were made to the 2016

protocol requiring all 28 participating countries to perform a concurrent validation study alongside the HAI survey [S4 page 1]. Demonstrating the importance of this, ECDC provided funding of 10,000 euros to each country to support the implementation of the validation studies [S6]. Both the protocols for the 2016 survey [S5 page 37] and the validation studies [S4 pages 1 & 3] were based on Reilly's 2010 research. The findings of the validation studies were used to adjust the results of each country's survey resulting in the identification of an additional 10% of infections, or 450,000 HAI [S6], and significantly improved estimates of the number of HAI in the 28 European countries. This is important as the results of these surveys are used to prioritise investment in surveillance and prevention efforts by countries across the European region. A higher and more robust estimate of the burden of HAI supports appropriate allocation of national resources for managing HAI. In addition, the impact of Reilly's 2010 validation study has extended beyond Europe. Based on this research, Reilly provided methodological expertise [S7 page 7] for the first Australian point prevalence survey in 34 years conducted in 2018. The methodology [S6 page 8] adopted by Australia was based on the ECDC protocol that was informed by Reilly's research [R2].

Impact on Scottish healthcare policy and practice

Reilly's 2016 Scottish point prevalence survey [R3, 4] led to a refresh of the Scottish Government Antimicrobial Resistance and HAI Strategy Group strategy to take account of the recommendations in the study report. To address the increase in Escherichia coli infections and prevent urinary tract infections they made prevention of Gram-negative infections a priority [S8 page 40] resulting in a number of changes to Scottish healthcare practice. These included implementation of a hydration campaign (2017) [S8 page 46] and the launch of a national urinary catheter passport (2017) [S8 page 46] and an enhanced surveillance dashboard for Escherichia coli infections (2018) [S8 page 45].

Impact on WHO's guidance leading an increase in the proportion of countries with national IPC programmes

The research findings from our systematic review on the effectiveness of national level IPC interventions in 2015 [R5] directly informed the WHO's guidance on "Core Components for National IPC Programmes" [S9 page 22]. Professors Price & Reilly were invited to present the findings (March 2016) to a WHO panel of global IPC experts who fully incorporated the recommendations of the review into the new guidelines (November 2016) The systematic review provided the evidence base that enabled the WHO guidelines for the core components of national level IPC programmes to move from being based on expert opinion to becoming evidence-based [S9 page 29]. These WHO guidelines are now being implemented by countries worldwide to support global action to maximise the prevention of HAI. The implementation of these guidelines has led to an increase in the proportion of countries, across the six WHO regions, with a national IPC programme from 41% in 2015 to 63% in 2018 [S10 page 99].

5. Sources to corroborate the impact

- S1. Title: Testimonial from a lead Healthcare Scientist at Health Protection Scotland regarding action on our research recommendations. Date: 25th January 2018
- S2. Title: Health Protection Scotland Healthcare Associated Infection. Annual Report 2018. Date: May 2019. Link: https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2776/documents/1_HAI-Annual-Report-2018-final-v1%201.pdf
- S3. Title: ARHAHI Scotland. Healthcare associated infection: Annual report 2019. Date: 22nd September 2020. Link: https://www.hps.scot.nhs.uk/web-resources-container/healthcare-associated-infection-annual-report-2019
- S4. Title: European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals – ECDC PPS validation protocol version 3.1.2. Stockholm: ECDC; 2019. Date:

January 2019. Link: https://www.ecdc.europa.eu/sites/default/files/documents/PPS-HAI-AMR-protocol.pdf

- S5. Title: European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals – protocol version 5.3. Stockholm: ECDC; 2016. Date: October 2016. Link: https://www.ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/PPS-HAI-antimicrobial-use-EU-acute-care-hospitals-V5-3.pdf

- S6. Title: Suetens Carl, Latour Katrien, Kärki Tommi, et al. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. Euro Surveill. 2018;23(46):pii=1800516. Date: 15th November 2018. Link: https://doi.org/10.2807/1560-7917.ES.2018.23.46.1800516

- S7. Title: Russo, P.L., Stewardson, A.J., Cheng, A.C. et al. The prevalence of healthcare associated infections among adult inpatients at nineteen large Australian acute-care public hospitals: a point prevalence survey. Antimicrob Resist Infect Control 8, 114 (2019). (in acknowledgments). Date: 15th July 2019. Link: https://doi.org/10.1186/s13756-019-0570-y

- S8. Title: Health Protection Scotland Healthcare Associated Infection. Annual Report 2017. Date: May 2018. Link: https://www.hps.scot.nhs.uk/web-resources-container/healthcare-associated-infection-annual-report-2017

- S9. Title: World Health Organization. Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Date: November 2016. Link: https://www.who.int/gpsc/ipc-components-guidelines/en

- S10. Title: Implementation of the Infection Prevention and Control Core Components at the National Level: A Global Situational Analysis. J Hosp Infect. 2020 Nov 30:S0195-6701(20)30549-1. doi: 10.1016/j.jhin.2020.11.025. Epub ahead of print. PMID: 33271215. Date: 30th November 2020. Link: https://doi.org/10.1016/j.jhin.2020.11.025