

Institution: University of Leicester		
Unit of Assessment: 17		
Title of case study: Reducing human error in prescribing medicines: an intervention		
Period when the underpinning research was undertaken: 2012–2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): William Green	Role(s) (e.g. job title): Professor in Technology and Innovation	Period(s) employed by submitting HEI: 2009–Present
Period when the claimed impact occurred: August 2013 – ongoing		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact <p>Professor William Green's research at the University of Leicester in collaboration with clinicians has: enhanced doctor's wellbeing in the workplace; improved their prescribing performance; and reduced contributing factors to patient harm and patient deaths. The research takes a holistic, systems approach to patient safety and has led to a widely adopted intervention: personalised, structured, video-enhanced feedback and deliberate practice following high-fidelity simulations, which was developed following a human-centred design approach incorporating clinicians, managers, patients, junior doctors, pharmacists and medical educators. Economic analysis demonstrates that this is a cost-effective intervention, saves hospital bed days, and reduces waste and litigation. This has been demonstrated across seven acute National Health Service (NHS) Trusts in England and two in New Zealand, and influenced the sector more broadly.</p>		
2. Underpinning research <p>Medical errors are a significant global challenge, recognised by the World Health Organization who in 2017 announced their Third Global Patient Safety challenge: Medication Without Harm. Medication errors are a complex and systemic contributing cause of preventable patient harm. As an estimate, research funded in 2018 by the UK Department of Health Policy Research Programme suggested 237 million medication errors occur annually in England, with associated costs to the NHS of GBP98,462,582, consuming 181,626 bed-days, and causing 712 deaths whilst contributing to a further 1,708 deaths.</p> <p>Professor Green, University of Leicester School of Business (ULSB), has been leading a series of regional, national and international inter-disciplinary research projects to reduce medical errors and improve patient safety in collaboration with healthcare practitioners since 2012 (total funding over GBP500,000). The research builds on his background in Human Factors and Ergonomics, approaching the design of socio-technical healthcare systems from a whole systems viewpoint [R1–R3]. To ensure that the outcomes of the research can be applied and fit the working environment, the research has been conducted <i>in situ</i> [R1, R2] and in collaboration with clinicians, managers, patients, junior doctors, pharmacists and medical educators (notably Dr Rakesh Patel, University of Leicester Medical School, 2012–2017). The team also drew on the work psychology expertise of Professor Stephen Wood in ULSB with whom Green had previously collaborated [R7].</p> <p>Green's research [R2–R5] focuses on medicine prescribing errors. Prior research funded by the General Medical Council in 2009 established that Foundation Year (FY) doctors in their first and second year of medical training following graduation, are significantly more likely to make a medication prescribing error in comparison to experienced colleagues. The research of Professor Green and colleagues focused on the reasons for medication prescribing errors, which led to the design of the EPIFFANY intervention [R3–R6]. The intervention (detailed in R3) takes prescribers through high-fidelity ward-round simulations with real patients, which look and feel like a real hospital environment but provide prescribers with a safe environment to practice. Following the simulations, prescribers are provided with video-based, personalised feedback of their interactions with patients.</p>		

Research evaluating the effectiveness of this intervention [R3, R4, R6] has demonstrated significantly positive outcomes for practice and patient safety. Specifically, there was no significant difference in error rates of FY prescribers who received the intervention when compared with those of experienced prescribers [R3]. FY prescribers not participating in the intervention had statistically significantly higher error rates and patients seen by them experienced statistically significantly higher prescribing error rates. Conversely, patients seen by the FY prescribers who received the intervention experienced a statistically significantly lower rate of 'significant errors' compared to patients seen by the experienced prescribers. At Northampton General Hospital NHS Trust, improvements in Human Factors and non-technical skills (communication) were also observed and significant. The break-even analysis demonstrates cost-effectiveness for the intervention [R3, R4].

3. References to the research

- R1. Green W.** (2017). Barriers to the adoption of electronic prescribing and medicines administration, University Hospitals of Leicester NHS Trust in June 2016. Confidential report for University Hospitals of Leicester NHS Trust.
- R2. Green W, Jones C, Maltby J, Robinson S, Roland D and Stafford C** (2017). Team situational awareness: Practitioner-centred design of a safety huddles toolkit. In *Proceedings of the Annual Conference of the Chartered Institute of Ergonomics and Human Factors*. London: Taylor and Francis., pp. 223-231, ISBN: 978-1-5272-0762-2.
- R3. Green, W., Shahzad, M. W., Wood, S., Martinez Martinez, M., Baines, A., Navid, A., ... and Patel, R.** (2020). Improving junior doctor medicine prescribing and patient safety. *British Journal of Clinical Pharmacology*, 86(11), 2234-2246.
- R4. Patel R, Green W, Martinez M, Fores M, Jay R, Mandalia R, Lim M, Shahzad MW.** (2014) Effective Prescribing Insight for the Future. Report for Health Education England.
- R5. Patel R, Green W, Martinez Martinez M, Shahzad M, Larkin C** (2015). A study of Foundation Year doctors prescribing in patients with kidney disease at a UK renal unit. *European Journal of Hospital Pharmacy*, 22(5), 291-297.
- R6. Patel, R., Green, W., Shahzad, M. W., Church, H., and Sandars, J.** (2020). Using a self-regulated learning-enhanced video feedback educational intervention to improve junior doctor prescribing. *Medical Teacher*, 42(8), 886-895.
- R7. Wood S, Burrige M, Rudloff D, Green W and Nolte S** (2015). Dimensions and location of high-involvement management: fresh evidence from the UK Commission's 2011 Employer Skills Survey. *Human Resource Management Journal*, 25(2), 166-183.

Grants

The research has been funded continuously since 2012 totalling over GBP512,000 with Professor Green as Principal Investigator for over GBP380,000. The funding has been awarded by NHS England bodies, Health Education England (GBP192,000); Academic Health Science Network (GBP72,000) in the East Midlands and North West, and Patient Safety Collaborative (GBP81,000); Economic and Social Research Council (GBP7,500); University Hospitals Leicester NHS Trust (GBP21,100); British Medical Journal (GBP28,130); Pfizer UK (GBP190,000); and Pfizer Australia.

4. Details of the impact

Impact of EPIFFANY on the Commission on Education and Training for Patient Safety

EPIFFANY was used as an exemplar to "Ensure staff have the skills to identify and manage potential risks" in the 'Commission on Education and Training for Patient Safety' report 'Improving Safety Through Education and Training' [E1]. In the report—led by Sir Norman Williams (former President of the Royal College of Surgeons of England), and Sir Keith Pearson, (Chair of Health Education England)—Recommendation 12 uses EPIFFANY as the example of best practice. It states: "The Commission were impressed with the results and would like to see this project expanded to have wider engagement with other [medical postgraduate] students and staff" [E1]. EPIFFANY was also quoted in the Commission's report following an independent evaluation of evidence by the Centre for Health Policy at Imperial College London [E2].

Impact on Health Education England (HEE): medical training tender must be based on EPIFFANY intervention

HEE is an executive non-departmental public body. It is responsible for the development of the healthcare workforce in England, ensuring the NHS has the right size of workforce, with the right skills, values and behaviours. Following the Commission's report [E1], HEE put out a tender in July 2016 for the *"Delivery of an Educator Support Programme for Secondary Care Educators working within Local Education Providers within the East Midlands"* [E3]. This was a response to an NHS Employers commissioned report by the Nuffield Trust which proposed NHS Trusts having, *"the right number of appropriately skilled staff"* being critical to the determinants of quality and efficiency of healthcare. HEE dictated that the approach to be taken for anyone tendering to be based on EPIFFANY and to deliver across sixteen secondary care sites in the East Midlands region [E3, p3]. Subsequently, the EPIFFANY intervention was presented to all sixteen sites through HEE workshops.

EPIFFANY used as a national case study

EPIFFANY won the 2014 East Midlands Academic Health Science Network (AHSN) Innovation Awards in the Frontline Innovation Award. It subsequently won the 2015 HEE Chair's Recognition Award for Research and Innovation. This meant HEE wanted to adopt the EPIFFANY intervention nationally. As a result, the EPIFFANY intervention is used as an exemplar by the AHSN [E4, E5, E6], emphasizing that it would be rolled out following the successes at University Hospitals of Leicester (UHL) NHS Trust and United Lincolnshire Hospitals NHS Trust. At the national NHS Confederation in 2017 EPIFFANY was a Case Study for the AHSN [E5]: *"the NHS Confederation is the only membership body that brings together and speaks on behalf of the whole NHS"*. This resulted in EPIFFANY becoming a case study on the AHSN's National Atlas of Solutions in Healthcare [E6], with a quote from the Head of Quality and Education for HEE East Midlands stating: *"EPIFFANY is a fantastic example of supporting and enhancing junior doctors' education and training. It's been demonstrated to improve prescribing behaviour, wellbeing and keep patients safer while in hospital through a safety culture. We're thrilled that something supported by HEE across the East Midlands is now being rolled out to more areas and would like to see it taken up further and across the whole of England"* [E6].

Intervention adoption resulting from impact on medical practice and patients – significantly reducing the likelihood of patients experiencing prescribing errors

The initial research [R3–R6] at University Hospitals of Leicester (UHL) NHS Trust led to the adoption of the intervention at nine further hospitals, six in England, two in New Zealand and one in Wales. This led to significant improvements in prescribing practice for FY doctors and patient safety in all locations. As an example, EPIFFANY was adopted at Pilgrim Hospital, Boston, United Lincolnshire Hospitals (ULH) NHS Trust in 2015 on the request of HEE, following the suggestion from (NHS Medical Director at the time) after seeing a presentation by the AHSN about the research (noting the significance of the report [E1] and case study [E5] noted above). The evaluation [R3] at ULH NHS Trust led to similarly significant results to the initial study in Leicester. Notably, of the 554 patients observed in the study period, the 265 patients seen by the FY doctors who had participated in the EPIFFANY intervention (as opposed to the FY doctors in the control group) were at least twice as likely to experience a minor, significant and serious medication prescribing error from a FY doctor who did not participate. Further sites who have adopted EPIFFANY are:

- 1) ULH NHS Trust (2015-) [R3, E10]
- 2) Royal Devon and Exeter NHS Foundation Trust (2017-) [E7]
- 3) Waitemata District Health Board, New Zealand (2017-) [E9]
- 4) Canterbury District Health Board, New Zealand (2017-) [E9]
- 5) Sherwood Forest Hospitals (SFH) NHS Trust (2017-) [E8a]
- 6) Wrightington, Wigan and Leigh (WWL) NHS Foundation Trust (2017-) [E8g]
- 7) Chesterfield Royal Hospital (CRH) NHS Foundation Trust (2018-) [E8d, E8e]
- 8) Northampton General Hospital (NGH) NHS Trust (2018-) [E8b, E8c]

In four of the NHS Trusts EPIFFANY was adopted and adapted as the mandated training for all new medical doctors (SFH, WWL, CRH, NGH) [E8] with between 30-60 doctors onboarded and trained annually at each Trust since 2017/2018. As a result, it has reduced the contributory factors to patient deaths, reduced prescribing errors and reduced the number of medication errors [E8]. The Director of Medical Education at SFH NHS Trust articulates the significance of this by suggesting it also improves the confidence and general positive feeling of the participating doctors towards working for the NHS [E8f]; this is critically important given pressure on the NHS workforce:

"[W]e presented a business case for the NHS Trust board to support our adoption of EPIFFANY as normal business. This means that the intervention is sustained and we are running it every summer for new doctors. The business case was supported by the board for two main reasons. First, the decrease in error rates in the EPIFFANY prescribers following the simulations in the July 2017 cohort. . . . Second, this reduction was coupled with exceptional feedback from participating doctors who suggested that the opportunity to participate should be offered to all junior doctors. Notably, the feedback from the trainees who took part was excellent, reportedly increasing confidence and knowledge around complex prescribing. This has translated into a reduction in TTO error rates as well as a reduction in Datix reports involving prescribing." [E8a].

Following a pilot in 2018, EPIFFANY has now been adopted as part of junior doctors' mandatory training when entering WWL NHS Trust. The WWL Professional Development and Clinical Assurance Pharmacist who led the adoption of EPIFFANY states, *"The benefits of the programme exceed the original targets – i.e. demonstrating a reduction in prescribing errors, although this remains the ultimate goal"* [E8f]. WWL NHS Trust are using EPIFFANY as part of a learning system to support junior doctors' progress through their first foundation year.

Participating junior doctors unanimously claim positive impacts on their practice as a result of participating in EPIFFANY: *"[The simulations and feedback] help you to then go back on to the wards and . . . develop a more systematic approach to your . . . ward round. . . . The feedback, identified some . . . fairly major things that you need to think about that I hadn't given enough thought to. . . . [I]t was definitely worth doing from that perspective [and] I've really enjoyed it."* (Participating junior doctor) [E8f].

The Healthcare Safety Investigation Branch (HSIB), who conduct independent investigations of patient safety concerns in NHS-funded care across England, report EPIFFANY being identified as an intervention to tackle serious incidents by the Royal College of Physicians who coordinated a joint working group with other professional bodies to develop and deliver work related to Medication Safety [E10]. Green presented to this group in 2019. Since then, Green has been working with the Swansea Bay Health Board, the NHS Wales Lead Head of Pharmacy, and the Wales Quality Improvement programme towards adapting EPIFFANY as a part of their national medicine safety programme.

5. Sources to corroborate the impact

E1. Improving Safety Through Education and Training, Report by the Commission on Education and Training for Patient Safety, March 2016

E2. Yu A. Fontana, G. Darzi, A (2016), Evaluation of education and training interventions for patient safety. A report by the Centre for Health Policy at Imperial College London.

E3. HEE, Tender for the Delivery of an Educator Support Programme for Secondary Care Educators working within LEPS in the East Midlands. 29th July 2016.

E4. Email newsletter example from EMAHSN.

E5. NHS Confederation members case study (June 2017). Improving performance on complex workplace tasks. NHS Confederation.

E6. AHSN Atlas of solutions in Healthcare, 2017.

E7. Mattick K and Farell O (2017). ePIFFany@EXETER: improving the prescribing of doctors-in-training. Final report.

E8. Testimony from three NHS Trusts and Junior Doctors:

a. Director of Medical Education, SFH NHS Foundation Trust.

- b. Consultant in Emergency Medicine, NGH NHS Trust.
- c. Operational Simulation and Response Lead, NGH NHS Trust.
- d. Consultant Pediatrician, Chesterfield Royal Hospital NHS Foundation Trust.
- e. Principle Pharmacist, Chesterfield Royal Hospital NHS Foundation Trust.
- f. Junior doctor participant feedback on their participation.
- g. Train not blame: how one hospital trust boosted error reporting by over 100% (February 2019). The Pharmaceutical Journal: A Royal Pharmaceutical Society publication.

E9. Testimony from Quality Improvement Pharmacist, Waitemata District Health Board and Honorary Lecturer, School of Medicine, University of Auckland, New Zealand.

E10. Royal College of Physicians Response to the 'inadvertent administration of an oral liquid medicine into a vein' safety recommendation report by the HSIB (8th July, 2019).