The Potential Role of Technology to Improve Hand Hygiene Auditing and prevent Hospital Acquired Gastrointestinal Infections

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Figure 1: Hand print culture contaminated with C. difficile spores

Background:

Hospital Acquired Infections (HAI) like ***C. difficile*** and **MRSA** can be transmitted on hand surfaces[1]. Correct **Hand Hygiene removes contamination**[2], yet **Healthcare Professional compliance remains low**[3,4].

Despite falling cases/deaths attributed to C. *difficile*[5, 6] (see Figure 2/Table 1), each case represents increased work for NHS staff and an estimated financial cost of between £3000-£4000[7], and additional pain, treatment and anxiety for the Patient.

Due to its endogenous /exogenous epidemiology, not all C. *difficile* cases are caused by cross-contamination; however it is proven that correct Hand Hygiene with soap and water can prevent spread between patients[8].

	England	Scotland	Wales	Northern Ireland
% Reduction	59	74	92	53

Table 1: Data from National Audit Office showing % Deaths with underlying cause recorded as *C. difficile*, from 2008 to 2010

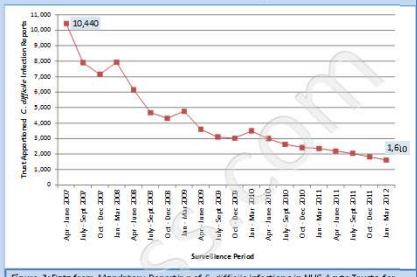

Figure 2: Data from Mandatory Reporting of *C. difficile* infections in NHS Acute Trusts, for Patients aged 2 years+ Decline in cases over past 5 years shown (full details of data caveats available at HPA source, see Reference 6)

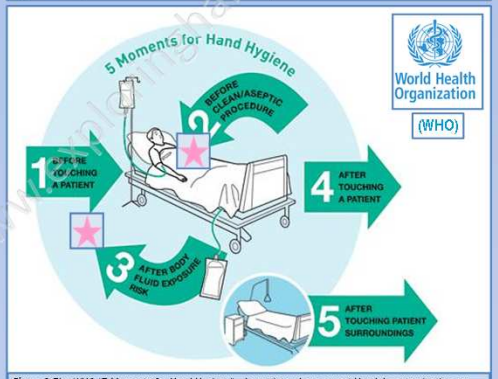

Figure 3: The WHO "5 Moments for Hand Hygiene" – key points where correct Hand decontamination can prevent cross-contamination

Measurement:

To improve Hand Hygiene compliance, Healthcare Professionals need to know their current performance, ideally related to areas of training (e.g. WHO 5 Moments see Figure 3). From such benchmarks the impact of new interventions can be assessed – however **securing accuracy has proven challenging**[9, 10].

Even direct observation, the WHO Gold Standard[11], only offers brief 'snap shots' of Hand Hygiene behaviour and is open to question regarding validity, due to Hawthorne Effect behaviour changes[12].

In other sectors, technology has been used to monitor compliance with key safety guidelines[13, 14]. Whilst Hand Hygiene technologies have been developed and introduced into Healthcare[15,16] (e.g. see Figure 4), our Systematic Review found WHO Moments "2" and "3" (see Figure 3) have no technological solution.

Figure 4: Here a Healthcare Professional wears a badge[13] which senses location, reminding the wearer of the need to perform Hand Hygiene by glowing RED, changing colour to GREEN once hands have been cleaned using substance containing alcohol, which is sensed as hands are held up to badge. Instant visual feedback provided to peers and Patients, data is stored for analysis.

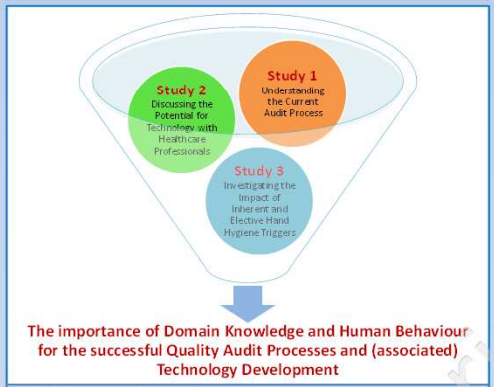

Figure 5: Project outline, leading to overall Research Question focus

Current Research:

The research explores the topic of **Hand Hygiene Auditing**, questioning the potential for technology to reduce the current burden.

Underpinning the Research Question are 3 studies with their own Objective and Aims (see Figure 5) – all being carried out using a variety of research methods (see Figure 6), within a Case study at an NHS Acute Trust University Hospital.

Purposive sampling is being used to involve Healthcare Professionals involved in all aspects of the Hand Hygiene Audit Process.

Thematic Analysis is being applied to interview data, with participatory observations being used to complement developing themes. Early findings highlight feedback as a key area for process improvement – with technology seen as a potentially positive innovation. However, examples of existing technologies were deemed unsuitable, by participants, as a replacement for the current Audit process as none could detect all the 5 Moments, nor give 'meaningful' data.

Study	Methodological Tool Used					
	Literature Review	Participatory Observation	Interview	Focus Group	Online Feedback	Data Analysis
1 – Current State	✓	✓	✓	✓	✓	✓
2 – Potential for Technology?	✓	✓	✓	✓	✓	✓
3 – Inherent Hand Hygiene	✓	✓	X	✓	X	✓

Figure 6: Research Methods being used across the 3 studies within the Case Study

Next Phase – Investigating the role of Human Behaviour

Research suggests **Hand Hygiene is not a homogenous behaviour**[17,18] but consists of 2 separate drivers; Inherent and Elective:

Figure 7: (r) Using a bed pan (l) Taking a blood sample
Suggested examples of Inherent drivers, where Hand Hygiene is performed due to an automatic sense of need to decontaminate

Inherent: Performed when hands appear or feel dirty, or when danger is sensed

Elective: Performed not automatically, but because of learnt practices of care

This research suggests that by understanding this behavioural element interventions could be developed more effectively; tailored to complement the underlying Human Behaviour associated with the required Hand Hygiene activity. To add empirical data to the developing field of Inherent/Elective theory, this study will run a structured series of observations across different ward contexts to monitor Hand Hygiene compliance at activities categorised as either "Inherent" (e.g. see Figure 7) or "Elective" (e.g. see Figure 8). It is expected that Hand Hygiene compliance rates will remain more constant for Inherent activities than for Elective activities – as the former should be less vulnerable to contextual interference, due to their automatic element.

Figure 8: (r) Using a machine (l) Taking a blood pressure
Suggested examples of Elective drivers, where Hand Hygiene is performed due to being taught as part of a guideline for care

The wider implication from the work is the suggestion that the WHO 5 Moments (see Figure 3) could be split into "Inherent" or "Elective", with the early hypothesis that Moments "2" and "3" be the former, and Moments "1", "4", and "5" being the latter. With regard to technology, this would suggest that developers could focus on innovations to help improve compliance at Elective moments, where behaviour is more likely to be in need of external cues, as opposed to Inherent moments, where behaviour is more likely to have an automatic element.

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