Ensuring that UK medical graduates meet the General Medical Council's outcomes relating to Human Factors

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SUMMARY

The General Medical Council (GMC; the UK medical regulator) "Outcomes for Graduates" document indicates newly qualified doctors must demonstrate they can practise safely. Furthermore, they must actively participate in improvement work relating to safety and quality. The detail of this overarching outcome positions Human Factors as central to this activity. This reflects an international direction of travel that recognises the lack of success of what might be described as a patient safety 'movement': Despite collective efforts, safety has not improved. In fact, a recent run of safety 'scandals' suggests that care is increasingly precarious. In the UK, Professional, Statutory and Regulatory Bodies agree Human Factors offers the best chance for meaningful safety and quality improvement, evidenced by national initiatives such as the Academy of Medical Royal Colleges National Patient Safety Syllabus and the Patient Safety Incident Response Framework (PSIRF). Including Human Factors-related outcomes in health and care educational programmes is not a minor 'bolt on' – it requires a co-ordinated and strategic approach. It also faces several challenges, not least the lack of Human Factors competence and capacity available to most educational institutions. This case study explores how a comprehensive and sustainable Human Factors curriculum was embedded in an undergraduate MBChB (medical) curriculum in a UK university. It is believed that this is unique in the UK, and that sharing our experiences will support educational faculty in developing their own programmes. It also offers the opportunity to start a national conversation about agreed HF outcomes across health and care curricula.

KEYWORDS

Medical education, Patient safety, Human Factors competency

Introduction

The GMC Outcomes for Graduates indicate newly qualified doctors must demonstrate that they can practise safely, positioning Human Factors (HF) as central to this. This reflects an international direction of travel that recognises what it means to 'practise safely' has changed. Despite collective efforts, the patient safety 'movement' has arguably failed. A contributory factor has been the basing of safety efforts on Quality Improvement (QI), which has its roots in industrial process, more suited to manufacturing than to the complexity of modern healthcare. UK Professional, Statutory and Regulatory Bodies now agree that HF offers the best chance for meaningful improvement, evidenced by national initiatives such as the Academy of Medical Royal Colleges National Patient Safety Syllabus (and associated training of patient safety specialists) and the Patient Safety Incident Response Framework (PSIRF), both based on HF.

These initiatives, while welcome, are undermined by the lack of HF competence across the health and health education sectors. CIEHF recognised this in its 2018 White Paper[1] "Human Factors for health and social care". Underpinning the vision of HF integration was the notion that "sufficient and relevant HF education is included in clinical curricula". If HF is to be applied in practice, then "sufficient" education must go beyond knowledge to include HF competency. There is another threat to successful delivery of such education - the UK healthcare-specific conflation between HF and what might be described as 'factors of the human' (or non-technical skills). This is from a misunderstanding during the transfer of safety learning from the aviation to health sectors. Non-technical skills training was a response to a systematic analysis of a series of incidents where crew dynamics played a significant part. The 'Human Factors' part was the systems approach to recognising that an intervention addressing non-technical skills was necessary. Unfortunately, this is rarely recognised in healthcare, meaning HF has become conflated with non-technical skills. A knock-on effect is the misunderstanding that HF is a small part of QI which has contributed to the ongoing dominance of QI in UK healthcare. It could be argued that QI (in its purest sense) and HF are ideologically very different. QI seeks to strip out variation and to standardise, while HF recognises that variation results from the reality of work in a particular system. Understanding that reality is key to developing improvements that work for that context. This presents an educational challenge: we must support *learning* about HF but also *unlearning* of what went before.

Much healthcare education is beyond the control of academic staff. For safety, much of what students learn is driven by the safety-related attitudes and values they observe in the workplace (the "hidden curriculum"). This may be at odds with formal teaching, and so any educational strategy must provide opportunities for students to reflect on mismatches between the taught and hidden curricula and be accompanied by HF education and training for faculty.

Approach

Any educational strategy needs to be constructively aligned, starting at the end, with a vision of the HF knowledge, skills and competencies medical graduates should possess. Valid and reliable assessment is then designed to support this, after which learning activities can be developed to support assessment success. The strategic approach also needs to ensure that the educational programme is adequately resourced and sustainable. For this current study, a consensus development approach was taken, which facilitates sharing of expert opinion. Experts were drawn from the University of Aberdeen and from NHS Education for Scotland. Some members of the expert group have dual roles with organisations involved in the delivery of National Patient Safety Syllabus training. An early decision was to base the development of the University of Aberdeen MBChB Human Factors for patient safety curriculum on a model proposed by Vosper and Hignett[2]. Key points of this model include the observation that any curriculum exists within a complex sociotechnical system, and therefore HF should be central – not just as *content*, but also as a *methodology* underpinning the design of an accessible curriculum that optimises system performance as well as enhancing staff and learner wellbeing.

Findings

Expert consensus established the following guiding principles:

- The curriculum should support development of competencies reflecting national initiatives such as the Patient Safety Specialist training, ensuring graduates are workplace ready.
- Activity should reflect the 'competence and capacity' pyramid described in the CIEHF White Paper[1]. This suggests that effective embedding of HF needs to be overseen and supported by Suitably Qualified and Experienced Professionals; That most HF-based activity will be led by a larger group of staff who are 'relative experts'; That all staff (across

the organisation) need to understand basic HF principles to ensure their activities are not incongruent with any HF work. Consequently, curriculum design was led by chartered members of CIEHF, and two strands were developed. The Core Strand ensures all students have a high-quality HF education, while the Advanced Strand allows interested students to work towards professional recognition as a Technical Specialist (TechCIEHF).

- Those undertaking the Advanced Strand must have meaningful opportunity to apply HF in practice, requiring effective partnerships with clinicians with an HF interest.
- The curriculum should support learner engagement with the wider HF community, including CIEHF, allowing them to develop the networks that will be critical in the workplace.
- Space in the curriculum is extremely limited so a key focus should be developing existing activities, viewing them through a Human Factors lens.
- Alongside the HF curriculum, staff development must be considered to ensure sustainability.

Developing the Advanced Strand was relatively straightforward. MBChB curricula include student-selected and elective components throughout the course, and we have developed HF options for all of these. The largest is in the Year 3 Medical Humanities block, where we have developed an HF course (with 150 notional hours of student effort). Medical Humanities gives all students an alternative perspective on medicine – much of their course is science-based, taking a 'positivist' approach which in many ways is at odds with the claim that healthcare is 'person-centred.' In the Humanities block they are encouraged to understand medicine, health, sickness and disability from different perspectives including that of the patient. HF is perfectly placed in this block – it sits on the cusp between the sciences and the humanities, providing students with practical tools for understanding patient stories in a way that can lead to improvements in safety and quality. In this course, learners get extensive practical experience with HF methods/tools which can be developed in electives later in the course. The course is CIEHF-accredited, and outcomes reflect our professional competencies, helping students to map activity for their portfolio for TechCIEHF.

The Core Strand was more challenging, as it relied on opportunistic working, but this has proved surprisingly effective, and has actually benefitted from cutbacks in the sector. Reduction in relative staff numbers always comes with a redistribution of tasks, which can be an opportunity. For example, the project lead 'inherited' the Year 1 lectures on Drug Therapy. This is recognised as being a critical area for patient safety. Existing teaching focusses almost entirely on 'what the body does to the drug'. However, patients take drugs in a system that extends far beyond their physical body, and not understanding this in the round creates additional risk. In the new teaching, students view the kinetic processes of absorption, distribution, metabolism and excretion through a systems lens. A full description of this beyond the scope of this paper, but one example would be the excretion of drugs in the urine. More usually, this would be viewed largely from a kidney function perspective – if your kidneys aren't working well, then it will take longer for the drug to be cleared. If the dose isn't adjusted to account for this, then we may end up with blood levels becoming toxic. However, it is possible to end up in the same situation even when kidney function is normal. Dehydration has a significant impact on drug clearance and prescribers rarely consider patients might be deliberately dehydrating themselves. Why might they do this? If you take a systems approach and consider drug therapy from the patient perspective, it becomes apparent that deliberate dehydration is a necessary strategy for many people. For example, women who have had children often suffer stress incontinence, and deliberate dehydration may be one strategy for reducing the risk of leakage, especially when access to public toilets may be limited. Access to public toilets is an environmental factor in systems terms, influenced by even more distant external environmental factors, such as spending on public services, and perhaps vandalism (contributed to by other social factors!) Another reason for deliberate dehydration might be disability. Travel can be disabling for people with even relatively minor impairments. For example, toilet accessibility

onboard aircraft is very poor, and travellers with reduced mobility often report dehydration as a strategy for coping. This approach has two very powerful messages for learners. Firstly, the need to understand the system in which the patient is taking their medication. Secondly, drug therapy is an equality, diversity and inclusion (EDI) issue. Almost invariably, those at higher risk of a medication-related adverse drug event are the poor, the old, females, the non-white and the disabled. For little extra work, we have covered the necessary drug therapy teaching, introduced the systems framework that students will return to throughout their course *and* raised EDI issues. This latter aspect is not minor: it is not only a social justice issue, but a curriculum efficiency. The GMC has mandated EDI outcomes, and this new approach to drug therapy allows these to be addressed in a meaningful way, giving us double value for the same learning activities. In the last academic session, we extended this by considering sustainability implications for deprescribing. A major contributory factor to medication-related adverse events is polypharmacy (where a patient is taking multiple medicines). Deprescribing is the planned and supervised process of dose reduction or stopping of medication that might be causing harm, or no longer be of benefit. Prescribers are reluctant (often citing safety concerns), and so it seems sensible to enhance safety by using a systems framework to support deprescribing. However, we also know pharmaceuticals are an environmental burden, from the carbon footprint associated with their manufacture through to the impact of drug contamination of aquatic ecosystems. As Barry Melia, Principal Pharmacist at Public Health Scotland (and Chair of Environmental Sustainability at the Guild of Healthcare Pharmacists) says, “the most sustainable medicine is the one that is never prescribed.” Our teaching on deprescribing therefore also contributes to the sustainability curriculum.

Building capacity and capability

Alongside content development, a faculty education package was developed (also CIEHF-accredited). This forms part of the University of Aberdeen MSc Clinical Education, and is available externally as a standalone course, meaning there is the potential for revenue generation which could support further curriculum development. One possible route would be micro-credentialling, offering bite-sized chunks of HF learning as part of a continuing professional development (CPD) package.

Currently, our ‘student experts’ are supported in becoming HF faculty, teaching in some of the Core Strand activities. It is hoped that the early adopters will be making applications for Technical Membership in about 18 months’ time. Some of their experience is captured in the case studies below.

Learner stories

Fraser Gold (Year 4)

“My first introduction to HF was through the Medical Humanities block. Before this course, I hadn’t even heard of the term “Human Factors”, but I had heard of ergonomists and Quality Improvement. I was interested in this course as one of my biggest fears of becoming a junior doctor is making an innocent mistake and being struck off by the GMC, making my six years of medical school worthless. I liked the idea that Human Factors considers the person in the context of a system and looks at finding more robust barriers to prevent errors rather than simply “blaming and retraining” the individual.”

This is a very powerful observation. The GMC is in a difficult position: as the regulator, it is charged with holding individual practitioners to account in a way that perhaps doesn’t reflect modern safety science. An attempt has been made to account for this in the GMC’s Good Medical Practice document: The GMC will respond to concerns about a practitioner by considering:

- The seriousness of the concern

- Any relevant context that may impact on risk (*including systems factors*; our italics)
- How the medical professional responded to the concerns

This is good progress, but the only way those contextual factors can be understood is if the medical practitioner is able to articulate them and explain how they impacted on practice. As Fraser suggests, Human Factors is about so much more than patient safety:

"I carried out a survey on students' mental health during the pandemic. One of my biggest worries was that if I admitted to struggling with my mental health, then the GMC may issue me a fitness to practice, and I wondered if other students felt similar. The survey revealed that 47% of respondents have worried about fitness to practice due to their mental health, and 77% have hesitated or not contacted the medical school due to this worry. Many of us do not seek support due to the fear of the GMC striking us off, and outside of medical school, healthcare workers generally do not feel protected in their workplace and worry about making mistakes. If the environment and culture of healthcare were changed to a more positive one with space for learning from mistakes using a Human Factors approach, then we may retain more staff and prevent burnout.

"This [HF] course really highlighted to me how important HF is within healthcare and how we all must be champions of it. It is mandated in the GMC 'Outcome for Graduates', yet many doctors remain unaware of its existence, let alone its importance. To me, patient safety is all about reducing preventable harm to our patients by strengthening barriers. A systems approach allows us to learn from incidents, which give us insight into the robustness (or otherwise) of our existing barriers. A mistake should not punish those with good intentions, who get caught up within the pressures of a system and we must protect and look after our most valuable resource within the NHS, our staff."

Connor Schlemmer (Year 3)

"Studying HF has enhanced and shifted my views on patient safety. I began the course with a viewpoint far closer to "root cause" and have been shown the value of examining problems more holistically, understanding that system errors are the result of interactions between system factors. It altered my thinking, from more surface level to seeing things in terms of system factors, interactions and resultant wanted and unwanted outcomes. It's made me more focused on patient safety and far more perceptive of the importance of design – not just equipment, but also systems as a whole to ensure they support the people that work in them. HF has moved me away from directing blame towards individuals, recognising that 'fire and rehire' doesn't fix problems. Only a systemic analysis can result in sustainable improvement after things go wrong."

Connor's reflection captures one of the key intended learning outcomes of the HF curriculum: that change in mindset which is necessary to support improvement. The HF course within the Medical Humanities block requires learners to undertake a partial systems analysis of their choice. Connor's reflections on booking a GP appointment highlight another foundational concept: Meaningful analysis of complex systems will often raise more questions than it answers:

"My project focused on the process of booking a GP appointment, following personal experiences of the difficulties. My systems analysis considered the perspectives of multiple stakeholders including doctor and patient. I identified issues in primary care such as understaffing, high workloads and lack of retention, and also considered possible recommendations and solutions. While the project identified some possible options for improving the efficiency of the primary care system at a lower level, generally it was considered that change needs to happen at a higher level, including areas such as the current NHS GP contract as well as government policy relating to the training and retention of new doctors and fully trained consultants."

AJ Carpio (Year 3)

Most of our learners are surprised by the way a systems approach 'opens the lid' on the complexity of apparently simple tasks. Furthermore, AJ's reflection reveals another HF "truth" – it is often the mundane minutiae that undermine successful outcomes, and it is worth trying to understand these.

"I did my HF project on the pain management pathway in Aberdeen Royal Infirmary. The system consisted of many different health care professionals interacting with each other and with various system elements such as equipment, electronic databases and prescribing platforms. By analysing interactions, I identified those with a particularly strong impact on the desired outcome of rapid pain relief. Key parts of the pain management process included: the patient notifying the nursing team of pain, nursing team communicating this to the medical team and lastly the medical team prescribing medication and communicating this to the nursing team. Communication was a key theme here, but I was surprised to see how often it was affected by unexpected systems factors. For example, sometimes 'notifying nurses' meant the nurse seeing the patient was in pain. Design and layout of patients' rooms could facilitate or hinder this recognition. Windows allow staff to monitor patients from the door. However, in the emergency department, the windows were covered in opaque film. I discovered that little squares had been cut from the film (a post-installation modification) to enable observation – a perfect example of [what, in systems terms, would be called] a workaround.

"My recommendation was to improve communication at all stages of the process, and my systems analysis allowed me to suggest solutions appropriate for the context. For example, redesigning the prescribing system to automatically inform the nursing team of any changes made to a prescription would enhance communication in the final stage of the process. This potentially reduces the cognitive workload on clinicians, prevents erosion in team dynamics and also reduces the time taken for patients to receive analgesia. Having done this project, I now have a deeper understanding of patient safety. I have learned that blaming people for mistakes is not the right approach for improving patient safety, but rather redesigning the system to make it harder for people to make mistakes. When it is not possible to 'design' out errors, it is possible to include redundancies to minimise harmful events."

Claire Taylor (Year 3)

Claire's reflection builds on this idea that the seemingly unimportant can hold the key to improvement. It is the HF specialist's job to dig into the messy reality of work and consider the relative contribution of system entities. Claire's project concerned the use of Early Warning Scores (EWS) which are a mainstay of identifying critically unwell and deteriorating patients. "Failure" to identify such patients has been cited in numerous incident investigations, and the organisational attitude to such "failures" can be summed up in a recent review[3], which concludes that EWS are effective tools, so long as staff use them properly! A national investigation by the Healthcare Safety Investigation Branch (now the Health Services Safety Investigations Body; HSSIB)[4] challenged this – other aspects of the work environment made it difficult to complete the observations necessary for EWS to be effective. Claire's work adds to this:

"Manual respiratory rate (RR) measurement is vital for the early detection of patient deterioration but is often performed inaccurately in practice. This study, employing a systems approach, investigated the systemic challenges affecting RR monitoring in the NHS. The findings highlight common pressures such as heavy workloads, high nurse-to-patient ratios and time constraints, which contribute to the reliance on estimation methods (quick counting, and the preference for even numbers), practices that undermine the accuracy of RR documentation. Variability in experience and knowledge among clinical staff also contributes to inconsistent measurement practices; with those who have just recently graduated being more likely to maintain best practice. Furthermore, the study reveals that RR is often undervalued compared to other vital signs, leading to a further

normalisation of inaccurate recording behaviours. This raises a critical question: if RR data is frequently inaccurate, what is the value of recording it on EWS charts? Rather than attributing these inaccuracies solely to 'human error' or insufficient training, the study emphasises the importance of understanding broader system influences. Unlike other vital signs, RR monitoring lacks widespread assistive technology. Could AI and digital health innovations bridge this gap? If so, their implementation must be guided by HF to ensure usability and avoid unintended outcomes. Future research should focus on the feasibility and long-term impact of integrating emerging technologies in clinical practice to improve patient safety.

"As my first HF project, this study provided an eye-opening introduction to the profound impact of human-system interactions in healthcare. It highlighted the importance of designing healthcare systems that account for the needs of the people that work in them, especially in critical areas like vital sign monitoring, where inaccuracies can significantly affect patient outcomes. This experience has fuelled my commitment to understanding and improving healthcare processes through a systems-thinking approach."

Maude Adams and Dinuki de Alwis (Year 3)

Maude and Dinuki's reflections are grouped together here because they capture a particularly critical aspect of Human Factors: its inherent inclusivity. Maude has identified issues relating to accessing cervical screening, a largely female issue, while Dinuki's study revealed the technological challenges of telemedicine tended to exclude older people and those with impairments.

Maude: "As part of the HF course, this study aimed to investigate the reasons behind the low attendance at cervical cancer screening appointments in the UK, using a HF approach, aiming to offer robust recommendations. Low attendance in the programme is a growing concern due to its critical importance in early diagnosis and prevention of cervical cancer. Data was gathered from literature and qualitative interviews, and a systems framework used as to analyse the task of booking an appointment for the cervical screening programme. Several factors were identified as barriers to attending appointments. Firstly, needing to be sent a physical invitation affected individuals without a fixed address, along with younger woman who moved flats often. Secondly, needing to call and attend at specific times was made harder by individuals having busy lives and additional responsibilities. Finally, the culture around appointments, which facilitates fear and a view that if you are vaccinated or practicing safe sex then you are at a low risk of cancer and do not need to attend. This is further confounded by lack of clear information provided about the need for booking, what will happen at the appointment itself, and what will happen if the results are positive. Overall, the report concluded that the reasons for low attendance are multifactorial and cannot not be solved easily. However, by using an HF approach, I was able to suggest evidence-based changes which may make a difference. These included self-testing and online booking systems."

Dinuki: "My introduction to HF and patient safety was in this humanities course. I had heard both terms used individually, but together, they changed my understanding. If you want to work in healthcare, you must prioritise your patients' needs, which means ensuring their safety is your top concern. However, how can you ensure that this occurs? I think that HF may contain the answer to this query. For my assignment, I chose telemedicine as it is an upcoming aspect of medicine worldwide, and I based my work on a literature review that aimed to understand the intended users and strengths and weaknesses of the currently available systems. I bounded my system by studying the pre-consultation phase, which deals with the technological requirement to have a device-led consultation remotely from the comfort of your own home. My findings suggested that technology-related shortcomings and lack of understanding and knowledge on the basic operation of electronic devices that result in people being unwilling to engage in such consultations.

I had not approached any system with the HF mindset before - so far, I have always believed that errors are only the result of personal incompetence. However, the HF approach gave me the necessary insight to understand the contribution of multiple systems factors and their interactions. Understanding this offers the potential to design a system that makes it easier for operators to do the right thing. Teaching myself to observe and think in this manner will not only help me understand situations better in the future, but help me move away from blame (whether blaming others, or self-blame)."

Key takeaways

- The University of Aberdeen MBChB includes a fully integrated HF curriculum which supports learners in achieving HF outcomes that support national workplace initiatives
- The authors believe that this is unique in the UK, and that sharing our experiences will support educational faculty in developing their own programmes.
- It also offers the opportunity to start a national conversation about agreed HF outcomes across health and care curricula.

We would like to leave the final word to Maude, who has been following the Advanced strand since she enrolled for her first year, where she completed a systems analysis of a major medication-related adverse event:

"Before I studied HF, it was easy to agree with the incorrect assumption that it was the actions of people which cause errors or accidents to occur. However, my patient safety study has significantly impacted my understanding of HF and its importance to patient safety. By applying a systems framework to real-life examples, it is very clear to see how it can directly improve patient safety. Most importantly, understanding the key principles of not blaming individuals and recognising the ineffectiveness of retraining is essential if we are able to truly learn from incidents in a way that stops them from happening again."

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