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Acting wisely in complex clinical situations: 'Mutual safety' for clinicians as well as patients

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ABSTRACT

Purpose: The hope that reliably testing clinicians' competencies would improve patient safety is unfulfilled and clinicians' psychosocial safety is deteriorating. Our purpose was to conceptualise 'mutual safety', which could increase benefit as well as reduce harm.

Methods: A cultural-historical analysis of how medical education has positioned the patient as an object of benefit guided implementation research into how mutual safety could be achieved.

Results: Educating doctors to abide by moral principles and use rigorous habits of mind and scientific technologies made medicine a profession. Doctors' complex attributes addressed patients' complex diseases and personal circumstances, from which doctors benefited too. The patient safety movement drove reforms, which reorientated medical education from complexity to simplicity: clinicians' competencies should be standardised and measurable, and clinicians whose 'incompetence' caused harm remediated. Applying simple standards to an increasingly complex, and therefore inescapably risky, practice could, however, explain clinicians' declining psychosocial health. We conducted a formative intervention to examine how 'acting wisely' could help clinicians benefit patients amidst complexity. We chose the everyday task of insulin therapy, where benefit and harm are precariously balanced. 247 students, doctors, and pharmacists used a thought tool to plan how best to perform this risky task, given their current clinical capabilities, and in the sometimes-hostile clinical milieus where they practised. Analysis of 1000 commitments to behaviour change and 600 learning points showed that addressing complexity called for a skills-set that defied standardisation. Clinicians gained confidence, intrinsic motivation, satisfaction, capability, and a sense of legitimacy from finding new ways of benefiting patients.

Conclusion: Medical education needs urgently to acknowledge the complexity of practice and synergise doctors' and patients' safety. We have shown how this is possible.

1. The need for reform in medical education

What more than anything arouses involvement, effort, emotion, excitement, and frustration among frontline hospital staff is encounters with real live patients. (Engeström 2018)

In the early twenty-first century, public concern that medical practice was harming patients (Kohn et al. 2000) undermined confidence in the medical profession. The rise of competency-based medical education (CBME: (Carraccio and Englander 2013)) to the status of a paradigm coincided with, and seems to have resulted from, pressure to improve safety (Holmboe et al. 2017). Experience has shown, though, that improving healthcare safety is far more complex than assuring individual competence. Meanwhile, a worrying new threat to healthcare is emerging: doctors, globally, appear less motivated to benefit patients (Nishigori 2020). Work-life balance is influencing trainees' choice of subspecialty (Douglas et al. 2018). Trainees' poor psychosocial health, which causes sickness absences and career breaks, (West and Coia 2019; Dornan et al. 2020;

Practice points

- Doctors' demotivation and poor psychological health are becoming serious threats to healthcare safety.
- Doctors' complex mix of attributes provides the human touch, which makes healthcare much greater than a series of correct actions.
- There is an inherent tension between the recent rule that patients must not be harmed and the time-honoured rule that patients should benefit as much as prevailing circumstances allow.
- Simplifying doctors' work to standardised competencies allows the assessment tail to wag the clinical practice dog.
- Mutual safety capitalises on synergies between their individual best interests to optimise patient benefit and bolster doctors' confidence, intrinsic motivation, satisfaction, and wish to continue practising.

Wilson and Simpkin 2020) is worsening the already problematic fragmentation of healthcare teams (Holmboe et al. 2011). This article reports a series of thematically linked projects (a programme), which explored the history of reform in medical education and how future healthcare could be made safer for doctors as well as patients. The aim was to explore how 'mutual safety' could be 1) conceptualised and 2) optimised.

Hippocrates, in the 5th century BC, elevated medicine to the status of a profession by asking doctors to swear an oath, which remains a moral foundation of medical practice. (Hippocratic Oath n.d.) The Hippocratic oath obliged doctors to ensure that artful use of treatments was more likely to benefit than harm patients. The oath placed the education of doctors on a firm foundation too: teaching is a moral imperative; education should be integral to practice; and students should perpetuate professional behaviours when they eventually become teachers. Accordingly, this article assumes that medical education should optimise benefit to patients.

The unfolding narrative that follows recapitulates the course of a research programme. Section 2 argues that medical practice and education are two tightly linked aspects of a single complex activity. Section 3 uses Cultural-Historical Activity Theory (CHAT (Engeström 2018)) to identify tensions that result from regarding medical education as simple. Section 4 reports a complex intervention, which used CHAT to advance Section 3's argument. Section 5 evaluates the programme and Section 6 proposes implications for practice and research.

2. The complexity of practice

Previous authors have debated whether medical education is better conceptualised as simple or complex (Regehr 2010; Norman 2011; Cristancho et al. 2019; Woodruff 2019). Simplicity is well exemplified by training non-clinicians to perform basic life support. (BLS) When a person collapses in the street and has no signs of life, THE solution is to compress their chest and inflate their lungs rhythmically. Doing this competently on a manikin fulfils one condition to become a first-aider. Treating breast cancer is, of course, more complicated than BLS. A radiologist interprets the patient's mammogram, a cytologist interprets the biopsy, a surgeon performs the mastectomy, and an oncologist gives chemotherapy. Despite more people and technologies being involved, advocates for the simplicity of CBME assume that individual competence is the educational key to safer care. Simplicity advocates assume that breast cancer is, ultimately, a standard disease (a 'determinate situation') which will respond in predictable ways to standardised clinical behaviour. If a woman has a poor outcome, it follows logically that someone or something in the system performed incompetently.

Advocates for complexity would argue that human health and wellbeing is not merely a binary between benefit and harm. Patients and clinicians are individuals with values and free will (agency), which allow them to work together well one day and less well the next. Technologies can behave unpredictably too: a biopsy may be unsuitable for analysis, equipment may fail, and any powerful therapy can have side-effects, some of which are unpredictable.

Occasionally, all these things will go wrong at once with potentially disastrous consequences though, serendipitously, no harm might occur, or even benefit. Complexity thinkers would argue that it would better serve a woman to treat HER breast cancer as a part of a greater whole and acknowledge her individuality.

It would be silly to suggest that BLS is better served by complexity thinking or, indeed, psychoanalysis by simplicity thinking. In between those extremes, the best way of conceptualising clinical problems is less clear. If ability to take the right action were the only criterion for choosing a doctor, patients would be better served by robots than human beings. In reality, doctors' complex mix of attributes provides 'the human touch', which makes healthcare far more than a series of correct actions. As life expectancy increases and health technology advances, doctors manage ever more indeterminate problems, resulting from multi-morbidity, interactions between psychological, social, and somatic causes of ill health, and the contributions of multiple actors. Doctors who are skilled at addressing biological problems may be incapable of addressing psychosocial ones because allowing a 'simple' disease to be indeterminate takes them outside their comfort zone. The under-resourced, busy contexts, and anti-social hours in which doctors have to deliver care and the unpredictable potential for treatment of serious diseases to cause harm as well as benefit can make the simplest problems indeterminate. Having used the term indeterminate and determinate to explain why education and practice can be conceptualised as complex or simple, we will now only use the latter terms.

This research assumes, as Hippocrates mandated, that human agency should be allowed to make clinical situations complex (Callus et al. 2020). Doctors' most important tasks, therefore, are to interpret situations (Cristancho et al. 2017) and increase the agency of patients and fellow clinicians in order to solve these. Such complex relationships can only truly exist in real practice. The contexts in which doctors learn to care for patients must therefore be the contexts where doctors balance real benefit and harm. Education research within this complexity is in its infancy.

3. A cultural history of the present

3.1. CHAT as an example of complexity thinking

Vygotsky, who laid the foundations of CHAT, (Wertsch 1991) departed from the simplicity assumptions of his compatriot Pavlov, whose psychology emphasised the deterministic effect of environmental stimuli on human behaviour. Vygotsky explored, experimentally, how interactions with people, material artefacts, and the language of learning environments, create a complex 'Zone of Proximal Development', which gives children agency to learn and develop. This process is cultural-historical, because the influences that mediate learning are products of the history of the culture in which children and adults learn. By mediating learning, these influences become part of their identities. Vygotksy's theory is a social one because it regards individual agency as part of a greater, social whole. Leontiev (Johnston and Dornan 2015) incorporated Vygotsky's concept of mediated learning in his formulation of what is now known as CHAT.

The central assumption of CHAT is that people learn by participating in social activities. Every activity is orientated towards an 'object'. The object has been described as 'a vision, often utopian', which the activity makes concrete (Sannino et al. 2016). Section 1 explained how Hippocrates made the patient the object of the activity of medical education. Clinicians are the subjects of this activity, which has two main outcomes: patient benefit, and clinical education. Members of clinical communities optimise those outcomes by dividing the labour of caring for patients. As clinicians learn and change, practice communities do so too. Clinical activity is mediated by tools (e.g. stethoscopes), the language of practice, and tacit or explicit rules (eg to maintain confidentiality). Interactions between these factors are orientated towards the patient as the cultural-historical object of medical education.

CHAT is a complexity theory because it regards any activity as an open system, which feeds back on itself and is open to external influences. This complexity underpins CHAT's most important contribution to practice improvement: 'contradictions' are inevitable features of any activity system (Engeström 2018). Carefully examining these can optimise benefit. In medical education, the imperative to manage a demanding workload by practising faster, for example, may contradict the imperative to practise slower, for the sake of better clinical education. CHAT encourages clinical educators faced with such a contradiction to consider whether, for example, a division of labour that gave students greater agency to define patients' complex problems before a trained clinician saw them could be cost-effective. This article explores an inherent contradiction between the simplicity rule 'doctors should be trained not to harm patients' and the complexity rule 'doctors should be educated to benefit patients as much as possible under prevailing circumstances'.

CHAT follows Lewin's maxim that the best way to understand a complex problem is to try to change it, (Krapp 2015) which is a reason for medical education researchers to change practice, not just observe it. The term 'formative intervention' describes change projects conducted by CHAT researchers (e.g. (Engeström 2018; Diniz et al. 2021; Meijer et al. 2021; Morris et al. 2021)) and the term 'expansive learning' describes the catalytic process that turns contradictions into new educational possibilities.

3.2. Flexner bringing science to bear on complex situations

In the early twentieth century, the professional imperative to balance benefit and risk was accentuated by developments in laboratory science, which now made it possible for 'a random patient with a random disorder, who consulted a physician chosen at random, (to have) a better than 50-50 chance of benefiting from the encounter '(Ludmerer 1985). The quality of medical education was compromised, though, by a contradiction. Business-minded Deans had changed the patient from Hippocrates' moral object of benefit to a fiscal object of revenue from students' fees. The activity of medical education used out-of-date knowledge as an instructional tool and reduced students – the subjects of the activity - to rote-learners. This resulted in a very variable and often low standard of medical education (Bonner 2002).

The Carnegie Foundation for the Advancement of Teaching commissioned a visionary pedagogue, Abraham Flexner, to recommend how to optimise benefit. His report (Flexner 1910) argued that the biopsychosocial nature of clinical problems made them complex. Doctors had, therefore, to choose optimum courses of action within the limits of medical knowledge and technology. Science was a tool that could help students learn to 'study patients' actual situations with keen attention, and free of presuppositions.' Students had to learn how to integrate, critically, a wide range of knowledge and continue to do so lifelong.

Flexner reset the rules to two years of university-provided education with stiff entry requirements preceding two years of deep immersion in practice. Recognising the epistemic complexity that was resulting from the rapid expansion of medical knowledge, Flexner used the elite Johns Hopkins University as a model for his recommendations. He did not, as Lewin would have advised, test the effects of his recommendations before finalising them, with the undesirable consequence that US medical education became less accessible to women and members of minorities. His careful analysis did, though, turn a contradiction at one moment in history into enduring, global improvement in the quality of medical education.

3.3. Reducing harm simplistically

In the final years of the twentieth century, opinion leaders were advocating strongly for curricula to have defined, measurable learning outcomes. The twenty-first century was ushered in by the influential report 'To err is human', which begins with the sentence: 'Health care in the United States is not as safe as it should be – and can be' (Kohn et al. 2000). Education researchers had, meanwhile, developed two eminently implementable tools: simulation; and reliable assessments of clinicians' ability to demonstrate competencies under test conditions (Reid et al. 2021). CBME, the result, was a trinity of assessing **simple outcomes** in **simplified contexts** to make **simple judgements** of individuals' fitness to practise. CBME brought medicine within educators' control.

The year 2010 marked the centenary of the Flexner report. The Carnegie Foundation commissioned influential scholars to recommend, anew, how to educate doctors to benefit American people (Cooke et al. 2010). The Lancet commissioned experts to recommend ways of improving global health (Frenk et al. 2010). Both reports recommended that clinicians' competencies should be standardised, which consolidated CBME's status as a paradigm. The recommendations introduced new contradictions, though, which Table 1 presents in detail. Recommending that doctors should approach patients holistically acknowledged implicitly that clinical problems are complex, and yet competence is simple. It was proposed that (inter)-nationally agreed, standardised competencies should be the currency of a global, interprofessional labour market. Table 1 argues that such a huge Lego model of interchangeable competencies could never have been agile enough to address a real global health threat like COVID-19. Later publications (Irby and Hamstra 2016) showed that these contradictions arose because assessment, which requires simplicity for reliability, was wagging the dog of professional practice, whose strength lies in the ability of doctors to manage complexity.

Table 1. Contradictions that result from attempting to reduce harm simplistically.

Contrasting features of CBME and clinical practice	Contradictions	
	Simplicity of the paradigm	Complexity of practice
The proposed global labour market, supported by an internationally coordinated, nationally adopted, and locally delivered competency framework, is a complicated, imposed structure. If such an entity could be constructed, it might work for predictable tasks like elective hip surgery. COVID-19, however, required clinicians to transform work in agile ways: individuals' agility on the ground outstripped structural capacity to manage the pandemic.	'Top-down', simplistic solutions are politically expedient	Practically effective, complex solutions often originate 'bottom-up'
CBME defines competence-not-to-harm as the currency of the proposed labour market. Benefit, though, results from capability-to-act-appropriately in risky situations. Capability is 'an all-round human quality; an integration of knowledge, skills, personal qualities and understanding used appropriately and effectively' (Neve and Hanks 2016). It is not possible to be capable without being experienced, which CBME tends to downplay. Evidence shows that competent but inexperienced graduates were ill-prepared to meet the demands of the COVID-19 pandemic (Dornan et al. 2020).	Competencies have 'exchange value' in the labour market; training ends when a clinician becomes 'exchangeable' for work	Capabilities are needed to make ill people better. Learning from experience continues lifelong
CBME holds individuals accountable to the standard of not being unsafe.(Un)safety, though, emerges from complexity characterised by 'time pressure, high stakes, inexperienced decision-makers, inadequate information, ill-defined goals, poorly defined procedures, dynamically changing conditions, and the need for coordination among multiple actors', where clinicians 'make decisions based on fulfilling their identities' within social groups, whose object is the patient (Engeström 2018).	Individuals held accountable	Unsafety emerges from collective activity
Competence can only exist in the present because capability to manage problems that do not yet exist could never be assessed reliably. CBME, therefore, grounds clinical education in the stability of the present and past rather than the unpredictability of the future.	Acquisition of competencies standardised in the present	The unexpectedness of complex practice exists in both the present moment and the future
It would not be possible to standardise education if it was closely related to patient-oriented practice because patients' non-standard nature is a defining feature of practice. CBME divorces education from practice by making education the antithesis of what many patients want and need.	Standardised education	Non-standard practice

The most potentially damaging contradictions result from changing the object of medical education from the time-honoured complex object (patient-as-optimal-benefit-despite-risk) to a simple object (patient-as-no-harm). This transformed a professional education, which made doctors 'useful' because they could benefit patients, to a market-oriented training, which would give doctors the right to earn in exchange for certified competence. It also divorced education, which was now to be simple, from the stubbornly complex practice of healthcare. Since the time of Hippocrates, students had entered medicine to fulfil their professional vocation to manage complex, risky situations in order to benefit patients. This had been motivating enough for doctors both to work long days and get out of bed at night. Certification of competence could never substitute for this. More demotivating still, the simplistic logic that equates competence with benefit makes it possible to equate harm with incompetence. CBME placed medical professionalism in a harmful bind, which could compromise doctors' intrinsic motivation to care for patients.

Theory and empirical evidence suggest that this contradiction has, indeed, compromised clinicians' professionalism. Anyone whose work is emotionally demanding is prone to burnout and poor mental health (Samra 2018). Doctors are prone to burnout; (Simpkin et al. 2018) more so than non-doctors, despite being more resilient (West and Coia 2019). Poor psychological safety, reluctance to speak about personally sensitive matters, and feelings of inadequacy are endemic in medical workplaces (West and Coia 2019; Atherley and Meeuwissen 2020). Student clinicians are particularly susceptible to negative emotions and poor mental health, particularly when supervisors have unreasonable expectations, behave unsupportively, and regard sharing doubts and seeking help as signs of weakness (Dyrbye and Shanafelt 2016; Atherley and Meeuwissen 2020). Clinicians who feel psychologically unsafe deliver less good care

(Atherley and Meeuwissen 2020). CBME, by creating identity conflict between external and internal ideals within a risky practice, could cause 'pathological altruism', (Samra 2018) where tensions between doctors' wishes to do the best for patients and the scope to do so result in aberrant behaviour (Sun 2018).

Clinicians, we conclude, are entitled to be 'safe' and patients can benefit from this. Education must reacknowledge the complexity and inherent risk of medical practice. We conceptualise 'mutual safety' as a biopsychosocial good, which results from developing clinicians' capability to optimise benefit and minimise harm. Mutual safety is equitably distributed between patients and clinicians, capitalises on synergies between their interests, and sustains clinicians' intrinsic motivation. Education and healthcare are, according to this conceptualisation, two closely related parts of a single practice, which is made complex by patients' and clinicians' exercise of agency. Since health problems are more or less complex, the safest clinicians will be those who are familiar with complexity, can attend to contextual factors, and analyse problems before trying to solve them. Because of its complexity, mutual safety can only exist as an aspiration, which energises healthcare education and practice. Section 4 reports a formative intervention, whose goal was to refocus medical education on the patient in order to expand the possibilities for mutual safety.

4. A formative intervention to optimise mutual safety

4.1. The research programme

All individual empirical projects that contributed to this programme had research ethics approval. The work took place in Northern Ireland (NI), a region of the United Kingdom (UK) with a population of two million people.

Health and Social Care is delivered by five Health and Social Care Trusts, which are part of the UK National Health Service (NHS). NI had one medical school until recently and has one agency responsible for postgraduate medical education and one for postgraduate pharmacy education. Two universities jointly educate postgraduate nurses.

4.2. Articulating the problem

The starting point was an intersection between medical education and practice, where harm results from clinical care provided by foundation trainees (FTs: newly qualified doctors in generalist 2-year residencies). The NHS, which provides FTs' workplace education, depends heavily on them to look after hospitalised patients under sometimes scanty supervision. In 2007, the national regulator of foundation training, concerned that FTs' prescribing was harming patients, commissioned us to measure the frequency of errors and examine their causes (The EQUIP study (Dornan et al. 2009)). We found that over 9% of their prescriptions contained errors, which often resulted from the complexity of practice in difficult working conditions. We next conducted a randomised controlled trial of giving FTs feedback on errors in antibiotic prescriptions. A pharmacist used behavioural techniques in small group discussions to empower FTs to address error-producing conditions in everyday practice. This reduced the prevalence of error (McLellan et al. 2016).

4.3. Creating urgency by highlighting a bind

National policy, however, was still dominated by CBME so we chose next to research a problem that defies simplistic solutions: using insulin to treat hospitalised patients with diabetes. Insulin is a powerful drug. Too little allows blood glucose to becoming damagingly high (hyperglycaemia) and too much makes blood glucose damagingly low (hypoglycaemia). The 'therapeutic window' between these extremes is narrow and unpredictably variable in sick, hospitalised patients. This creates a bind because prescribing the same insulin dose could, on one day, cause a patient to become hypoglycaemic (incompetent act) on the next day optimise blood glucose (competent act), and on the next day allow blood glucose to become dangerously high (incompetent act, for diametrically opposite reason to hypoglycaemia). Experience teaches doctors to optimise benefit, whilst accepting that harm cannot be eliminated completely. Insulin treatment is an important problem because FTs write about 70% of prescriptions for the people with diabetes who occupy 1 in 6 UK hospital beds. The error rate for insulin prescriptions is four times greater (30% or higher) than for prescriptions overall and extended hospital stays, hypoglycaemia, and hyperglycaemia are endemic. No nationally coordinated improvement effort has resulted and the most serious ill-effects of diabetes care have barely improved over the last decade (Rayman and Kar 2020).

4.4. Turning the bind into possibilities for expansive learning

The term expansive learning describes how CHAT helped us address the contradictions in Table 1 and move towards a more collaborative and future-focused way of practising.

4.4.1. Forming a community
Table 2 describes how we formed a community of diabetes care and clinical education to change practice.

4.4.2. Critically questioning present assumptions
The team's attempts to implement best evidence (from our own trial: Section 4.2) identified further binds. First, a simplistic distinction between error and non-error proved unhelpful for insulin because, whilst errors could be identified retrospectively when they caused harm, the team found most errors indefinable prospectively for reasons explained in Section 4.3. Second, the low staffing level that makes practice harmful also stops FTs being released simultaneously for group education. These limitations demanded a new solution.

4.4.3. Modelling the new solution
Optimising mutual safety in complex clinical situations requires clinicians to learn new behaviours, for which Capability-Opportunity-Motivation-Behaviour (COM-B) theory provides a framework (Michie et al. 2011). This theory predicts that clinicians will adopt new behaviours when they are motivated to do so. 'Motivation' is of two types: reflective (deliberate), and automatic (habit). Clinicians need to break unsuitable, automatic habits and refocus their motivation into a more deliberative type of behaviour. Two main factors influence this motivation: clinicians' psychological capability, and the opportunities provided by the social environments in which clinicians practice. Theories about clinical harm, (Reason 2008) uncertainty, (Fox 2000) and implementation science (Damschroder 2020) augmented COM-B to provide a heuristic (thought tool) shown in Figure 1 and a pedagogy described in Table 2, whose aim was to help clinicians learn to act wisely.

4.4.4. Testing and implementing the model
The thought tool was used in two ways. One was to help clinicians behave in mutually safe ways at the point of caring for patients. The other was to help them reflect, after the event, on personally significant experiences and learn mutually safer future behaviours.

4.4.5 Consolidating and transferring the practice
Between 2017 and 2020, we educated 249 clinicians (141 FT1 and 23 FT2 trainees, 79 senior medical students, and 6 prescribing pharmacists) in 243 reflective conversations. The conversations were facilitated on 118 occasions by pharmacists and on 60, 51, and 14 occasions respectively by doctors, nurses, and people with diabetes. We also transferred the pedagogy to regional curricula for nurse and pharmacist prescribers, not described in detail here.

1a: Heuristic for addressing complex situations
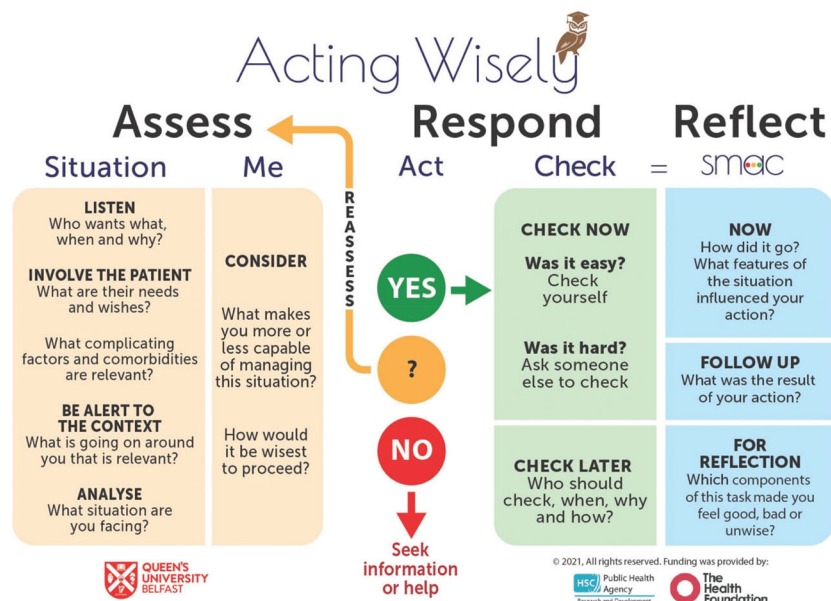
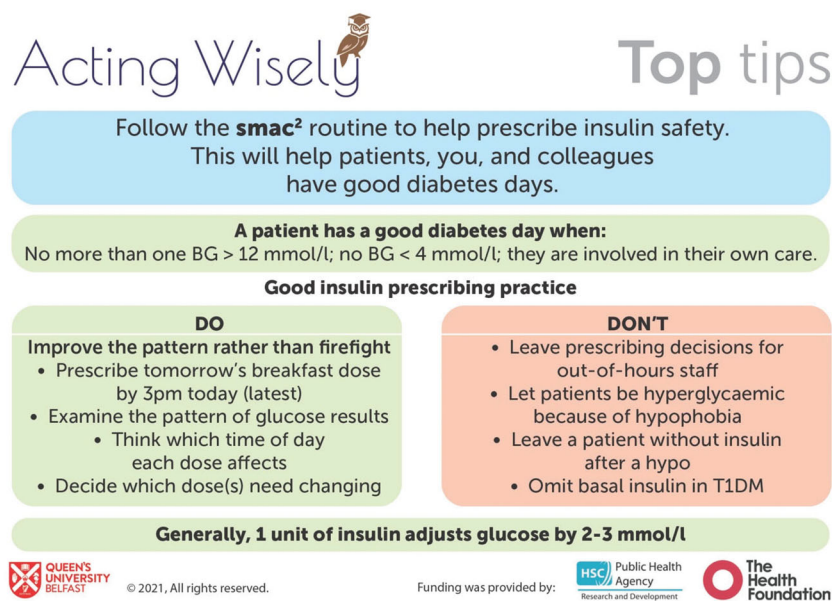1b: Motivational tips, distilled from our analysis of (sub)optimal practice

Figure 1. Tools to help (student) clinicians learn to Act Wisely.

5. Evaluation

The 247 conversations resulted in approximately 1000 commitments to behaviour change and 600 learning points, which included both intellectual and practical capabilities and affects such as becoming less fearful and more confident, motivated, and rewarded. These quotations show how, by legitimising complexity, the intervention increased two participants' agency:

> I learned that, in between a good and a bad decision, there is often a 'valid decision', which can help manage patients safely. With insulin, a valid decision is often the only option. (Dyad: FT1 - Pharmacist as discussant)

> (I learned that), if I can justify my actions and document them thoroughly, patient care can be safer and more effective. (FT1 – Pharmacist)

The following narrative, Figure 2, and Table 3 describe how the intervention helped clinicians break out of the bind created by the simplistic object of solely avoiding harm and, by positioning patients as the object of optimum benefit, improved mutual safety.

5.1. Breaking out of binds

We coined the term 'hypophobia' to describe how an overriding fear of causing hypoglycaemia exposed patients to

Table 2. How the intervention was designed to turn contradictions into expansive learning.

Galvanising bottom-up, officially sanctioned system change
Executive Team: A successful funding bid allowed the first author to recruit a person with type 1 diabetes, (patient) the authors, (clinicians; see biographies below) the regional lead pharmacist for medication safety, a diabetes specialist pharmacist, a clinical education administrator, and two additional diabetes specialist nurses to form an interprofessional executive team.
Engaging service users and clinicians 'on the ground': Senior and junior doctors, nurses, and pharmacists from the whole region participated as researchers, educators, learners, and change agents. In addition, we trained people with diabetes to be 'patient advocates', in which capacity they educated FTs following the same procedures as doctors, nurses, and pharmacists.
Supervisory Board: Representatives of all agencies listed in 'settings' formed a Board, enhancing two-way communication between policy and practice.

Turning non-standardisable situations into mutually safe clinical practice
Heuristic: The theories named in Section 4.4.3 contributed to the design of an 'in the moment' heuristic (shown in Fig 1a) to guide mutually safe responses to complex situations. This:
• Positions the patient as object of collective activity by directing clinicians to assess patients' needs as dictated by their clinical problem, and personal wishes, including the contribution they wish to make to decision-making.
• Directs the clinician to
• Assess the sociomaterial context and their own capabilities to respond to the needs of patients and fellow clinicians in that context.
• Choose one of three alternative actions: act directly on the patient (prescribe insulin); recruit help (from someone who is more senior or more expert, or from an information source); reassess the situation and then choose one of those actions.
• Check the decision, using an additional heuristic (which distinguishes slips from mistakes) to decide who should do the checking.
• Find out later how the action influenced benefit and harm so corrective action can be taken and learning can result.
• Identify points for later reflective learning.
'Top tips': The heuristic was accompanied by several 'Top tips' (Figure 1b), including:
• National audit criteria, which define treatment targets.
• Other pieces of wisdom, distilled from expert practitioners' experiences and capabilities.

Helping clinicians learn, interprofessionally, from prior experience and commit to acting wisely for mutual safety
'Case-based discussions' (CBDs): These one-to-one discussions between a student clinician and their supervisor are a mandatory component of Foundation Training, regarded by many people as tick-box exercises of little educative value. We developed procedures to turn these into reflective conversations, making it safer for clinicians to manage complex situations. Non-directive counselling principles help a discussant (who may be a person with diabetes, doctor, nurse, or pharmacist) 'empower' clinicians to address difficult situations more wisely and verbalise learning points.
Faculty development: We also developed procedures to educate discussants to encourage clinicians to reflect back on actions they had taken and learn how they could, in future, optimise mutual safety. Student clinicians also made one or more specific, measurable, achievable, realistic, and time-bound (SMART) commitments to behave in mutually safer ways in future. The text refers to these as commitments.

harm caused by hyperglycaemia. This quotation describes a clinician learning to break out of that bind:

> Insulin prescribing scared me throughout medical school; in the early stages of F1, I feared giving someone too much insulin so tended to let them run high. I looked at the (test results from the previous day) and tended not to make too many changes to doses even if the patient's blood glucose was high. (FT1 – Pharmacist)

5.2. Optimising benefit to patients

Analysis of participants' 1000 commitments to optimise practice supports three main conclusions: 1) many interacting factors made any clinical action more or less appropriate. 2) Information resources, capability to practise, patient benefit, and learning outcomes were in dynamic, bidirectional relationships with one another. 3) The processes through which these processes and outcomes interacted were, like clinical presentations and clinical actions, complex.

Figure 2 uses Activity Theory as a framework to represent the findings pictorially. The main **tool** was information. Participants drew on applied and contextual information more than the codified information provided by books and guidelines. Patients' records gave information, which could make complex situations clearer and document previous actions, which it was 'safe' for clinicians to repeat. Information came from people, prior experience, and material resources but rarely, before our intervention, from any structured process of feedback. Any prescription involved at least four members of the **community**, vicariously if not in person: the prescriber; the patient, who may have been more expert in insulin therapy than the clinician; a nurse who may have been less experienced than

the prescriber but had to administer the insulin and resuscitate the patient if hypoglycaemia resulted; and a supervising clinician, who was usually absent and sometimes less capable of treating diabetes than the prescriber. The **division of labour** between stakeholders was dictated by a whole range of contextual factors. Participants told us how, before the intervention, many implicit **rules** helped them get by, often just to the end of a shift when someone else would become responsible for the patient. Figure 2 shows the major effect of the intervention: changing the rules to ones that could optimise participants' capability.

The following commitment to advocate for the patient within a hierarchically organised medical team shows the intervention increasing a junior clinician's agency:

> I won't be afraid to speak up as the patient's advocate and ask for clarification of plans; if one person does it maybe others will too. (FT1 – Pharmacist)

The next commitment illustrates how, as a result of the intervention, a junior clinician made a SMART commitment to embrace complexity:

> I will speak to (hospitalised) patients to understand how meals in hospital compare with meals at home. Do they test at home and what results do they get? How would they manage these results themselves? (Medical student – Nurse)

The collective behaviour that optimised mutual safety is described, in CHAT terminology, as 'knotworking' (represented by the knot at the centre of Figure 2): 'a rapidly pulsating, distributed, and partially improvised orchestration of a collaborative performance among otherwise loosely connected actors.' Knotworking is, as earlier work has shown, (Lingard et al. 2012) very characteristic of the way clinicians practise.
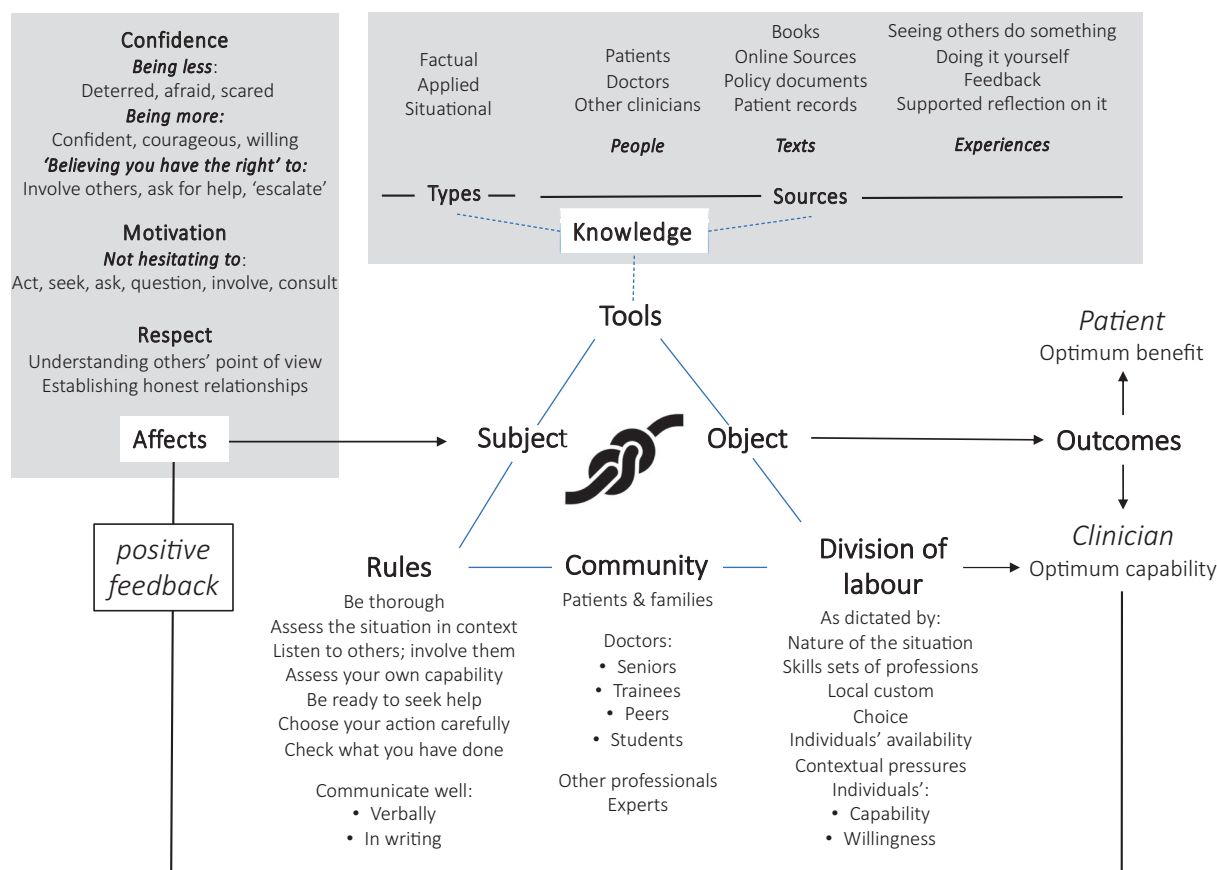
Confidence
Being less:
Deterred, afraid, scared
Being more:
Confident, courageous, willing
'Believing you have the right' to:
Involve others, ask for help, 'escalate'

Motivation
Not hesitating to:
Act, seek, ask, question, involve, consult

Respect
Understanding others' point of view
Establishing honest relationships

Factual
Applied
Situational

Patients
Doctors
Other clinicians

Books
Online Sources
Policy documents
Patient records

Seeing others do something
Doing it yourself
Feedback
Supported reflection on it

People   *Texts*   *Experiences*

— Types —   ———————— Sources ————————

Knowledge

Tools

Affects ⟶ Subject   Object ⟶ Outcomes

Patient
Optimum benefit

Clinician
Optimum capability

positive feedback

Rules
Be thorough
Assess the situation in context
Listen to others; involve them
Assess your own capability
Be ready to seek help
Choose your action carefully
Check what you have done

Communicate well:
• Verbally
• In writing

Community
Patients & families

Doctors:
• Seniors
• Trainees
• Peers
• Students

Other professionals
Experts

Division of labour
As dictated by:
Nature of the situation
Skills sets of professions
Local custom
Choice
Individuals' availability
Contextual pressures
Individuals':
• Capability
• Willingness

Figure 2. Activity system of optimising mutual safety.

5.3. Optimising benefit to clinicians

Potential benefit resulted from giving clinicians more agency to manage complex situations and become more capable as a result. Figure 2 shows some affective benefits, which resulted directly from optimising patient benefit. Table 3 uses verbatim quotations to analyse benefit to clinicians in finer-grained detail.

6. Discussion and conclusions

Our cultural historical analysis argued, as others have done before, (Morcke et al. 2013) that the case for replacing supported experiential learning with CBME has not been clearly made. We argue that, to the contrary, CBME may make medical education less able to benefit patients by distancing the epistemologies of education and practice from one another. We argue, further, that this could compound the unsafety of practice by harming clinicians. While CBME remains an ideal pedagogic approach to simple educational tasks such as training clinicians to perform the many standardisable practical procedures in current use, the complexity of practice makes this alone insufficient.

We proposed that mutual, rather than individual, safety should be the goal of medical education. A potent cause of harm to patients and doctors – insulin therapy – allowed us to explore how educational interventions could address complexity. We did this by repositioning patient benefit as the object of the activity of medical education. We took a bottom-up approach, involving a wide range of clinicians who work and learn alongside doctors. We conclude that embracing complexity could increase clinicians' practical capability, intrinsic motivation, and reward. The disillusionment of doctors makes it ever more important to pursue mutual safety.

Themes in this article have been articulated by earlier authors. Lingard used activity theory and knotworking to trouble the simplistic idea that individual competence can improve the teamworking that characterises clinical practice today (Lingard 2010; Lingard et al. 2012). Hodges used the metaphor of tea-steeping to advocate for experiential learning in the era of competencies (Hodges 2010). Billett demonstrated a complex relational interdependence between learners and the environments in which they learn (Billett 2006). He encapsulated what we also have shown: that practitioners learn by (a) engaging in work activities ('just doing it'), (b) observing and listening, and (c) the physical and social setting of the workplace ('just being there') (Billett 2014) to which our intervention added the important element of helping student clinicians learn reflectively from those experiences. Finally, a burgeoning literature elaborates our argument that clinical indeterminacy leads to uncertainty, ambiguity, and psychological harm (Ilgen et al. 2019; Hancock and Mattick 2020). The rigour of this earlier work allowed us to focus specifically on the practical task of reshaping medical education so it can address present and future complexity, uncertainty, and harm.

Our work has important limitations. Our choice of a particularly difficult clinical task makes the transferability of our findings to other aspects of practice uncertain. The region where we did the work may not be representative of other parts of the UK, let alone other countries. Our implementation depended on the enthusiasm of our practice community. The benefits listed in Table 3 are potential rather than proven and we have provided no proof that patient outcomes improved. We did, however, implement the pedagogy on a large scale and transfer it to the professions of pharmacy and nursing, to clinicians at various

Table 3. How the intervention made practice potentially safer for clinicians.

Verbatim reports of what participants learned	What the situations represented (S), what could be learned from them (L), and potential benefit (B)
Escaping binds	
I learned … the importance of following a patient up and checking the patient did not become hypoglycaemic after receiving insulin (FT1 – doctor)	S Inescapable possibility that an adequate dose of insulin might prove excessive. L Ensuring follow-up makes risky actions safer B Greater confidence and less chance of (self) blame
Becoming more capable	
Insulin is a powerful drug; needs to be treated with respect (FT1 – person with diabetes)	S Inherent risks of powerful drugs B Risks can be managed by being appropriately cautious
I learned how difficult it can be to manage some patients' blood glucose because they respond differently to insulin (FT2 – Pharmacist) *There is uncertainty in clinical practice and sometimes there isn't a right answer (Medical student –Nurse)* *Importance of knowing your limitations and checking with somebody with relevant expertise (FT2 – Pharmacist)* *Even the most expert clinicians can be challenged by situations they have not encountered before. It is reassuring that they seek advice from peers and consider multidisciplinary support (Pharmacist – Pharmacist)*	S Complexity of disease and treatment effects S 'Greyness' of clinical decisions L Coming to terms with clinical complexity L Modelling on more experienced clinicians B Greater confidence to accept complexity, seek/accept help, and work with members of other disciplines
It has taught me to look at patient care holistically (FT1 – Pharmacist) *If something is confusing you, bring it down to what you already know and work logically through it then ask for help when you get out of your depth (Medical student – Doctor)*	S The need to evaluate any clinical situation in its entirety L Integrating information to make optimal decision B Motivation and capability to analyse situations makes them more amenable to solution and therefore more potentially rewarding
I have learned not to become too overwhelmed by the environment - that there are strategies, which can help with that. (Medical student – Nurse) *I will try to understand my emotions around prescribing insulin; what stressors and aspects of my behaviour could block safe prescribing (FT2 – Doctor)* *Not to panic; be level-headed; think of all available sources to obtain information on dosing. (FT1 – Pharmacist)*	S Emotional impact of managing complex situations L Understanding this and developing cognitive-behavioural strategies to manage emotions B Greater capability to manage complex situations B More confidence and potential reward
Importance of speaking with patient about the insulin regimen and approach, especially if non-conventional and subsequently involving them in decision-making (FT1 – Doctor)	S Situations where patients have expertise that clinicians lack S The possibility that individuals who share the object of preventing harm can harm themselves and others by not behaving in coordinated and collaborative ways
Learned how easy it is for friction and tension to arise between HCPs when clear management plans are not in place. Everyone in this case was trying to keep the patient safe (Medical Student -Pharmacist) *From this case, I learned several things. First, I learned not to point fingers when a mistake has happened. Instead of blaming each other, the important thing to do is to correct the mistake and minimise any harm (FT2 – Pharmacist)*	L Understanding other individuals' points of view and motives B Rewards of working collaboratively in a blame-free culture
Becoming more confident	
I learned that you should know your limitations and not be afraid to act. (FT1 – Pharmacist) *Don't be afraid to ask the patient about their management (Medical Student - Nurse)* *Don't be afraid to seek help or go back and query advice required (FT2 – Doctor) Specialist Nurse)* *Having the confidence to question if unsure about instructions (FT1 – Doctor)*	S Bind: fearing that acting may cause harm and fearing also that not acting (admitting uncertainty, asking for help, or questioning advice) will be interpreted as weakness L Acting and seeking help are legitimate; choosing between them is made possible by weighing the demands of the situation against one's own capabilities B Greater agency to access support and collaborate
Lots of pressure on F1 to give ad hoc dose of insulin – I try to resist this but sometimes the easy way out is just to give a quick fix. (FT1 – Pharmacist) *Have confidence to say when uncertain and need more time (FT1 – Doctor)* *Double-check if not confident (FT1 – Pharmacist)*	S Pressure on clinician from colleague to act mindlessly L Admitting to uncertainty, resisting pressure, and checking actions carefully are appropriate responses B Greater confidence
Becoming more motivated	
Don't follow the crowd – if patient has a high blood sugar consistently, increase the appropriate dose (FT1 – Nurse)	S Tendency of people to 'play safe' by not doing anything different from others, and err on the side of not being blamed L Playing safe can be dangerous B Motivation to practise in a more appropriate way
I learned that involving the health care team and patient together and reaching a consensus is really important (Medical Student – Nurse) *Always see it from patient's point of view. Be prepared to be flexible if patients have different points of view from your own. (Medical Student – Doctor)* *I also learned the importance of communication between staff. In this case, it is good to discuss with the sister in charge what measures to take. (FT2 – Pharmacist)*	S Good practice entails collaborating, communicating, and behaving adaptively L Being able to 'knotwork' increases net benefit to patients and clinicians B Fewer negative emotions and more positive ones because responsibility is diffused rather than shouldered by an individual
Feeling rewarded	
It was reassuring that the patient had the outcome I intended (FT1 – Pharmacist) *I learned that my management was appropriate, despite my supervisor deciding on a different plan (Medical student – Doctor and Nurse)*	S Evidence that an action has appropriately addressed a complex situation often emerges after the event S Learning from our intervention that, despite their supervisor rejecting their plan, the clinician's action was equally reasonable B Greater confidence as a result of supported reflection on experience

different stages of training, and between universities and healthcare provider organisations. We will soon report a more detailed empirical analysis of clinical indeterminacy to increase the potential transferability of the work.

The main practical implication is that education for mutual safety depends heavily on experiential learning. Reflection on experience helps learners develop agency to address future complex situations in ways that abstract teaching before the event cannot. Paradoxically, reflection on complexity can make education **simple** – for example, 'don't be hypophobic' – without being **simplistic**. Another implication is that educators need to tailor educational interventions according to the complexity or simplicity of the tasks they wish to influence. We invite readers to access our tools which are covered by creative commons licenses and therefore freely available for use (Making Insulin Treatment Safer 2020). We will soon, also, publish our work in 'toolkit form' to help educators and faculty developers increase student clinicians' capability and motivation to benefit patients.

Our work has an important implication for the value system of medical education: educators should foster a culture that supports and encourages clinicians rather than one that is quick to criticise and blame. It has an implication, also, for research: formative interventions guided by CHAT typically start when a practice community has identified a problem, are led by outsiders to practice, involve many people in regular meetings, and have practical impact at a mainly local level. In this case, a small team of clinician-educator-researchers positioned themselves as outsiders to the practice community of which they were part, took the lead in bringing the problem to light, recruited willing practitioners to represent people who could not spare time to participate in change, harnessed practice to make change, and delivered transferable outputs as well as local benefit. Our partial outsider status was at a price: our intervention is not yet fully embedded in medical foundation education regionally, let alone nationally. In mitigation, though, the transferability of the intervention allowed us to move it to other education programmes that were more ready to change.

We conclude by agreeing with Flexner that doctors are professionals and not technicians. They are of value to society because they are capable and willing to address complex problems, which require moral courage, intelligence, and tenacity. Of late, there has been a tendency to regard clinicians as no better than their most recent assessment or appraisal. The poor psychosocial health and demotivation that seems to be resulting is a wake-up call for society to value and nurture medical professionalism and encourage doctors to act wisely in the face of ever-changing and increasing complexity.

Disclosure statement

The authors have no competing interests to declare.

> ## Glossary
>
> **Mutual safety:** A biopsychosocial good, which results from developing clinicians' capability to optimise benefit and minimise harm. Mutual safety is equitably distributed between patients and clinicians, capitalises on synergies between their interests, and sustains clinicians' intrinsic motivation.
>
> **Expansive learning:** A catalytic process, which turns contradictions that hold communities back from working towards a common object into possibilities to develop practice and optimise health outcomes.
>
> **Indeterminate:** This adjective describes the nature of clinical situations, where multi-morbidity, interactions between psychological, social, and somatic causes of ill health, and the contributions of multiple actors complexify even the simplest patient presentations.

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