Chartered Institute of Ergonomics & Human Factors

PREVIEW

Making human factors and ergonomics work in health and social care

A practical introduction to healthcare ergonomics based on the CIEHF professional competencies intended for those responsible for implementing human factors and ergonomics programmes and interventions to improve patient safety, system performance and wellbeing of patients, service users and staff.

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HUMAN FACTORS EVERYWHERE

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Foreword

NHS England and NHS Improvement jointly set out a vision for patient safety in the NHS Patient Safety Strategy. This includes a focus on education and training, with the aspiration to educate patient safety specialists who can provide leadership with a systems focus based on insights from human factors and ergonomics (HF/E) and safety science. The Chartered Institute of Ergonomics and Human Factors (CIEHF) issued a set of professional competencies for human factors specialists. This book aims to operationalise these and make them accessible to a wider audience in health and social care in line with the vision for education and training set out in the NHS patient safety strategy.

In July 2021, CIEHF launched the Healthcare Learning Pathway in collaboration with its partners at Loughborough University, Robert Gordon University, NHS Education for Scotland and Human Factors Everywhere, and in partnership with Health Education England and the Royal College of Nursing. The Healthcare Learning Pathway takes students on a journey from thinking differently about systems and safety, to the scientific background underpinning the discipline, and on to integrating HF/E in practice. The Healthcare Learning Pathway is organised into three levels: Level 1 is an accredited one-hour online course introducing students to how HF/E can contribute to improving health and social care work; Level 2 provides a certificate grounded in HF/E science, covering aspects such as systems, the analysis of tasks and processes, the design of interfaces and the structure and processes of organisational learning; Level 3 offers a recognised qualification achieved through one-to-one learning with a CIEHF specialist as mentor to support students with the application of HF/E in their practice.

This book complements the Healthcare Learning Pathway and is intended as a practical resource for students. The book aims to provide well-founded, practical guidance to those responsible for leading and implementing HF/E programmes and interventions in health and social care. The book is structured around the different levels of a system, where practitioners might place their focus. For each level, the nature of issues that are frequently addressed is given, followed by a characterisation of available HF/E methods and approaches. Then, a selection of representative and important HF/E methods and approaches is described in detail using a practical example. This will help guide practitioners through the many opportunities for HF/E interventions and the wide range of methodological choice.

Following the launch of the Healthcare Learning Pathway, CIEHF provides this free resource, which contains the first three chapters of the book. Chapter 1 covers Level 1 of the Healthcare Learning Pathway. The two subsequent chapters complement the foundational modules on systems (Chapter 2) and task analysis (Chapter 3) of Level 2 of the Healthcare Learning Pathway. To support the development of the book, this pre-release includes a link to a feedback form, where you can share your thoughts, ideas and feedback with the authors.

The Chartered Institute of Ergonomics and Human Factors received its Royal Charter in 2014 to recognise the uniqueness and value of the scientific discipline and the pre-eminent role of the Institute in representing both the discipline and the profession in the UK. This includes the protected status of “Chartered Ergonomist and Human Factors Specialist” with the post-nominal C.ErgHF awarded to practising Registered Members and Fellows, who are among a group of elite professionals working at a world-class level.

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Chapter 1 - Introduction

Human factors and ergonomics for patient safety

Patient safety is the responsibility of all staff but typically managed by a few, who have the job title of patient safety lead or specialist. Human factors and ergonomics (HF/E) has been suggested as being useful to understanding health and social care systems and improving patient safety. This book can be used by anyone looking to enhance patient safety within the fields of health and social care. We recognise that many readers may have some existing knowledge of HF/E principles and methods. The book aims to provide a sense check of any existing knowledge and to support the practical application of HF/E, while signposting to further resources for deeper study. Each of the chapters focuses on a specific element of the work system. The chapters explore how HF/E can help understand the interactions between these elements of a work system. HF/E can become a way of thinking to look at a safety concern by understanding how the system creates the opportunity for safe or unsafe work and care.

This chapter introduces the basic principles of HF/E and unpacks the individual elements to be considered in the context of a work system. This covers how different elements may influence outcomes relating to safety, efficiency and wellbeing, and how HF/E aims to design safety into a system (see Box 1 for an example).

Chapter objectives and learning outcomes (see Figure 1)

- ✔ To explain what HF/E and systems approach are.
- ✔ To understand what to look at within a healthcare work system.
- ✔ To be familiar with how HF/E approaches the improvement of system outcomes.
- ✔ To understand how HF/E practitioners achieve their work.

A large trust wished to procure beds that were suitable for all areas of the hospital. The HF/E support was requested to support the trust's decision-making to ensure the procurement contract agreed would ensure the safety of patients and staff, while providing the best financial arrangement for the trust.

A full scoping of the clinical areas and the patients cared for was completed to identify the intended users of the beds. These included adult and paediatric patients, clinical staff, cleaners and porters, to understand the key activities they are required to complete with the bed and preferred features to support these activities. The subsequent evaluation of the beds to support these activities was based on the ability for them to ensure the safety of staff and patients and the associated efficiency of these activities. Analysis of the environments where the beds were intended to be used and other equipment likely to interact with the beds ensured a complete insight of the properties to be considered as essential or desirable from the beds to be procured by the trust. Checks of the size of doorways, lifts, and floor space ensured any bed could be moved between clinical areas. Rarely is healthcare equipment used alone and beds were considered key to supporting monitors, drip stands or mattresses, all of which need to fit securely and easily.

Different companies provide a range of different bed products, including specific beds for paediatrics and bariatric patients. Ultimately, the final decision was made following an evaluation of all relevant types of bed through a trial (product evaluation) with representative user groups to evaluate how well each product could support the activities required. There were just two companies able to support all types of beds required, with the final decision made based on the contract agreed to ensure the maintenance and reliability of all stock required.

Box 1: An example of HF/E approach to organisational change

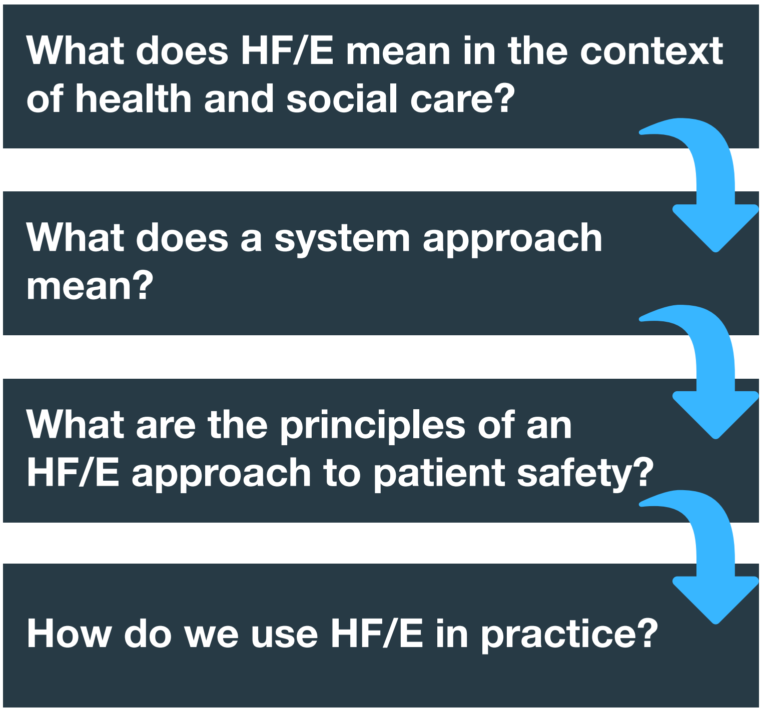

Figure 1: Questions addressed in this chapter

What does HF/E mean in the context of health and social care?

The acronym HF/E reflects both human factors and ergonomics, which are used interchangeably as they have the same aims and are defined by the International Ergonomics Association as:

"Human factors is concerned with the understanding of interactions among humans and other elements of a system. It's the profession that applies theory, principles, data and methods to design to optimise human wellbeing and overall system performance. Practitioners contribute to the design and evaluation of tasks, jobs, products, environments and systems to make them compatible with the needs, abilities and limitations of people."

The term "system" is frequently used in the field of HF/E and has an intuitive meaning to most people, but this may not be the same meaning. In healthcare, the term system may refer to a purely technical system in the form of a piece of equipment. For example, the patient's bed and the interaction between the technical components of the bed form a distinct technical system. As an HF/E practitioner in a clinical setting, we would want to understand the safety, functionality and reliability of the bed in the intended clinical setting with the people likely to interact with the bed. This extends the boundary of the system from just the technical elements within the bed to how the bed functions in the context of the necessary environment to support the tasks that need to be completed to deliver everyday patient care or emergency interventions. This could be regarded as a sociotechnical system. Consider an unstable patient being transferred to intensive care. Can we be sure the bed can fit between all doors, be moved easily without injuring those transporting the patient, enable emergency care if required in transit, and support all necessary monitoring and medical devices required by the patient? How easily can staff clean and maintain the bed to ensure a high level of performance based on the design and use of the bed? A hospital bed may seem a basic requirement for every hospital. This single piece of equipment may fundamentally influence the safety of the patient transfer, support staff to deliver emergency treatment if required in transit, avoid staff injury and ensure the reliability and, therefore, availability of beds for patients to be admitted to. The compatibility of the humble hospital bed, procured by an organisation, may potentially influence patient safety, hospital efficiency and staff sickness and absence. Consider how different the system may look in a community setting and a patient's home, where some tasks may be constant but the environment will fundamentally influence key interactions.

When organisations start to look at and understand how people function or accommodate the equipment and environments they work within to fulfil the tasks required, they start to understand how healthcare systems really achieve their safety and performance. This is the fundamental approach adopted by HF/E to consider how systems interact and how work is really done. HF/E then applies the principles of design to optimise the equipment, environments and tasks to make it easier for people and organisations to do the right thing efficiently, hard to do the wrong thing and, ideally, impossible to do anything that may cause harm. HF/E places people at the centre of the system and designs the system to support the capabilities and constraints associated with people in the system.

HF/E has been described as having twin aims, which are not mutually exclusive (see Figure 2). Any HF/E improvement or intervention should consider the wellbeing of people in the system to be directly related to the safety, efficiency and cost effectiveness of an organisation. For example, the preservation of an effective break system for staff may enhance the performance of clinical tasks and reduce injury and can influence time lost to delays in clinical tasks, sickness and absence of staff, which may incur the cost of agency staff. Presenting data to an organisation that represents the cost associated with a safety concern can be an effective approach to proposing the value of a HF/E approach and designing systems to balance safety and wellbeing alongside system performance and efficiency goals.

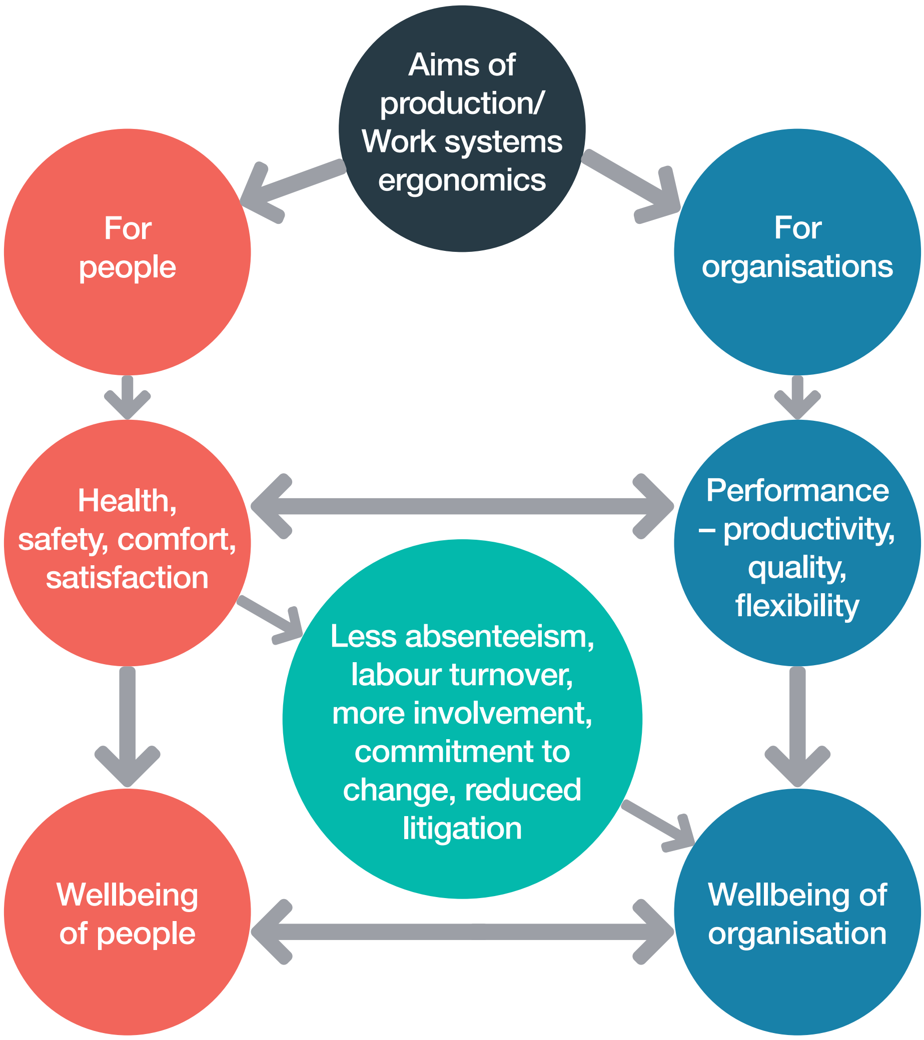

Figure 2: Twin aims of HF/E

HF/E can be used to consider any type of system, simple or complex, technical or sociotechnical. It would be wise to be clear about the boundary of the system that is the focus of any safety improvement. This will give you clarity about the limitations and help ensure a realistic timeframe to your work.

A systems approach

A systems approach is a phrase often associated with HF/E. A system is a number of distinct elements, which work together to achieve a common goal. It is widely acknowledged that there is a need to understand the individual elements of a system, while recognising that the interaction between the individual elements is dynamic and the value of the whole system is greater than the sum of the parts (Wilson, 2014). A systems approach considers how the elements of the system do, or could, interact with each other and influence a particular outcome.

The fundamental misunderstanding that healthcare safety might be enhanced as long as we identify the “bad apples” amongst staff is finally starting to be recognised. A single element, unless in the most simple system, can rarely be found as the “cause” of an incident or safety issue. For example, the skillset of the staff available in a unit, at any single moment, will be influenced by the organisation’s approach to the recruitment and sustainability of staff, the competence training programmes, the rostering of staff, and acknowledgement of the consistent set of skills required to enable a unit to function. The performance of staff within a unit may need to compensate for other elements in the system. Understanding which element of the system is compensating more than another needs to be teased out to recognise key influences on how the whole system currently functions. The ability to achieve this understanding and avoid “bad apple” thinking requires organisational processes to reflect a systems approach (Russ et al., 2013).

KEY INSIGHT

Do risk assessments consider the whole system, do procedures and policies consider the typical context and environment where they are used, do incident reporting or investigation move beyond just focusing on staff? To achieve the effective integration of HF/E into health and social care systems to impact patient safety, a systems approach must inform the design of organisational processes, environments, equipment and documentation.

Adopting a systems approach to safety can provide a framework to acknowledge that although staff are often involved in the last interaction prior to an incident, generally their actions and behaviour are the product of influences from the whole work system. This can also change the language used when looking at unintended or undesirable outcomes, where a single “cause” may not be evident, but a systems approach can provide evidence of contributory factors. Identification of contributory factors provides a rich source of information and understanding of where to target safety improvement resources.

Understanding how a system works comes from taking time to look at the elements of a system and how they typically interact with each other. This can reveal which elements are most influential or likely to contribute to particular outcomes, which elements are most dependent upon another, and which elements may be compensating for insufficiencies of another element.

The Systems Engineering Initiative for Patient Safety (SEIPS)

Adopting a systems approach can be made easier with a framework to work from, as we all need a map to navigate unfamiliar terrain. There are many frameworks used by HF/E practitioners to represent system design. One specifically developed for healthcare contexts is the Systems Engineering Initiative for Patient Safety (SEIPS) (Holden and Carayon, 2021, Holden et al., 2013, Carayon et al., 2020), see Figure 3.

SEIPS was developed early in 2000 to integrate concepts from engineering, HF/E and Donabedian's quality model (Donabedian, 1988). SEIPS is a model that provides a way to consider what a particular work system looks like (left side of the model), in the context of where care is delivered, which influences the clinician's work and patient care (middle of the model) and subsequently impacts upon the outcome for the patient, staff and organisation (right side of the model). Put simply, the model can focus relevant questions to understand what and who does the work, how and where does work and care happen, and what impact do all of these factors have upon the effectiveness and experience of patients, staff and healthcare organisations.

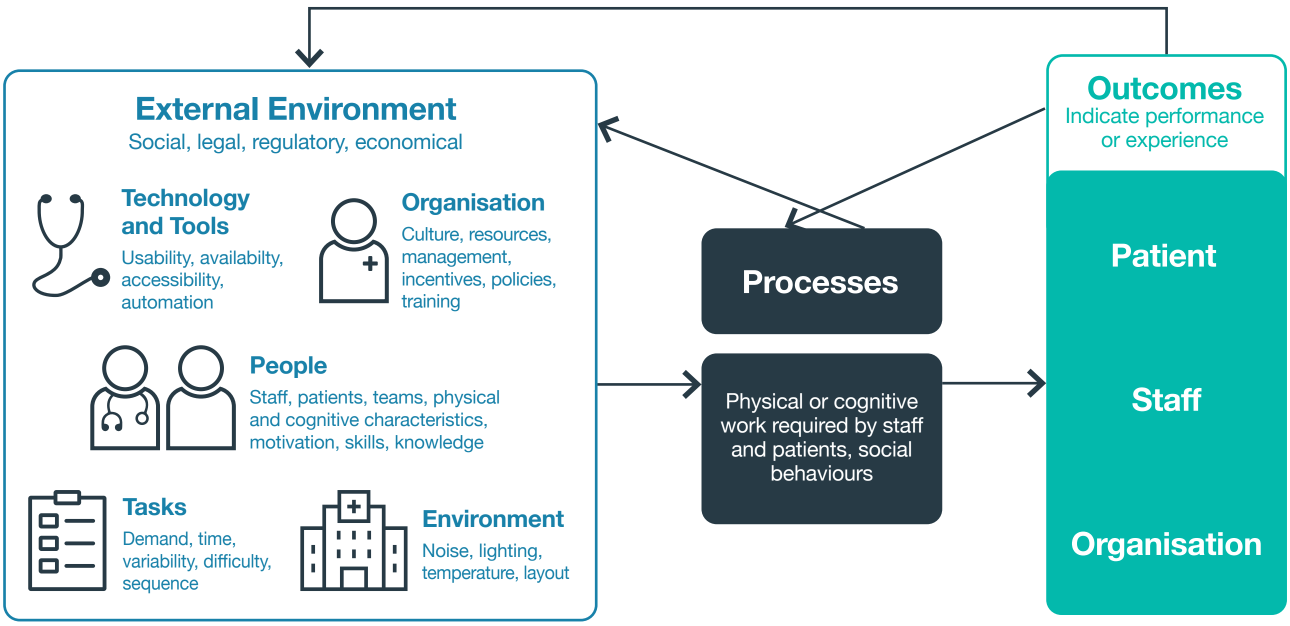

Figure 3: Adapted illustration of the Systems Engineering Initiative for Patient Safety (SEIPS)

The SEIPS model emphasises feedback loops as a feature of how dynamic systems monitor, respond and adapt to system outcomes. The dynamic and adaptive properties required of healthcare systems are a fundamental strength, and healthcare is considered to be a complex sociotechnical system. The adaptations or trade-offs made by staff or the wider system to be adaptive to the situation faced may signal stress and strain in the system, which may influence the ability to deliver a service. Adaptations may also lead to emergent properties within a system, which may not all be predictable or advantageous, with some having a disproportionate impact on a patient's care compared to what might appear a relative minor adaptation. For example, the procurement of a technical system, which does not interact with an existing system, may require staff to adapt and duplicate entries or delay inputting patient information. Multiple entries of similar information increase the chance of an entry being incorrect, and can increase staff workload, which staff compensate for by not taking breaks. This may lead to reduced reliability in patient records, increased risk of staff fatigue and increased stress, which all have the potential to influence patient safety.

SEIPS suggests two perspectives to the outcome produced by the system based on a perspective of time. Typically, in healthcare we will consider success or the safety of patients relative to outcomes immediate or "proximal" to their care, e.g., a missed clinical treatment. The implication of the outcome "distal" to the time when care was delivered, e.g., steady loss of functional independence for a patient, may not be directly linked to an episode of care. The implication of how we consider the impact or cost of safety issues in healthcare usually considers the more immediate and visible impacts. A subsequent chapter in this book on outcomes will expand further upon how healthcare looks at and measures the influence of the system.

We use SEIPS throughout the book to provide a helpful visualisation of how the work system (the elements within the system, people, equipment, environment, tasks and the organisation) influences the safety of the processes, which are necessary to care or manage a patient within a specific area of healthcare, see Box 2 and Table 1.

Several incidents in the failure of the return of blood samples to several GPs were not identified for more than 12 months. These incidents were reviewed to understand how the system prevented the reliable return of the results and an immediate recognition in the failure of the system.

The return of blood test results to a primary care setting requires the interaction and communication across multiple technical systems and healthcare settings. Once a test is completed in a hospital setting, the sample may be processed within an external laboratory. The results, once processed, will be communicated through IT systems.

Test results are received and processed by primary care administrative staff. Results that suggest abnormalities or the need for a medical review must be identified, prioritised and the relevant staff and patients informed.

Box 2: Receiving blood results

Work system	Prompt	How it applies to receiving blood results
Task	What is being done?	How transfer of information is completed between different systems, prompts and assurances in the need to look for incoming results, identify and interpret results which require additional action, recognise failure for results to return.
Tool / technology	What is being used?	The interaction of multiple technical systems, how software and interface design support tasks, the completeness in the recording and logging of outgoing and incoming results.
Environment	Where is it being done?	Communication of information: multiple organisations, distributed locations (healthcare organisation and patient homes). Attention and interpretation of information: noisy, distracting work environments with competing tasks.
People	Who influences it?	Patient might be proactive if informed of results to expect by when. Staff checking test results routinely or as patient attends an appointment.
Organisation	How is it being completed?	Procurement of technical systems with capability to alert failure in result return, interface design to identify failure in result return, proactive assessment of risk and complexity of technical communication systems, impact of software updates or change in system configuration or staff resources on reliability of result handling.
External	What outside of the organisation may be of influence?	The national guidance and evaluation of technical systems, which NHS providers can procure. The national or international standards for testing that systems are fit for purpose and minimise use error and failure.
Process	Return of blood result	How might the following be influenced: recorded analysis of blood sample, transfer of blood results, recognition of arrival of results, interpretation of results and communication of results to patients, alert for failure of results to return.
Outcome	Proximal and distal impact upon patients, staff and healthcare organisations	Accurate and timely return of all test results aligned to the correct patient. For the patient this may impact timing of treatment or diagnosis, clinically this may influence the ability to minimise hospitalisation or treatment and for staff an effective work system may reduce the stress and workload associated with ensuring all test results are managed efficiently and effectively.

Table 1: Analysis of receiving blood results using SEIPS

We can use SEIPS to guide our interrogation of the system and look retrospectively at an undesirable outcome. This example in Table 1 uses SEIPS to consider the contributory system factors that influenced the failure in the return of a blood sample. SEIPS can become a useful tool or a way of thinking about how the system can be examined and unpicked to identify what, who, how and where influences the way work and care happens. This “way of thinking” is how HF/E intends to inform healthcare’s goal to improve patient safety. HF/E provides a well-established approach to view the person as just one part of the system, with the design of the system directly influencing the way work is done and safety is achieved.

HF/E strives to influence all aspects of the system from the design of task and processes, the equipment and the work environment (covered in subsequent chapters in the book), to reflect the physical and cognitive capabilities and limitations, preferences and expectancies of the people involved. A core aim of HF/E is to make it easier for people to do the right thing and hard to do the wrong thing, and, ideally, impossible to cause harm.

SEIPS can also be used proactively to inform a risk assessment or planning of new services and even physical spaces, see Table 2. For example, the development of a new theatre suite, intensive care unit, GP practice or community unit could consider the system to ensure all users are consulted to understand the tasks they complete, the environment required and the equipment likely to be used, stored and transferred between different healthcare procedures and processes.

Work system	Prompt	How it applies to the design of a new system
Task	What is being done?	What are the lighting requirements, power supplies, temperature relevant to tasks? What are the physical and cognitive properties of the tasks? How do tasks come together to deliver a specific function, and can the environment and equipment support this?
Tool / technology	What is being used?	How will equipment and tools be stored, moved and accommodated within clinical spaces? Which equipment interacts to support particular tasks? Can safety of tasks be supported to minimise use error or avoid known safety issues through the tools and technology?
Environment	Where is it being done?	How can the environment enhance the physical and cognitive requirements of the tasks required? Will lighting, temperature or noise impact task and human performance, e.g. safety critical communication, decision making? How will storage of all equipment and medication meet policies and practical requirements, based on understanding of tasks?
People	Who influences it?	What are the physical characteristics of the users, can the shortest staff reach lights or drug cupboards, can the tallest staff read computer screens or avoid banging their head on low hanging infrastructure?
Organisation	How is it being completed?	How will breaks be accommodated? Are rest areas compatible to the number of staff, support micro sleeps, access to food and drink at any time of day?
External	What outside of the organisation may be of influence?	National guidance on design, regulatory requirements, funding allocated.
Process	Admission to clinical area. Delivery of care. Transfer to other clinical settings.	How might the following be influenced: IT systems used to admit, check or transfer patient information; layout, space and flow between key tasks within and across interrelated clinical areas and with staff and patient group.
Outcome	Proximal and distal impact upon patients, staff and healthcare organisations	Environment designed to support the safe and efficient delivery of care. Effective interaction across different healthcare processes and environments. Ease and safety for all staff roles to provide care. Effective and efficient management of patient conditions. Staff wellbeing and job satisfaction. Decrease recovery time for patient and minimise risk of harm.

Table 2: SEIPS as framework to guide the design or evaluation of a new work place

Designing safety into different types of systems

The examples in Table 1 and Table 2 do not acknowledge fully the complexity that exists in health and social care systems but provide a framework to start to ensure the breadth of the system elements are included. Health and social care systems are dynamic and uncertain settings, generally working with time pressures and a multitude of different staff roles, all providing different functions but with the same goal of enhancing patient and client wellbeing and ensuring safety. This can require the need to embrace the messy reality of what health and social care systems look like, how they must adapt and transcend several clinical and non-clinical settings, and the variability that exists to ensure efficiency and safety are carefully balanced. This requires insight into how different processes may interact, each with their own discrete work systems. This takes our gaze up from the elements at the work system level to interacting work processes.

TIGHTLY COUPLED SYSTEMS

How closely parts of the system interact and couple together determines how dependent one element of the system is upon another. A nurse may be unable to deliver a drug without a prescription. A poorly completed prescription or drug chart will delay the delivery of the drug. The delivery of a drug and completion of a drug chart are closely coupled and dependent upon each other but can be two discrete processes completed by different members of the team.

LOOSELY COUPLED SYSTEMS

Health and social care systems do not all benefit from a clear sequence or dependency between processes or tasks. A patient may arrive in an emergency department and speed is required to take a blood sample to inform how the patient should be treated. Who takes the blood, completes the request for tests and sends the blood for testing may vary, depending on how staff are required to support the patient. In another context, where blood may be taken in a GP practice or by a phlebotomist on a ward, the sequence of tasks and a single member of staff will be consistent through the whole process.

The variability that exists in systems can be described as loosely coupled, and this implies a greater level of complexity as to how tasks or processes are completed, and may have a greater level of variability in terms of their sequence, timing, person doing the work and even how the work is done. Why does this matter? Understanding the context is important to understand how the system usually succeeds. Variability and loosely coupled systems can be a positive characteristic as it allows the system to respond to variable demands or shifts in system priorities. Health and social care systems have to adapt to accommodate the needs of many patients and clients, the time pressure associated with certain conditions or tasks or the availability of resources within the organisation, for example specific staff skills or access to organisational services in responding to a deteriorating patient or managing the delivery of a baby.

These two different properties of a system, loose and tight coupling, influence how we focus our safety improvements (Vincent and Amalberti, 2016). They require different approaches to support patient safety and staff wellbeing. In tightly coupled systems, the predictability of how tasks are completed can support the use of rules and procedures to reduce the risk of harm. However, even the best safety intervention can be overused or misused. Organisations will often assume a level of safety based on the library it holds of up-to-date policies and procedures. When we take a closer look and count the number of pages of all the policies and procedures a single member of staff is required to recall, relevant to their field of work, it becomes quickly apparent that it is highly unlikely the human brain can remember all these details. Even asking staff to show you where to find all relevant policies and procedures can be a challenge. This makes an excellent activity to try when going into a new work environment: ask staff to allocate a selection of policies and ask their opinion on how practically achievable they are at all times of the day or week in all contexts. This may illustrate issues of accessibility or usability of how policies and procedures are stored or written.

Observing how work is really done, we find reasons why practically policies and procedures may contradict or require adjustments by staff to reflect the reality of a work context. This may be due to how practical it is to adhere to the policies within a particular environment, manage the associated time pressures and retain

compassion and care for patients and service users. For example, staff balancing the need to see many patients in a short period of time, e.g. in an outpatient clinic with the amount of time spent with each individual patient. Trade-offs are inevitable as staff aim to achieve the efficiency required by the organisation to meet performance goals, e.g. a defined period between patient referral and consultation. Clinics may be booked with many patients all allocated a ten-minute appointment time, with little room to deviate from timings without having an impact on the efficiency of the clinic. It may take just one piece of information to not be immediately available and the clinic could stall, except they do not stall as staff adapt and accommodate to these less than perfect scenarios. Administrative and clinical staff will work to ensure the patient's care is not impeded, and clinicians work hard to provide consultations, perhaps with incomplete information, to enable the patient to proceed to the next investigation or intervention required.

When working in a safety role, spending time in different work environments can help understand why policies and procedures may not always be achievable or be unlikely to be adhered to. This is rarely down to a blatant disregard by staff or just one factor in the system, but rather a combination of how the organisation responds to performance measures, availability of staff, effectiveness of equipment and tools relied upon, physical environments and even the unpredictability of the work and people within the system. So, the question is how many of the policies and procedures are critical to the tasks completed. Some procedures will always be essential for safety-critical and clearly defined tasks, but how else can safety be achieved, and is there a better way other than resorting to writing another procedure?

KEY INSIGHT

In the context of a loosely coupled system, where unpredictability is high, time pressure likely and the reliability of information varies, a more dynamic approach to safety is required. This requires an organisation to respond with a greater emphasis placed upon supporting staff to be able to make and execute decisions and tasks in the safest way.

A proactive approach to recognising local issues and addressing organisational, environmental and equipment challenges can assist in increasing the preparedness and resilience within the system to enable staff to work and make decisions safely. How reliable and quick are IT systems to obtain and prompt staff to information which may support their decision-making? Do the physical environment and process of procurement and restocking of equipment assist staff and patients to receive the most appropriate equipment within the required timeframe? Does the organisation or wider system ensure rostering or access to testing and scanning facilities, which enable staff to increase the knowledge used to inform their clinical judgement and intervention? The resources available and the workload created by the demands associated with patient care will influence the scale of trade-offs made by staff or mistaken selections of equipment required as efficiency is prioritised over quality and accuracy.

The context of a health and social care environment will determine which aspect of the work system is most significant or compromised relative to a particular process. HF/E looks to address how the system influences safety, performance and wellbeing. The trade-off of time versus efficiency, and of efficiency versus quality, is important to acknowledge to develop realistic and suitable safety and quality improvements while acknowledging the remaining risks.

Not all risks can be removed, that is the reality of managing safety in dynamic and uncertain systems, but we should aim to have knowledge of the risk and support an approach to manage and reduce the risk. HF/E can help organisations obtain a transparent log of the risks specific to different healthcare work systems, to clarify where the responsibility for that risk lies within the organisation and ensure frontline staff are supported by the organisation by acknowledging and managing the remaining risks. Health and social care professionals are obviously accountable for their individual competency and skills to optimise service user and patient safety and manage risks. Organisations are accountable for the ability of the professional to obtain and deliver these skills in the context of the system. Organisations manage the risk created or inherent to the work system. HF/E can support system design to enable staff, patients, and service users to interact safely and efficiently and optimise the wellbeing of all.

How do we do HF/E?

The simple answer is there are many different methods and tools used to understand different systems, see, for example, Stanton et al. 2013 for a practical overview of a large number of HF/E methods. The approach to recognise safety issues in technology may look different from understanding how communication influences a task, and different again if we are considering the flow and design of a specific health and social care process or environment. Some methods lend themselves to the collection of quantitative and measurable data, for example, considering improvements in the efficiency of a task or the reduction of a specific incident reported or staff injury. However, if we are interested in wellbeing, workload or fatigue, these may rely on qualitative and quantitative evaluation. Methods and tools can be learnt or developed over time, but the priority for health and social care is to understand the principles of the systems approach, which HF/E adopts as a way to look at improving the safety of service users, patients and staff.

Quality improvement (QI) has become well established as an approach to address patient safety. This has enabled many staff to be effective in addressing workplace challenges. The subtle difference between the terms quality and safety needs to be appreciated to understand why HF/E may complement existing QI strategies (Hignett et al., 2015). QI has traditionally focused on the efficiency of the system and the adoption of best practice, focusing on the standardisation of normal work practices. Approaches to safety, recognised across other safety critical industries and safety regulators, focus on the identification of hazards (potential for harm) and risks (likelihood and consequence of harm). Safety is addressed through recognising the predictable and unpredictable contexts specific to an industry's systems to identify where to focus resources to reduce or mitigate associated risks. HF/E has a long history in addressing safety through understanding how systems usually function safely but need design solutions to address the risks.

There are similarities and differences between QI and HF/E approaches (see Table 3), however, these should not be pitched against each other as both can benefit health and social care systems.

	QI	HF/E
Focus	Process	Safety, wellbeing, performance
Investigations	Data driven	Observation and analysis of work
Approach	System and participatory	System and participatory
Solutions	Modify process, teams, training	Redesign: tasks, equipment, environment and system

Table 3: Characteristics of QI and HF/E

Recognising the strengths of each, and the most appropriate time to apply them, is the most constructive use of the methods familiar to each discipline. Now is the time to optimise both; HF/E has a focus on understanding the complexity of system and what is required to design safety into the system, while QI can support the process and evaluation of change in the system. Drawing an analogy to clinical practice, HF/E offers a diagnostic approach to the hazards and risks (pathology) which exist in the system (environment, tasks, equipment, people and organisation), adopting a multidisciplinary team (staff, patients, all users) approach to design how to solve the problem. QI has tools and instruments to implement changes and to assess that the change adopted is effective in achieving the intended outcome. When combining QI and HF/E, we should look for outcomes that encompass the aims of both disciplines: seek to reduce harm through reduced risk, increase efficiency through enhanced processes, and optimise staff and patient wellbeing.

The challenge can come if outcome measures drive the focus of change and are selected based solely on their ability to visually present quantitative change. The messy reality of health and social care systems must be acknowledged and understanding the problem should ultimately determine the focus of change. Managing safety in any safety-critical industry does not lend itself easily to randomised controlled trials, which are best suited to situations where there are a limited number of variables to control and measure. Patient safety improvements obviously require evaluation, but outcome measures should be selected based on the perception of value to the patient, staff and organisation and intrinsically linked to knowledge in enhancing the safety of complex sociotechnical systems. An HF/E approach rarely relies on just one piece of information to explore or explain a work context. The triangulation of different sources of information is more likely to ensure a richer insight and focus on how best to evaluate the effectiveness of any subsequent intervention. Equally important is the understanding that all perspectives are relevant. The clinical perspective is significantly valuable but cannot provide the whole picture. Administrative staff, patients' porters, cleaners, clinical engineers and those who are intermittently present in an environment provide the benefit of understanding how different parts of the system function. Or how the same task is done differently by different staff members; for example, the routine task of patient identification may be achieved differently, with some staff groups adopting safer strategies, which could be shared and standardised by an organisation. The voice of the patient and relative is equally key, as intentions and perspectives of those delivering a service may not always align to those receiving it; measuring improvement needs to reflect how different users suggest what could be classified as an improvement from their perspective.

The design and development of any intervention should seek to adopt a codesign approach, engaging all relevant stakeholders. However, HF/E interventions also integrate science and evidence identified as relevant to the issue. The use of evidence is essential to recognise the strength or likelihood of success for any safety intervention introduced. Interventions to control safety can vary in form and strength; matching a control to the potential for harm is based on the evidence of effectiveness and available resources. There are a few key principles applicable with any design process and these include the need to understand the context and users to develop a potential solution, while continuously evaluating and reiterating any design until an acceptable solution is found. HF/E relies on these principles to modify and adapt solutions, rather than expect a solution previously adopted in another area to be immediately effective. One size will not fit all contexts in health and social care.

Summary

This chapter introduced you to the principles of a systems approach used within human factors and ergonomics. You have been provided with a framework, SEIPS, to support this way of thinking. This should enable you to review an area in health and social care and consider which elements of the system interact with each other and how those interactions make it easier or harder for professionals to work and maintain safety. You were introduced to differences in how systems may interact, and where different approaches to safety might be required. This chapter has started introducing the idea of blending QI and HF/E together, acknowledging that health and social care systems are messy, which requires a proactive approach to understanding the context of a system and its risks to inform how to design safety into the system. The remainder of the book will provide practical guidance on how to look at each element of the work system illustrated within SEIPS. Then the only way to fully understand what and how HF/E can support patient safety, performance and wellbeing is take a leap of faith and try some of the ideas presented within the book. Everything shared in this book has been used in health and social care settings by the authors, but more importantly the presented approaches are applied widely across industries to understand and improve outcomes.

CIEHF HF/E Competencies

1. **Human factors/ergonomics (HF/E) principles**
   - 1.1 Understands the role and application of HF/E principles in optimising system performance and wellbeing across all ages and capabilities.

2. **Human factors/ergonomics (HF/E) theory and practice**
   - 2.1 Understands the theoretical and practice bases for analysis of human interactions.
   - 2.3 Understands the theoretical and practice bases for data collection and analysis relating to HF/E.

3. **Human capabilities and limitations**
   - 3.1 Understands the theoretical and practice bases for HF/E relating to physical capabilities and limitations.

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