CATARACT SURGERY TASK & FINISH GROUP

The Contribution of Human Factors and Ergonomics to Optimising Clinical Work Design

About Human Factors and Ergonomics

In healthcare settings internationally, there is strong interest in the integration of Human Factors and Ergonomics (HFE; Box 1) principles and methods to jointly optimise the performance of care systems and the wellbeing of people who use and work in related facilities. Key stakeholder bodies such as the World Health Organisation, Royal Colleges, professional bodies, higher education institutions, special interest groups, and clinical regulators all recognise the need to build workforce capability in this applied discipline. Given that HFE is concerned with the evaluation and improvement of all aspects of human work, foundational knowledge of key principles and methods will be useful for cataract surgery multi-disciplinary teams in meeting the goals and supporting the work of the Cataract Task and Finish Group (Figure 1).

Why HFE?

The evidence is clear that all modern healthcare systems are at risk of multiple issues related to delivery of efficient and safe patient care, the design of the built environment, the usability and safety of digital technology and medical devices, workforce physical and mental wellbeing problems and other important challenges around service delivery and related clinical work system designs. These range in impact from those that can be managed locally, to high profile and costly events or identified organisation failings that are subject to external inquiry and high levels of public scrutiny, bringing wide-ranging implications.

Without exception, reports or recommendations arising from investigating or studying these issues or events show a lack of consideration and concern given to systems-based design planning, implementation, and evaluation. A clear learning need is, therefore, apparent at all levels of the healthcare workforce, including in the regulatory, strategic, policy, educational and operational domains. As a basic starting point, NHS Education for Scotland (NES) has produced a Factsheet on Human Factors and Ergonomics for the health and social care workforces (Appendix 1).

Box 1. About HFE: Definitions, Purpose, Approach, Benefits and Competence

HFE Definition: The International Ergonomics Association defines Human Factors and Ergonomics (HFE) as: '*the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance*.'

HFE Purpose: HFE focuses on two interdependent outcomes: System Performance and Human Well-being, and aims to jointly optimise these. This is a distinguishing feature of HFE compare, for example, with Quality Improvement or behavioural interventions.

HFE Approach: HFE and HFE professionals always take a systems approach that focuses on interactions between system elements (e.g. people, technology, environment, organisational aspects). To meet the joint optimisation aims above it is concerned with designing optimal systems, taking human needs, capabilities and limitations into account. It follows that a key principle is user-centred design, whereby people using and experiencing systems play a key part in their specification and implementation.

Anticipated HFE Benefits: HFE is closely aligned to improved safety performance, due to its maturity as a scientific discipline is safety-critical industry. It also provides a coherent way of approaching further important outcomes in terms of quality, productivity/efficiency, sustainability, job retention etc. Optimised systems are key to satisfaction, well-being and a range of positive outcomes for individuals, teams and organisations.

Figure 1. Step Action Cards

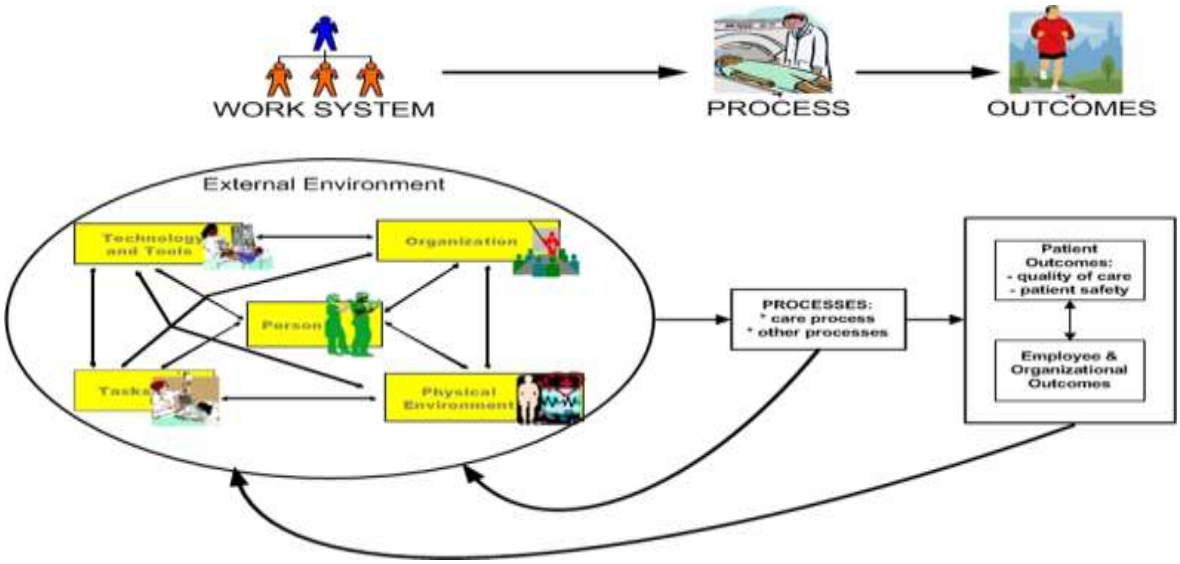
Clinical Work System Analysis and Redesign

As a starting point for the Cataract Surgery redesign, the work system analysis method for healthcare that is illustrated in Figure 2 is grounded in HFE science and application of this approach would provide information on the barriers to, and facilitators of, clinical work system design issues. This HFE systems framework has multi-functional purposes and applications (e.g. work procedure design, incident investigation, general problem-solving, teaching HFE) and is arguably the most popular HFE approach in healthcare.

In the diagram, a generic clinical work system is depicted (e.g., operating theatre, community pharmacy, ambulance vehicle, mental health ward, open plan offices, staff dining room). The focus of the care work system on the left of the diagram is on characterising the *interactions* between people and five other system elements or components: job tasks, tools and technology, the physical environment, organisational of work, and external influences such as safety legislation, regulation and policy. These *interactions* (often complex, dynamic and unpredictable) inform how clinical and organisational outcomes (both wanted and unwanted) are achieved. For example, how these determine **system performance issues** such as efficiency and productivity and **human wellbeing issues** such as health and safety, wellbeing, and comfort – from the HFE perspective all of these issues are inextricably linked and so the whole work system should be assessed holistically.

A fuller description of the performance influence factors (or PIFs) related to each of these work system elements that can enhance or degrade performance and wellbeing is shown in Appendix 2.

Figure 2. A Framework to Guide Work System Analysis and Redesign



In addition to consideration of the work system analysis content, the following Systems Thinking principles will further guide users when applying the tool:

1. Define your local clinical system 'boundary' to make it more manageable (you cannot solve everything).

2. Seek out the experiences and views of others regardless of seniority or work role as they have different perspectives on how the system works and can be improved.

3. Recognise that care delivery will result in both wanted and unwanted outcomes because of the highly complex, multiple, interacting contributory factors from across the system, not just the decisions and actions of a single person.

4. When looking back at the decisions and actions of others involved in, for example, safety incidents or the design of care systems, do not blame or judge but seek to understand why these made sense given both the context and situation they faced at the time, otherwise they would not have made them (this is known as the Local Rationality principle).

5. Explore the differences and seek to close the gap between Work-as-Imagined – i.e., what is written in policies and guidance and assumed in the minds of those removed from the 'sharp-end'; and Work-as-Done –i.e., how that work is really done in reality at the 'coalface' of everyday healthcare practice.

6. Finally, focus learning and improvement on wider systemic design solutions as much as possible and less so on person-level behavioural interventions or weak or passive recommendations or improvement interventions (e.g., asking people to remember to do things to improve the reliability of a care process is unlikely to be sustained, nor is introducing an improvement that will add a few minutes work to their day).

Basic HFE Education for the Cataract Surgery MDT

The indicative curriculum content outlined in Appendix 2 provides basic HFE education on selected topics which will be of interest to achieving the goals of the Cataract Surgery Task and Finish Group and of building workforce knowledge of HFE concepts and tools that will be useful for this clinical work specifically, and more generally for improving the design of all aspects of human work beyond this project.

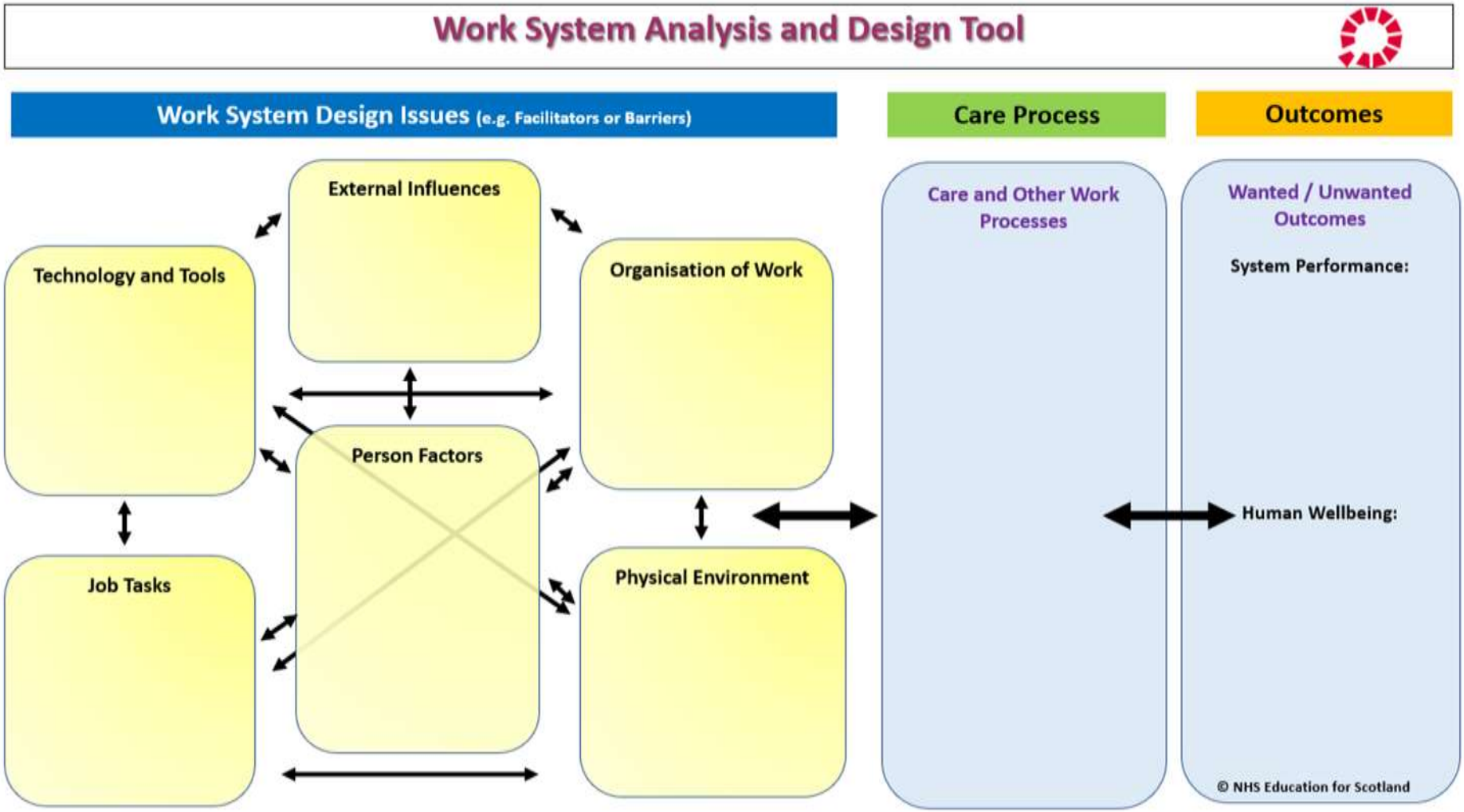
APPENDIX 1 – HFE FACTSHEET

NHS Education for Scotland	**FACTSHEET** **Human Factors & Ergonomics for Health and Social Care**	Human Factors

In this brief guidance, a series of Ten Facts about the 'true' purpose and approach of Human Factors & Ergonomics in Health and Social Care is outlined and a few unfortunate but common misunderstandings are corrected.	
1	• **Health & social care have been very slow to embrace the benefits of Human Factors science and practice, unlike other safety-critical industries. To illustrate the gap, it is estimated that less than ten qualified Human Factors specialists are directly employed in the NHS, so there is an urgent need to upskill key workforce members.** o Organisations can do this quickly and at low cost by funding individuals to be trained to postgraduate level on UK university distance learning courses with Chartered Institute of Ergonomics and Human Factors (CIEHF) accreditation. o Additionally, if a member of the clinical risk or patient safety team, for example, moves on why not advertise for a qualified Human Factors specialist to apply for the post? At a national level, specialists should also be employed to advise on the design and implementation of healthcare technology, new buildings and workspaces, procurement of NHS supplies, supporting the ageing workforce, improving workforce wellbeing, safety improvement initiatives and education & training. o For NHS organisations 'buying-in' Human Factors-related consultancy and training it is important to make sure that the individual providers are qualified (from an accredited university course) and are members of the appropriate professional body - the CIEHF in the UK. Some consultancies will purport to provide 'human factors' training or advice, but experience shows that this will be flawed or limited if it's not provided by suitably qualified, competent and experienced professionals (Facts #2 to #10)
2	• **Many different disciplines make important contributions to improving human work in healthcare - such as clinical risk, health & safety, organisational development, human resources, patient safety and quality improvement. So, what is different about Human Factors?** o The distinguishing features and scientific approach of Human Factors which sets it apart from other disciplines are: 1. It ALWAYS takes a holistic 'systems approach' to understanding a problem then developing, implementing and evaluating a solution. 2. It is ALWAYS design driven and takes account of the capabilities, limitations, needs and preferences of people. 3. It ALWAYS focuses on jointly optimising system performance (e.g. productivity, efficiency, effectiveness, system safety) AND human wellbeing (e.g. health and safety, enjoyment, satisfaction, experience). o In summary, Human Factors is a bridging discipline that can 'add value' to the work performed by other disciplines but it should be embedded throughout the life-cycle of a product or service development or safety improvement approach.
3	• **It is unfortunate, but much of what is published about Human Factors in health and care – e.g. training curricula, policy documents, educational guidance and research studies – often misunderstands and misapplies the purpose, approach and benefits of the science and should be treated with caution** o A key reason for this is the failure to adequately involve professional Human Factors specialists to advise on and contribute to this type of work – although some progress is being made here it still represents a challenge in getting the right messages across to healthcare leaders, educators, clinicians, managers, researchers and so on. o This leads to the continuous recycling of the same 'myths and fictions' about Human Factors (and related safety science issues) and so the profession has to devote much-needed time and resources to countering and correcting these misconceptions – hence this Factsheet!
4	• **'Human Factors' is also known as 'Ergonomics' in most of the world – they are viewed as the same discipline by the profession, but the different terms have simply evolved over time for historical and geographical reasons.** o Both terms are acknowledged in the names of professional bodies such as the Chartered Institute of Ergonomics and Human Factors in the UK and the Human Factors and Ergonomics Society in the USA in recognition of this history. o As a quick sense check, if you substitute one term for the other and it doesn't sound quite right in the context that it is used or as part of an intervention then it is unlikely to be Human Factors/Ergonomics, even though it may be a good approach to improving care.

5	• **Human Factors in healthcare is often wrongly promoted as a means of eliminating 'human error' – this is impossible in most circumstances, particularly in highly complex adaptive care systems, and is largely a futile endeavour.** o Human Factors is not about 'eliminating error', it is about *designing* care systems (rather than people!) that are resilient to unanticipated events so that when things inevitably go wrong the impacts of this on people and organisations are minimised – risks are always understood and managed to be 'as low as reasonably practicable' (ALARP). o Arguably, the obsessive focus in healthcare on 'medical error' (and its synonyms) is often inaccurate and misleading, implies individual failure and foments blame - and is ultimately educationally backward and self-harming to the healthcare professions.
6	• **Human Factors as a discipline is poorly understood in healthcare and is often wrongly conflated with approaches such as team working initiatives, non-technical skills training, crew resource management, simulation education, mindfulness and attempts to change human behaviour in general.** o While these important approaches deal with work performance issues of great interest to Human Factors, they rarely adopt the principles and methods that are core to the discipline (Fact #2) although some progress is being made e.g. taking a systems approach and using Human Factors methods in the design of healthcare simulation scenarios.
7	• **Human Factors is not just about improving patient safety.** o From the Human Factors perspective patient safety is just one important outcome that emerges from highly complex healthcare system interactions. Other examples of important outcomes include staff wellbeing, patient experience, safety culture, productivity targets and efficiency savings. o The key issue here is that all such outcomes are inextricably linked and interdependent, but in terms of our healthcare organisational and national initiatives in these areas we tend to focus on them individually rather than holistically which is viewed as a limitation from the Human Factors perspective.
8	• **Human Factors is often wrongly interpreted in health & care as being about 'factors of the human'** o Many safety and improvement interventions that are incorrectly labelled as 'human factors' attempt to address problems by teaching people to modify their behaviour (in this interpretation 'human factors' *are* perceived and understood as the characteristics, attributes, attitudes, values and behaviours at the personal level). o In fact, Human Factors adopts a much different approach and addresses workplace problems by applying scientific principles and methods to evaluating, modifying and improving the *design of the work system* with the people who do the work to make things (equipment, tasks, processes etc) easier, more usable, efficient and safer for them.
9	• **'Human Factors' does not refer to the failures of people in health & care.** o A common misunderstanding in healthcare is that things going wrong is 'caused by human factors' or 'the human factor' – this directly infers that it is all down to the failure of people. This is completely contrary to the non-blame stance adopted by Human Factors as a science and practice and related understanding of why things go wrong (and right) in highly complex healthcare systems. o In reality, things go wrong as the result of complex, system-induced, interacting phenomena which are linked to inadequately designed work processes and technologies. o Therefore, it is the *lack of attention* given to Human Factors principles, methods and expertise in the *design* of healthcare workplaces, tasks, processes and technology (with key inputs from those at the sharp end at every stage) that gives rise to things going wrong in the great majority of cases.
10	• **Human Factors is a scientific discipline that requires years of training, supervised practice, mentorship and professional development – this is very similar to the requirements of those undergoing training, for example, in the medical, social work, pharmacy or nursing & midwifery professions.** o Human Factors specialists (also known as Professional Ergonomists) will hold relevant undergraduate and/or postgraduate qualifications and be members of a professional body where they are expected to adhere to a code of conduct and are subject to mandatory CPD and annual regulation. In the UK the profession has 'Chartered' status which is a significant marker of professional competency and accreditation (Fact #1). o Like clinicians, Human Factors specialists also tend to sub-specialise and so will have different areas of interest, expertise, experiences and skills-sets e.g. organisational (macro) ergonomics, product design, usability, risk and safety, procurement, human performance and physical ergonomics. o Human Factors as a discipline does not contain a small set of principles and methods that can be learnt during a short training programme - although these types of intensive educational courses are useful for 'adding value' to the work of those leading and advising on, for example, clinical risk, simulation, patient safety, non-technical skills training and quality improvement activity.

APPENDIX 2 – Work System Analysis Worksheet



SEIPS Explained

- **SEIPS is the Safety Engineering Initiative for Patient Safety.**
- **It is based on a Human Factors systems approach to understanding care systems, processes and outcomes to inform better design and improvement.**
- **SEIPS can be used by anyone as a general systems analysis and problem-solving tool e.g. incident investigation; hazard identification; incident reporting & data collection; simulation design; protocol & checklist development; research design and data analysis..**

Guiding Step

1. **As a team, use the worksheet as a prompt to highlight the system-wide factors that contribute to the issue at hand**
2. **Seek to understand how these factors influence processes and interact to produce outcomes (wanted or unwanted)**
3. **Link this new knowledge to making improvement recommendations**

Examples of Performance Influencing Factors (PIFs)

Person Factors

e.g. Physical, psychological capabilities, limitations and impacts (frustration, stress, fatigue, burnout, musculoskeletal, satisfaction, enjoyment, experiences, job control); personality or social issues; cognitive ; competence, skills, knowledge, attitudes; risk perception; training issues; personal needs and preferences; psychological safety; performance variability; personal goals; adaptation to work conditions.

Care team e.g. roles, support, communication, collaboration, supervision, management, leadership

Patient/client e.g. complexity of clinical condition, physical, social, psychological, relationship factors

Others e.g. families and carers, and other health and social services colleagues

Tools & Technology

e.g. design interaction and device usability issues; familiarity; positioning, accessibility; availability; access; mobility; operational /calibrated /maintained; device usability; various IT design issues.

Task Factors

Specific actions within larger work processes, includes task attributes such as:

- level of task difficulty /complexity;
- time taken;
- hazardous nature;
- variety of tasks;
- sequencing of tasks
- workload, time pressure, cognitive load,

Physical Environment

e.g. Layout; noise; lighting; vibration; temperature; humidity and air quality; design of immediate workspace or physical environment layout; location; size; clutter; cleanliness; standardisation, aesthetics; crowding

External Influences

e.g. Societal, government, cultural, accreditation and regulatory influences e.g. funding, national policies and targets, professional bodies, regulatory demands, legislation and legal influences, other risks and influences

Organisation of Work Factors

e.g. Structures external to a person (but often put in place by people) that organise time, space, resources, and activity.

Within institutions:

- Work schedules/staffing
- Workload assignment
- Management and incentive systems
- Organisational / safety culture (values, commitment, transparency)
- Training
- Policies/procedures
- Resource availability and recruitment

In other settings:

- Communication
- Infrastructure
- Living arrangements
- Family roles and responsibilities
- Work and life schedules
- Financial and health-related resources

Outcomes

Outcomes – System Performance e.g. Safety; productivity; resilience; efficiency; effectiveness; care quality

Outcomes – Human Wellbeing e.g. Health and safety; patient satisfaction and experience; enjoyment; staff turnover; staff welfare; job satisfaction

APPENDIX 2

Examples of Indicative Content for Proposed Basic HFE Curriculum

Target Audience: Cataract Surgery Multidisciplinary Team

Purpose:

To raise awareness of general HFE concepts and tools that can potentially be applied by novice users to potentially evaluate and re-design existing cataract surgery clinical work systems to optimise efficiency, safety and wellbeing.

Learning Objectives: TBC

1. Curriculum Content: HFE Concepts

General Human Factors and Ergonomics

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
Introduction to Human Factors (Safety Science)	e-Learning	45 mins	Provides a general overview of Human Factors science in healthcare	TURAS
	YouTube Video	7 mins		LINK

Designing Work for People

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
The Consequences of Bad Design	Pre-recorded Webinar	20 mins	Outlines the lack of human-centred design with tools and technologies and the related impacts on performance and wellbeing	**LINK**
Human Connections-I	Case Studies	10 mins	Provides examples of what good design can look like	**LINK**
Human Connections-II	Case Studies	10 mins	Provides examples of what good/sub-optimal design can look like	**LINK**
Safe digital healthcare isn't easy	Pre-recorded Webinar	20 mins	Provides examples of what good/sub-optimal design can look like	
Human Factors in Robotic Assisted Surgery	Pre-recorded Webinar	25 mins	Provides examples of what good/sub-optimal design can look like	LINK

Designing for the Clinical Environment	YouTube Video	10 mins	Provides examples of what good/sub-optimal design can look like	LINK
Saving Lives by Design	YouTube Video	10 mins	Provides examples of what good/sub-optimal design can look like	LINK

Work-As-Imagined (WAI) / Work-as-Done (WAD)

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
Varieties of Human Work	Blogs	15 mins	Understanding system thinking concepts such WAI and WAD is critical to informing how clinical work systems are currently designed and could be better designed	LINK
Work-As-Imagined and Work-As-Done: Mind the gap	Short Video	5 MINS	Understanding system thinking concepts such WAI and WAD is critical to informing how clinical work systems are currently designed and could be better designed	LINK

Efficiency-Thoroughness-Trade-Offs (ETTOs)

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
Efficiency-Thoroughness-Trade-Offs (ETTOs)	Blog	10 mins	ETTOS are an everyday behaviour of all people working in complex care systems – knowledge and acknowledgement of these are important to understand behaviours, decisions and performance and better inform local learning and re-designs	LINK

Human-Centred Design of Work Procedures

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
Design of Work Procedures	Pre-recorded Webinar	40 mins	Work procedures such as SOPs and Checklists guide and support how work is done in clinical services. However, they are often cited as problematic and unusable and the NHS workforce	LINK

			is not trained to design, implement and sustain them from a human-centred perspective. Knowing how to design or redesign work procedures is important in supporting work performance, including efficiency and safety.	
Design of Work Procedures	Guide	10 mins		LINK

2. Curriculum Content: HFE Tools for Novice Users

Systems Engineering Initiative for Patient Safety (SEIPS)

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
Work System Analysis Tool (SEIPS)	Pre-recorded Webinar	30 mins	Provides an example of the Human Factors systems approach to understanding problems and re-designing care systems	LINK
Worksheet	Practical 2-Page Worksheet	10 mins		TBC

Walk-Through-Talk-Through (WTTT) Analysis

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
WTTT	Brief Guide	10 mins	Walk-Through-Talk-Through is a combined verbalised walkthrough and observation method commonly used by HFE specialists to better understand how everyday 'work is actually done' in real-time by those at the 'sharp-end' of practice.	TBC
WTTT Worksheet	Practical 2-Page Worksheet	10 mins		

Safety Culture Discussion Cards

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link

Culture Cards	Card Set for Care Teams	Flexible	Enable the care team to collectively reflect on and learn from work system issues that impact on performance and wellbeing (e.g. leadership, risk, learning, resources)	LINK

Systems Thinking for Everyday Work (STEW) Discussion Cards

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
STEW Cards	Card Set for Care Teams	Flexible	The STEW principles underpin, and are characteristic of, a holistic systems approach to understand everyday clinical work and may aid care team and organisational understanding of system performance issues and how best to improve tham.	LINK

NASA Task Load Index (TLX)

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
NASA TLX	YouTube Video	5 mins	A tool for making subjective measurements of perceived workload to assess a task, system, or team's effectiveness or other aspects of performance	LINK

Dynamic Risk Assessment and Control

Title	Modality	Time to Complete	Relevance to Cataract Surgery	Link
A 5-Step Guide to Risk Assessment and Control in Clinical Environments	Guide and Worksheet	15 mins	Formal assessment of the clinical and organisational hazards and risks in the local clinical service is critical in designing and introducing controls to minimise the potential for harm. (This resource is from primary care but can adapted for any clinical service)	LINK

Supported By:

- Reflective Learning Log
- Facilitated discussions (online/face-to-face)
- Workshops (classroom)