HUMAN FACTORS AND ERGONOMICS IN HEALTH AND SOCIAL CARE

AN APPLIED APPROACH

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Printing history
This edition first published in 2025.

The authors and publisher welcome feedback from the users of this book. Please contact the publisher:

Class Professional Publishing,
The Exchange, Express Park, Bristol Road, Bridgwater TA6 4RR

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Email: info@class.co.uk
Website: www.classprofessional.co.uk

Class Professional Publishing is an imprint of Class Publishing Ltd
A CIP catalogue record for this book is available from the British Library

Paperback ISBN: 9781801610933
ePub ISBN: 9781801610940
ePDF ISBN: 9781801610957

Cover design by Nicky Borowiec
Designed and typeset by PHi Business Solutions
Printed in the UK by Hobbs

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Product safety information can be found at https://www.classprofessional.co.uk/terms-of-use/gpsr-statement/

In this first-of-a-kind book, four authors with solid pedigrees in practice and research in the field have come together to help explain what human factors and ergonomics (HF/E) is and how to do it. The book covers the key topics that comprise HF/E in practice, supporting the Healthcare Learning Pathway of the Chartered Institute of Ergonomics and Human Factors, and building in the professional competencies for practitioners. The result is a practical and readable book that will help readers upskill to membership of the CIEHF, so that they can help integrate HF/E in practice in their own organisation to help improve system performance and human well-being.

Steven Shorrock, co-editor of *Human Factors and Ergonomics in Practice*, Adjunct Associate Professor, University of the Sunshine Coast, Australia.

This great 'how-to' book is an excellent reference for patient safety leaders and clinicians interested in applying human factors principles in their operational safety work. It is also valuable for human factors professionals working in the healthcare domain. The structure of the book makes it easy to use with chapters covering the basic concepts of safety, which are all made operationally relevant and applied to practice.

Rollin J. 'Terry' Fairbanks, Senior Vice President, Chief Quality and Safety Officer, MedStar Health.

At last, a book about Human Factors & Ergonomics (HF/E) in healthcare written by chartered professionals who are highly experienced in related research, education, and practice and have a particular focus on patient safety. This fantastic offering makes a huge contribution to outlining both foundational and more advanced HF/E principles, concepts and methods that healthcare leaders, practitioners, educators, scientists, risk, safety and improvement advisors and many others can readily apply. Importantly, this timely contribution lays all of this out in a very readable and accessible fashion, with the welcome bonus that it provides much-needed practical guidance on the purpose and approach of HF/E which is sometimes misunderstood in healthcare. This is a must-read for everyone with a strong interest in improving organisational performance and the wellbeing of people who work in, and use, healthcare services.

Paul Bowie, Programme Director (Safety & Improvement), NHS Education for Scotland.

Foreword

There is an ever-growing demand for human factors knowledge in health and social care. This has created an appetite for clinicians, patient safety professionals and even some qualified human factors professionals, entering healthcare for the first time, to understand the practical application of our scientific discipline in the clinical and care environment.

This book offers an excellent resource for those looking to increase the breadth of their human factors skills, providing examples to illustrate typical health and social care issues. The book has framed itself around the fundamental sociotechnical systems principle of human factors, using the well-known SEIPS framework (Systems Engineering Initiative for Patient Safety) to describe where and how human factors can be considered irrespective of the care setting. The handbook style aims to guide the reader to consider their own work or care setting and to be creative in how practically they can use the principles or concepts described. This is an excellent resource for those new to the field or looking to consolidate their existing human factors education.

Each chapter seeks to answer a set of questions by providing examples and sharing the authors' cumulative 50 years of experience working in the area of health and social care. They have helpfully mapped the content to the current health and social care learning pathway and to competencies that have been outlined by the Chartered Institute of Ergonomics and Human Factors (CIEHF). This guides the reader to understand where and how to develop their own human factors journey and to consider the different levels of membership and accreditation that they may wish to consider undertaking to establish their own capability and professional skills in this discipline.

As the current President of the CIEHF I welcome this pragmatic book, which can help health and social care to build the capacity to deliver human factors. This will in turn support bringing healthcare in line with other industries where the scientific discipline and professional practice of human factors have actively contributed to improvements in safety and performance.

Mark Young, President, CIEHF

Preface

NHS England 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) maintains a set of professional competencies for human factors specialists. This book intends 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 the ways in which HF/E can contribute to improving health and social care work; Level 2 provides a certificate 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 route to an accredited qualification (such as TechCIEHF), 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 elements of a work system, where practitioners might place their focus. For each element, the nature of issues that are frequently addressed is given, followed by a characterisation of available HF/E methods and approaches. Where appropriate and feasible, we describe in more detail a selection of representative and important HF/E methods and approaches using a practical example. This will help guide practitioners through the many opportunities for HF/E interventions and the wide range of methods to choose from. Each chapter concludes with a list of CIEHF professional competencies addressed. This can help the readers who are considering an application for technical specialist or registered member of CIEHF. As part of the application form, the applicant needs to indicate their level of expertise of the CIEHF

professional competencies and support this with evidence, such as project reports. The overview of the CIEHF professional competencies at the end of each chapter can help the reader to think about the kinds of evidence that might be appropriate to demonstrate different competencies. To note, the CIEHF professional competencies are not static and are undergoing regular review. However, while the number of competencies and their wording might change, the content overall is not expected to change significantly, and the list of competencies used in the book (2023/2024) is likely to remain a good guide.

The book is intended to be read sequentially, but readers can also jump to chapters of particular relevance to their interest. It is advisable to start with the Introduction (Chapter 1), as this provides an overview of HF/E and the systems approach used in the book. The following chapters (Chapter 2–7) discuss the different elements of a work system. If you are interested in a specific aspect, for example the physical environment, you could prioritise the relevant chapter accordingly. Chapter 8 looks at outcomes based on the systems perspective and relates outcomes back to interactions of the elements of the work system. The remaining chapters (Chapters 9–11) build on the systems perspective introduced in the first part of the book and cover further topics on organisational learning, equality, diversity and inclusion, as well as how to integrate and embed HF/E. The final chapter (chapter 12) considers the future, challenges and how to build your role in human factors within health and social care.

The CIEHF 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.

We would like to thank Dr Noorzaman Rashid for his enthusiasm and encouragement towards this book.

Mark Sujan
Laura Pickup
Helen Vosper
Ken Catchpole

CHAPTER 1

Introduction

Chapter Objectives and Learning Outcomes

- To explain what human factors/ergonomics (HF/E) and a 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.

Human Factors and Ergonomics for Improving Systems

Human factors and ergonomics (HF/E) help with an understanding of health and social care systems and improve outcomes, such as patient safety and staff well-being. This book can be used by anyone looking to improve such outcomes 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 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 about patient safety and other concerns by understanding how the system creates the opportunity for successful or unsuccessful work and delivery of 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 the ways in which different elements may influence outcomes relating to safety, efficiency and well-being, and HF/E aims to design safety into a system (see Box 1.1 for an example).

BOX 1.1 An example of an HF/E approach to organisational change

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 that the procurement contract that was agreed would safeguard the safety of patients and staff, while also 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, which included adult and paediatric patients, clinical staff, cleaners and porters, to understand the key activities they would be required to complete with the beds and the preferred features of the beds that would support those activities. The subsequent evaluation of the beds to support these activities was based on the ability for them to guarantee the safety of staff and patients and the associated efficiency of the activities. Analysis of the environments in which 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 in the beds to be procured by the Trust. Checks of the size of doorways, lifts and floor space ensured that 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 provided 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.

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. These are defined by the International Ergonomics Association as follows:

> *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 well-being** 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 we would want to understand the safety, functionality and reliability of the bed in the intended clinical setting and 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 would be regarded as a sociotechnical system. Consider an unstable patient being transferred to intensive care. Can we be sure that the bed can fit between all doors, can be moved easily without injuring those transporting the patient, can enable emergency care if required in transit, and can 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 its design and use? A hospital bed may seem to be a basic requirement for every hospital. Yet, this single piece of equipment may fundamentally influence the safety of the patient transfer and the ability of support staff to deliver emergency treatment if required in transit, may avoid staff injury and ensure the reliability and therefore availability of beds to which patients may be admitted. The compatibility of the humble hospital bed, procured by an organisation, may potentially influence patient safety, hospital efficiency and staff sickness and absence.

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 therefore 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, make it hard to do the wrong thing and, ideally, make it 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 1.1) (Wilson and Corlett, 1995). Any HF/E improvement or intervention should consider the well-being 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 hiring agency staff. Presenting data to an organisation, which represents the cost associated with a safety concern, can be an effective approach to proposing the value of an HF/E approach and designing systems to balance safety and well-being alongside system performance and efficiency goals.

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 its limitations and help you to ensure a realistic timeframe to your work.

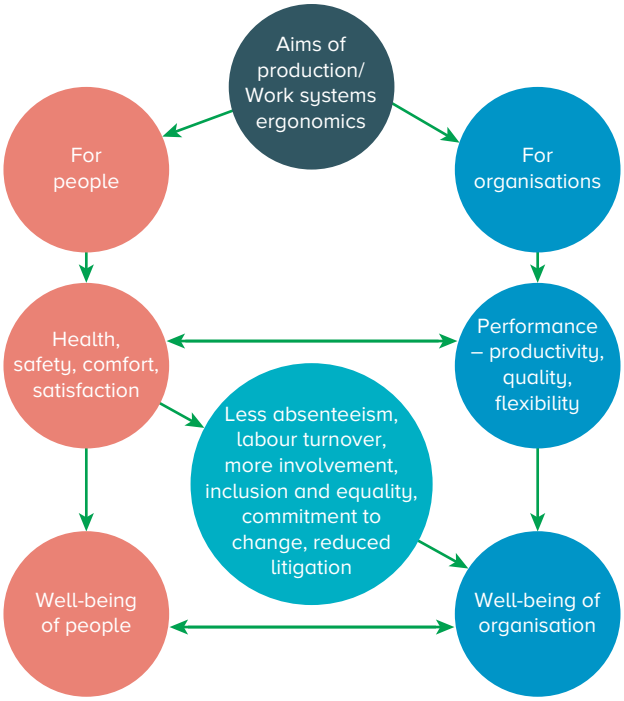

FIGURE 1.1 Twin aims of HF/E.
Source: Based on Wilson and Corlett, 1995.

A Systems Approach

'A systems approach' is a term often associated with HF/E. A system consists of 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 simultaneously 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 safety in health and social care systems, or any other safety-related system, might be enhanced as long as we identify the 'bad apples' among staff, is finally starting to be recognised. A single element, unless in the simplest system, is rarely found as the 'cause' of an incident or safety issue. For example, the skill set 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 provided, 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 the current functionality of the whole system. The ability to achieve this understanding and avoid