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Stephen Goundrey-Smith

# Principles of Electronic Prescribing

Springer

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# Series Preface

This series is directed to healthcare professionals who are leading the transformation of health care by using information and knowledge to advance the quality of patient care. Launched in 1988 as Computers in Health Care, the series offers a broad range of titles: some are addressed to specific professions such as nursing, medicine, and health administration; others to special areas of practice such as trauma and radiology. Still other books in the series focus on interdisciplinary issues, such as the computer-based patient record, electronic health records, and networked healthcare systems.

Renamed Health Informatics in 1998 to reflect the rapid evolution in the discipline now known as health informatics, the series continues to add titles that contribute to the evolution of the field. In the series, eminent experts, serving as editors or authors, offer their accounts of innovation in health informatics. Increasingly, these accounts go beyond hardware and software to address the role of information in influencing the transformation of healthcare delivery systems around the world. The series also increasingly focuses on "peopleware" and the organisational, behavioural, and societal changes that accompany the diffusion of information technology in health services environments.

These changes will shape health services in the new millennium. By making full and creative use of the technology to tame data and to transform information, health informatics will foster the development of the knowledge age in health care. As coeditors, we pledge to support our professional colleagues and the series readers as they share the advances in the emerging and exciting field of health informatics.

Kathryn J. Hannah
Marion J. Ball

# Preface

The purpose of this book is to provide electronic prescribing (EP) systems implementers with an overview of the clinical and professional issues involved with the use of EP systems, and a discussion of the key systems design principles involved. The book does not assume any detailed clinical or IT knowledge on the part of the reader; as such, it provides general guidance on possible applications of EP systems. However, the book should not be used a substitute for detailed analysis of a specific EP system by analysts with appropriate domain expertise within a healthcare setting; the author accepts no liability for issues arising from the use of the book inappropriately in this way.

This book is the result of several years of reflection and work in the area of electronic prescribing and medicines management. It represents a major project for me, as a pharmacist, a health informatician and as a writer. However, in my experience, major undertakings such as this are rarely the sole work of one person. I would therefore like to make a number of acknowledgements, and to thank a number of people whose assistance and support has been invaluable in the production of this book.

I would like to thank those hospital staff who were willing to be interviewed and to share their experiences of electronic medicines management with me:

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Stephen Goundrey-Smith
Charlton, Banbury, Oxfordshire
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# Chapter 1
# Philosophical and Social Framework of Electronic Medicines Management

## Introduction

Electronic prescribing (EP) involves the use of computer systems to facilitate the prescription, supply and administration of medicines within a hospital. EP systems are able to capture a full prescribing history for a patient in a transferrable manner, and open up the potential for use of databases and decision support tools to assist the prescriber in medicine selection.

Over the last ten to twenty years, EP systems have been developed and used in a number of countries around the world, but their use is by no means widespread. Currently, in the United Kingdom, only a handful of acute hospitals have full EP systems throughout the hospital. There are, however, further hospitals with EP in certain wards and specialities only. EP systems – and in particular, computerised decision support tools to aid prescribing – have been pioneered in the United States, and there is much research documentation on their use in a US context. Nevertheless EP systems have still not been widely adopted in the US, for various reasons (Fig. 1.1).

However, because of sociopolitical developments on a global scale, healthcare providers around the world are increasingly concerned with cost-effectiveness, the increased likelihood of litigation and the need for clinical governance and transparency in healthcare processes. Consequently, there will be an increasing emphasis on the clinical application of information technology to help healthcare providers streamline their business processes and achieve outcome targets. An area of healthcare where there is a critical need to use IT for these purposes is the prescribing and supply of medicines in secondary care. Use of departmental systems to manage the discrete activities of particular departments or specialisms in hospitals is now well established. Hospitals around the world routinely use systems to manage and process pathology and radiology order requests, and have systems for pharmacy management. Patient administration systems (PAS) to manage admissions and discharge and to facilitate the patient pathway or "patient journey" in secondary care are also in routine use. However, the area of EP and medicines management is one where there has been less technology adoption to date.

There are now compelling – but, at points, contestable – data concerning the role of EP systems in risk reduction and optimising business processes in hospitals, which will

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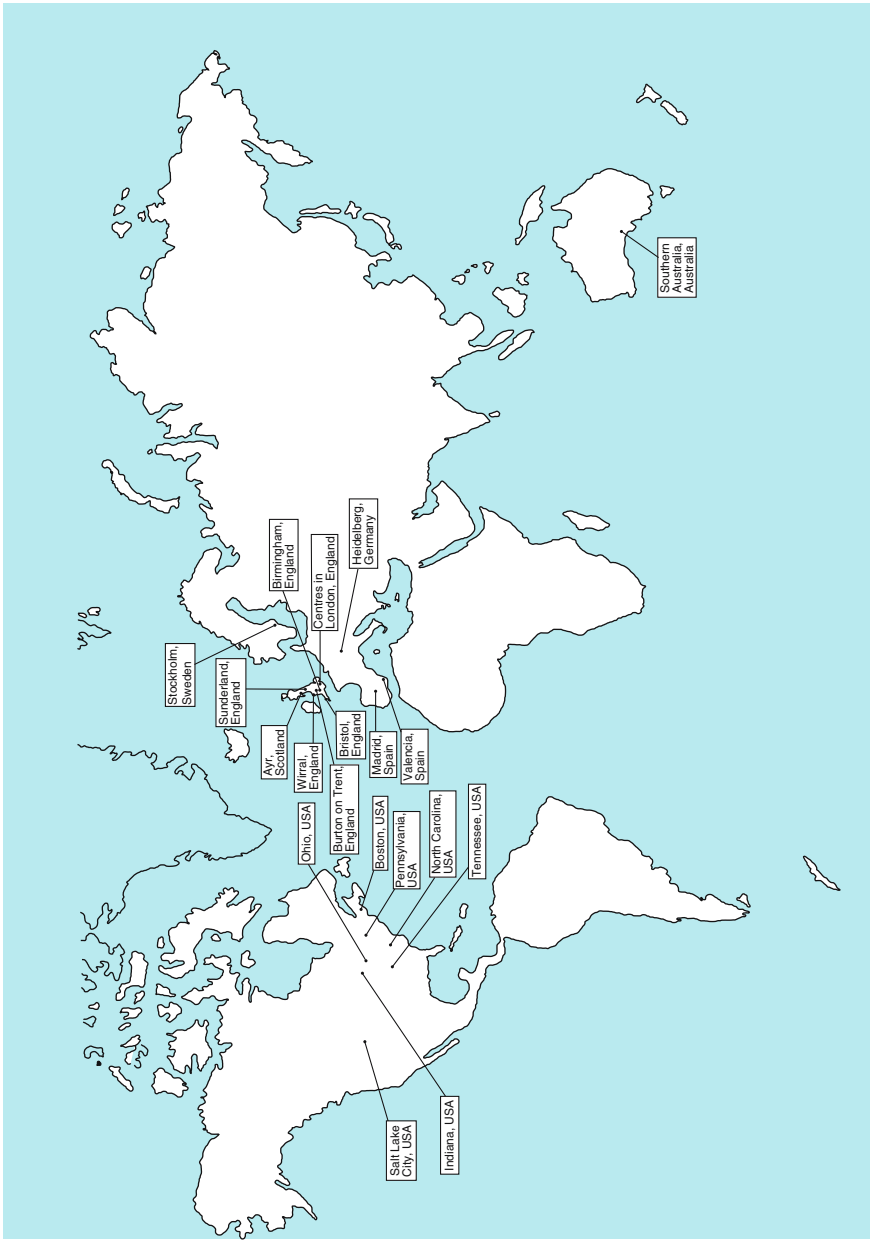


**Fig. 1.1** Published experience of EP systems around the world

be discussed in later chapters of this book. For this reason, there is an increasing interest in the benefits of EP systems from both healthcare professionals and healthcare provider managers. Elsewhere in Europe, regional and national healthcare IT programmes have been established to address population healthcare issues.[1] Over the next few years, it is hoped that the Connecting for Health (CfH) IT programmes for the National Health Service (NHS) in England will implement EP systems at all hospitals in England.[2] Furthermore, successful establishment of regional or national programmes will generate further interest in EP at European and international level. There is therefore likely to be an exponential growth in the significance of EP over the next ten years.

Furthermore, in any given health economy, a broad constituency of professionals are involved in the design, implementation, management and maintenance of EP systems, depending on the technology employed, the structure and organisation of the healthcare system concerned, and the roles of the different professionals within the system. This would include healthcare professionals (doctors, nurses, pharmacists and other healthcare professionals), healthcare managers and administrators, IT specialists from within the health system or software vendors, drug data suppliers and other stakeholders, such as government regulatory bodies or the pharmaceutical industry.

This book will discuss issues associated with secondary care EP systems to date, the basic principles of design and implementation of these systems, and how their design and configuration can impact on benefits realisation, hospital workflow and clinical practice. While the book explores the current benefits and potential role of EP systems in hospitals, and describes interfaces with other secondary care systems (for example pharmacy systems and pathology systems), discussion of primary care IT systems for medicines management – in particular, the electronic transfer of prescriptions (eTP) in community pharmacy – is outwith the scope of the book. There is, however, an expectation that, in future, secondary care and primary care systems will be able to communicate with each other.

This book will necessarily refer to the published literature to illustrate the recognised benefits of EP systems and the potential applications of such systems, described in each chapter. Nevertheless, the book is not intended to provide an exhaustive review or quantitative analysis of published studies.

This chapter will set the scene by exploring some of the social, political and philosophical issues that attend the use of electronic systems in healthcare, and in particular, EP systems.

## Definitions and Terminology

Since electronic systems for medicine prescribing have been developed independently in different countries, under the auspices of different healthcare systems, it is inevitable that there will be variations in terminology. Furthermore, terms that are not synonymous may be used interchangeably or in an indiscriminate manner.

A recent UK definition of *electronic prescribing* is as follows:

> The utilisation of electronic systems to facilitate and enhance the communication of a prescription or medicine order, aiding the choice, administration and supply of a medicine

> through knowledge and decision support, and providing a robust audit trail for the entire medicines use process
>
> Connecting for Health Electronic Prescribing Baseline Specification.[3]

This is a useful working definition for an EP system because it takes into account the capacity of an EP system to add value to the patient's prescribing history through use of clinical decision support tools, and also the process of storage and communication of medicine orders. It is an appropriate description of some of the EP systems in current use in the UK. It is also a suitable definition for many of the US EP systems that are available at present.

However, in the US, the term *computerised physician order entry* (CPOE) is often used in the literature to describe computer applications that are used for EP. This term is often used synonymously with EP. However, CPOE is a broader term that can encompass the transmission of other clinical order types, such as pathology tests or radiology tests, as well as medication orders. However, when applied to medication orders, CPOE only addresses the prescribing element of the medication use process,[4] together with the electronic transmission of the medicine order. Strictly speaking, the term CPOE does not embrace the database and decision support elements of an EP system, which are regarded by many commentators as an essential aspect of an EP system.

In the US, the provision of medication in response to prescriber orders and the management of the supply of medicines is the role of *pharmacy information systems*.[5] These systems are designed to manage information relating to the use of medicines in patient care and include functionality for online order entry, pharmacist review, medication profiles, label printing, stock or inventory control and reporting (medication use reports, dispensing reports etc.). Since some pharmacy information systems may be used to facilitate EP, with online order entry and, in some cases, clinical decision support tools, some commentators consider them as EP applications. However, this is in contrast to the UK, where there is a more clear demarcation between pharmacy systems, which are well developed and universally used, and EP systems, which are still in their infancy.

In Europe, the European Committee for Standardisation has defined electronic prescriptions in terms of the exchange of prescription messages between prescribers and dispensers, and between healthcare providers and official authorities as permitted by national regulations.[6]

This definition focuses on the dissemination of prescription information between stakeholder organisations, following recognised messaging conventions and in accordance with national laws, thus reflecting the European Union emphasis on removing barriers to commerce across the EU. It does not mention clinical decision support, and is concerned with the business and commercial aspects, rather than the clinical aspects, of the medicines use process.

The definitions and terms used have different emphases and, when used correctly, reflect different aspects of the whole medicines use process. Overall, it is clear from a discussion of the terminology that EP is a complex discipline, the success of which relies on the successful interplay of system design, data support and clinical practice.

In addition, the term *electronic medicines management* should be considered. Electronic medicines management is a broader term than EP, since it encompasses all medicine-related activities – including selection, supply, medicine administration and monitoring of medicine use – not just the act of prescribing. It is therefore a useful description of many contemporary EP systems, which are comprehensive in their scope, and are designed to support and manage all medicine-related activities in a hospital. However, the term *medicines management* is one that has largely been coined by the UK pharmacy profession and has little currency outside the UK and outside the pharmacy profession.

In addition to the definitions of the overall process of EP, it is recognised that the descriptors and nomenclatures used within the EP systems must conform to recognised standards in order for the systems to be internally consistent in their operation and intraoperable with other systems. Controlled terminologies, as they relate to EP systems in particular, will be discussed in the chapter on data support. However, it has to be recognised that the major harmonisation endeavours for healthcare IT – for example, Health Level Seven (HL7) and the International Standards Organisation (ISO) TC 215 – seek to address process issues beyond the prescribing of medicines in a clinical scenario. So, for example, the ISO TC 215 standard for identification of medicinal products (structures and controlled vocabularies for ingredients (substances))[7] lists international pharmacovigilance (reporting of side effects of drugs), clinical trials, product regulatory approval and environmental protection or toxicology as business use cases for controlled vocabulary for medicines, as well as EP.

## The Benefits of Automated Systems

In the earliest days of computer technology, automated systems were developed in order to store and retrieve information. With the advent of solid state technology, where for the first time it was possible to build computers that were powerful enough to handle large volumes of data with optimal speed, but small enough to be of practical use in a working environment, organisations began to see the potential of computer-based systems to replace bulky paper records.

Computer-based systems also bring the possibility of fast and accurate retrieval of information, based on appropriate indexing and coding methodology. There is also the potential to post messages against certain records according to keywords and other attributes, which is potentially useful in clinical applications. Indexing and coding can present procedural issues in the design of a simple database, concerning classification, accessioning etc.; in the area of medicines and therapeutics information, the use of indexing methodology to provide clinical decision support is potentially a very complex – and critical – science. Data structures and coding systems for medicines data will be discussed in detail in a later chapter, together with use cases and known problem scenarios.

A review of experience of EP applications in the UK[8] has demonstrated that EP implementations have resulted in the following benefits:

- Availability of a fully electronic prescribing history.
- Improvement in legibility and completeness of prescriptions.
- Improvement of hospital business processes due to electronic dissemination of prescriptions.
- Availability of electronic decision support tools at the point of prescribing.
- Comprehensive audit trail of prescribing decisions made.
- Reduction in the rate of medication errors.

Some of these benefits have also been reflected in the major quantitative studies of systems in the US. These benefits will be discussed in detail in subsequent chapters.

The benefits of EP systems are far-reaching in significance, in terms of effects on risk management and risk reduction, and also financial cost. However, it is acknowledged by experts in the field that realisation of these benefits is dependent on system design. Given the likely growth of interest in electronic medicines management, a discussion of design issues with electronic medicines management systems, and their impact on benefits, will be timely for the many groups of professionals likely to be involved.

Automated systems offer advantages over traditional paper-based systems in three main areas:

- Accuracy – Automated systems can support the consistent use of medicine nomenclature, the accurate recording, display and transmission of prescription information, and the accurate display of clinical warnings as a result of a logical system of trigger points. In short, EP systems automate repetitive processes or monotonous processes, which are prone to human error when carried out manually.[9] Thus automated systems are able to contribute to risk management objectives in hospital prescribing.
- Standardisation of data – Automated systems allow patient data to be captured and stored according to standard formats and conventions. This facilitates the electronic transfer of patient data, and the production of comprehensive management reports. The production of management reports by hospitals and healthcare providers is an issue of great political significance in many healthcare economies where there is a need for governments and the public to be aware of healthcare issues and outcomes. However, reporting is an area of clinical IT where there are often many methodological and technical obstacles to be surmounted. It is hoped that EP systems in development will address important deliverables in management reporting. However, in standardising patient data, electronic systems therefore have the capacity for what has been described as "mass customisation."[9] In healthcare terms, this means that, although the system handles large amounts of patient data, it is able to produce an individual care plan based on the specific personal requirements of each patient.

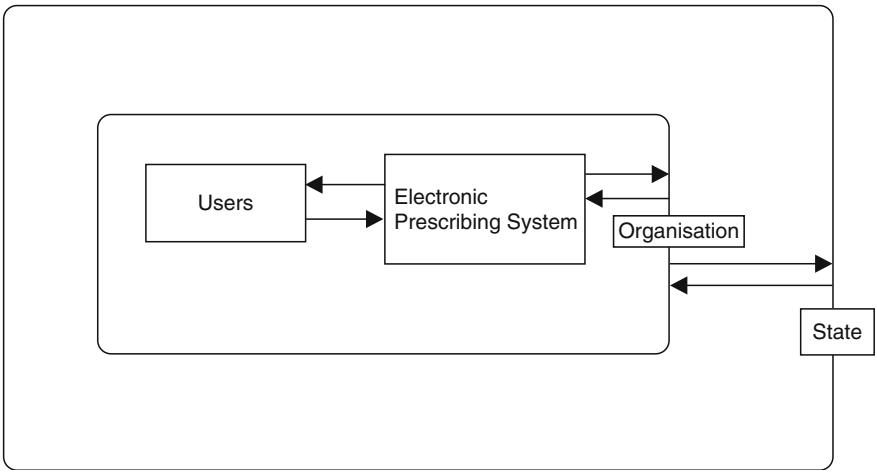


**Fig. 1.2** Relationships between the EP system, the user, the healthcare provider and the state

- Facilitating changes in working practices – Automated systems have the capacity to process prescription information accurately and at scale, and are able to facilitate the display of that information in different contexts, according to system design and hardware availability. They are therefore able to make possible new ways of working for individuals and organisations. Because the system takes care of the routine recording, computational and transmission aspects of prescription information management, organisation processes may be restructured so that health professionals can engage with near-patient clinical activities, which require intuitive human qualities (Fig. 1.2).

## EP and the Individual

Given that electronic systems have the potential to improve health outcomes, through increased accuracy of prescription information management and dissemination, and to revolutionise working practices, the implementation of an EP system may have a significant impact on individual users – the healthcare professionals involved with the prescription, supply and administration of medicines. The introduction of an EP system will also have consequences for the working lives of hospital managers, healthcare informaticians and IT professionals and other health provider staff who are not patient-facing.

Many individual healthcare professionals will appreciate the potential benefits of an EP system; they will see the potential for a system to improve health outcomes and reduce risk in their particular area of practice. This will be especially the case for consultant medical staff whose performance may well be monitored using the