Health Informatics

Stephen Goundrey-Smith

Principles of Electronic Prescribing

Second Edition

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Stephen Goundrey-Smith, MSc
Cert Clin Pharm, MRPharmS
SGS PharmaSolutions, Chedworth
Gloucestershire
UK

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Preface

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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- Former colleagues and associates from iSOFT – George Brown, Tom Bolitho, Clive Spindley, Tim Botten, Sue Braithwaite, Julie Randall and Raghu Kumar
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- Fellow members for the Guild of Healthcare Pharmacists/United Kingdom Clinical Pharmacy Association (UKCPA) IT Interest Group Committee

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Chapter 1
Philosophical and Social Framework of Electronic Medicines Management

Introduction

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

Over the last 10–20 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 electronic prescribing systems throughout the hospital. There are, however, further hospitals with electronic prescribing in certain wards and specialties only. Electronic prescribing systems – and in particular, computerized 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. In addition, electronic prescribing and clinical decision support tools are increasingly being implemented in Australia and in European countries other than the UK (Fig. 1.1).

However, due to 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, quality 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 to achieve outcome targets and to optimize care quality and cost-effectiveness. 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. For many years, hospitals around the world have been using systems to process patient data, manage

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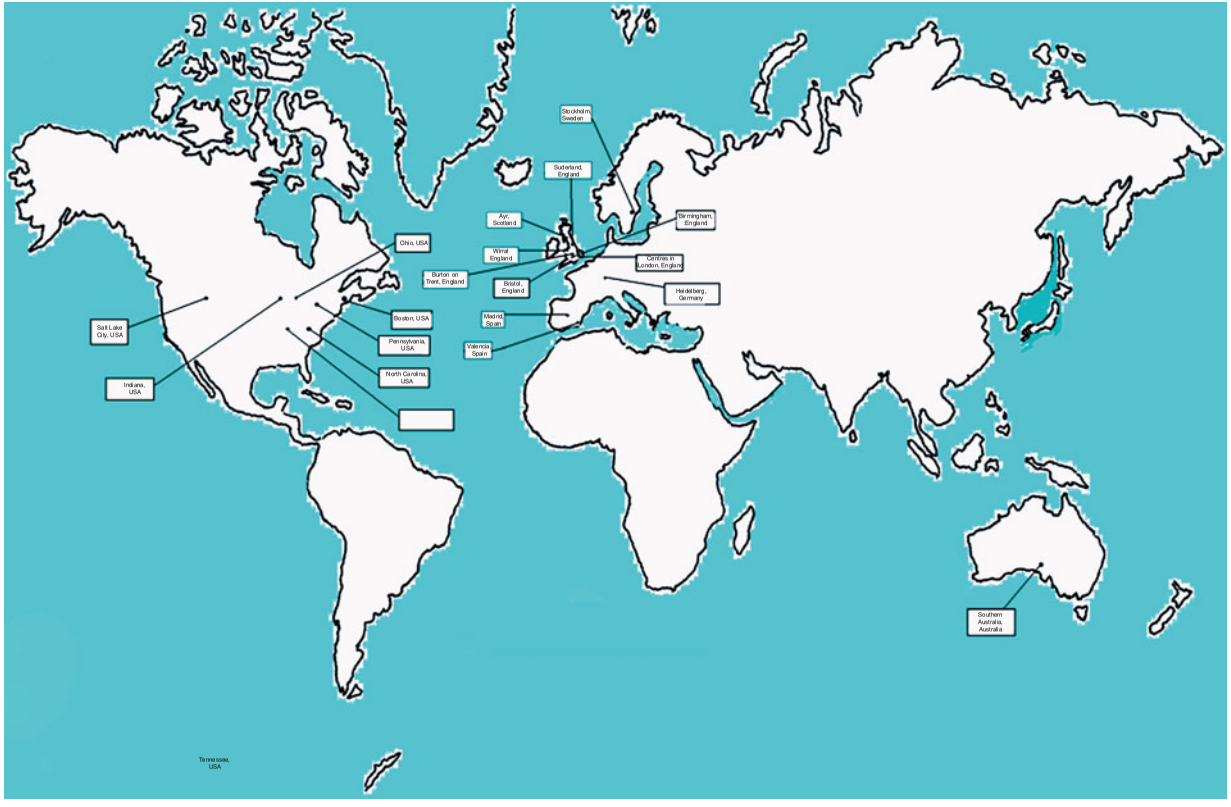

Fig. 1.1 Worldwide experience of hospital electronic prescribing. Centers with published experience of EP system implementation in secondary care (For full details, see Appendix 1)

clinics or treatment episodes, and to create and communicate orders (e.g. radiology or pathology orders). These would include patient administration systems (PAS) to manage admissions and discharge and to facilitate the patient pathway, or "patient journey" in secondary care, and systems for pathology laboratory and pharmacy management. However, the area of electronic prescribing and clinical medicines management is one where the adoption of technology is at an earlier stage.

There are now compelling – but, at points, contestable – data concerning the role of EP systems in risk reduction and optimizing business processes in hospitals. There are also clear benefits for the use of well-structured and maintained clinical decision support systems for the prescribing process. The benefits data for both EP systems and clinical decision support tools will be discussed in subsequent chapters. For these reasons, there is an increasing interest in the benefits of EP systems from both healthcare professionals and healthcare provider managers, and there is likely to be continued growth in adoption of EP systems over the next 10 years.

Elsewhere in Europe, regional and national healthcare IT programmes have been established to address population healthcare issues.[1] In the US, systems have been established by the major healthcare insurance providers to optimize the quality and cost-effectiveness of treatment, especially for long term conditions [3]. The Connecting for Health (CfH) national IT programme for the National Health Service (NHS) in England, which ran from 2002 to 2011 did not deliver a national EP solution for hospitals in England, as originally envisaged. However, the CfH E-prescribing programme has provided methodology advice and research resources for hospital EP implementers [4], and has had a valuable coordinating role helping hospitals in England share implementation experience with some of the EP systems that are already commercially available.[2]

In any given health economy, a broad constituency of professionals are involved in the design, implementation, management and maintenance of electronic prescribing 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 professions), 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 electronic prescribing systems and clinical decision support 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

[1] For example, the Umbrian regional healthcare system in Italy (see Barbarito [1]) and the Stockholm Regional Drug Prescribing System in Sweden (See Sjoborg et al. [2]).

[2] The NHS Connecting for Health e-prescribing programme has had an important role in sharing the experience of previous implementations – see http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/challenges.

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 recognized benefits of EP systems and the potential applications of such systems, described in each chapter. Since the first edition of the book, a greater body of research literature has become available, with work on clinical decision support methodology, paediatric EP processes, user perceptions of EP systems, together with new material on risk management and error reduction. This second edition incorporates the findings of this research but, as with the first edition, does not attempt 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, electronic prescribing 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
> NHS Connecting for Health [5]

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 *Computerized Physician Order Entry (CPOE)* is often used in the literature to describe computer applications that are used for electronic prescribing. This term is often used synonymously with *electronic prescribing*. However, *CPOE* is a broader term which 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 [6], 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* [7]. 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/inventory control and reporting (medication use reports, dispensing reports etc.). Since some *pharmacy information systems* may be used to facilitate electronic prescribing, with online order entry and, in some cases, clinical decision support tools, some commentators consider them as electronic prescribing 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 electronic prescribing 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.[3]

This definition focuses on the dissemination of prescription information between stakeholder organisations, following recognized messaging conventions and in accordance with national laws, thus reflecting the EU emphasis on removing barriers to commerce across the European Union. 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 *electronic prescribing* since it encompasses all medicine related activities – including selection, supply, medicines 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 medicines-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.

[3] European Committee for Standardisation. European PreStandard (ENV) 13607. Health Informatics. Messages for the exchange of information on medicine prescriptions.

As well as definitions of the overall process of electronic prescribing, it is recognized that the descriptors and nomenclatures used within the EP systems must conform to recognized 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 recognized 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))[4] lists international pharmacovigilance (reporting of side effects of drugs), clinical trials, product regulatory approval and environmental protection/toxicology as business use cases for controlled vocabulary for medicines, as well as electronic prescribing.

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 indicated that electronic prescribing 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.

[4] International Standards Organisation. Health Informatics – Identification of medicinal products – Structures and controlled vocabularies for Ingredients (Substances) ISO TC 215/WG 6 N 549.

- 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 EP systems in the United States. 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 [9]. 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 [10]. 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 standardizing patient data, electronic systems therefore have the capacity for what has been described as "mass customisation" [10]. 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.
- 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

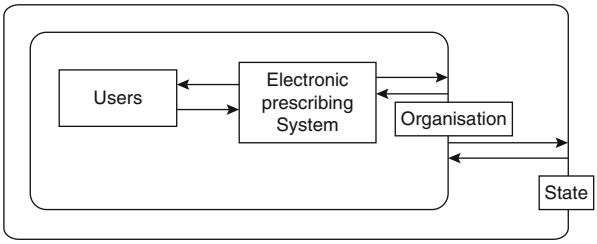

Fig. 1.2 The relationship between the EP system, the healthcare provider organization and the state

require intuitive human qualities. Nevertheless, while re-engineering of business processes may be possible with automated systems, it may not always be desirable, and the objective of software design may be simply to automate and improve the efficiency of existing working processes (Fig. 1.2).

Electronic Prescribing and the Individual

Given that electronic systems have the potential to improve health outcomes and care quality, through increased accuracy of prescription information management and dissemination, and to revolutionize 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 health outcome and care quality information for their patient list. However, in an increasingly regulated healthcare environment, other healthcare professionals will see the value of EP systems in helping them to achieve performance objectives and to comply with ethical, legal and professional requirements [11]. Some healthcare professionals, however, may be concerned about adverse effects on their sphere of practice, with the political and litigation implications that those adverse effects might entail. For this reason, they may be concerned about the capacity for electronic systems to generate new and uncharacterized errors, which is well-recognized in the literature [12].

Furthermore, an individual's attitude towards the implementation of an electronic system is often not related to whether or not they are familiar with the documented research evidence for the use of such systems. This suggests that factors other than system knowledge and familiarity affect a person's attitude to the introduction on an electronic system.

An automated system may introduce a new way of doing one or more business processes within an organisation, and therefore bring about changes in working