Chapter 1

Introduction

What is a clinical information system?

Critical care is full of digital technology. Infusion pumps are automated, ventilators have digital interfaces to manage their functions, images are stored in a database, and administrative teams use information systems.

A clinical information system, referred to throughout this book as a CIS, is a piece of technology that supports the entire clinical process at the bedside.

A CIS provides the technology for the clinician to manage patient data and coordinate care. Its primary function is to compute, store and display data from various sources (Figure 1.1).

For example, it can store arterial blood gas results, compute fluid balance, and display heart rate over time. It structures data in the database, which makes it easier to retrieve historical data or collate a particular result across a cohort of patients.

A CIS also functions as a tool to coordinate patient care. It provides mechanisms to prescribe drugs, order investigations, communicate with healthcare professionals from all disciplines and document all patient care.

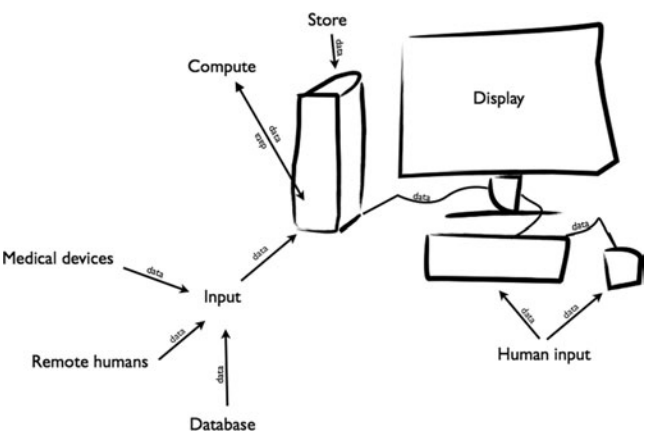

Figure 1.1 The clinical information system (CIS).

A CIS can be a tool that supports all aspects of patient care on a critical care unit (CCU).

CIS versus paper

A major difference between CISs and paper is the way that data can be integrated and viewed and used in patient care (Figure 1.2).

A CIS can provide a three-dimensional view of the data, with a bit of effort to overcome the two-dimensionality of the screen. It is easy to scroll backwards and forwards in time, viewing historical as well as current data. It is possible to juxtapose data, such as graphing blood pressure against heart rate one above the other (Figure 1.3).

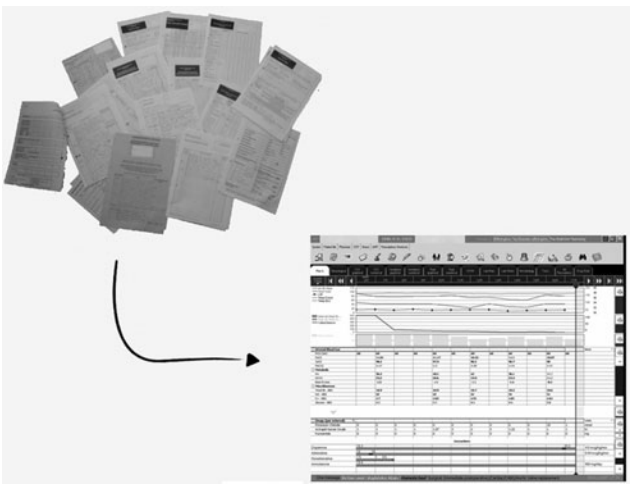

Figure 1.2 CIS: Transformation from paper to screen allows wider integration and organization. All data are contained in one location but can be accessed from many. Data can be organized (again and again) in many different ways.

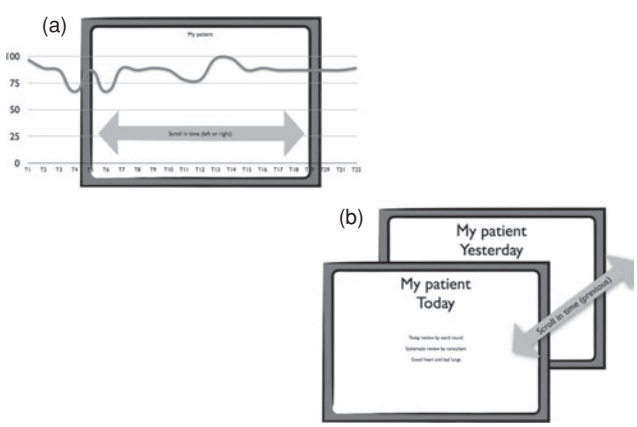

Figure 1.3 (a) Three-dimensional view of data: scrolling back in time, juxtaposing data from various sources, reviewing historical data. (b) Granularity of data: zooming in/out, e.g. reviewing time-point or trends over a long period.

Unlike paper, it is possible to alter the granularity of the data, zooming in to view particular data points and zooming out to view trends.

Introducing a CIS is a greater financial undertaking than developing paper forms. Yet it can also provide new ways of supporting care.

A CIS provides a more reliable tool to plan patient care, increasing legibility, consistency and accountability (Figure 1.4). As will be discussed in later chapters, this has advantages and disadvantages.

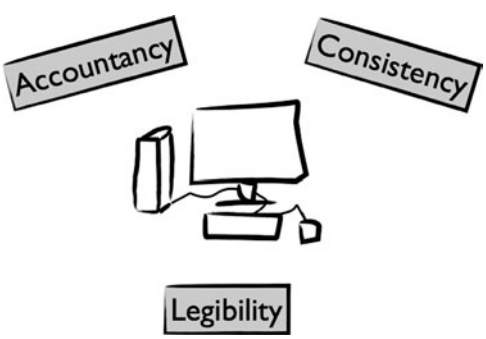

Figure 1.4

The formalization of work practices can cause problems, and the flexibility of paper in supporting communication can be missed. These problems can be overcome to reap the benefits of a CIS in most contexts.

CIS in different flavours

There are various CISs available, with many specialized for use in critical care.

The systems all have similar functions, but have differences that can be significant for the choices an institution makes.

Some systems support all aspects of patient care within the institution, while others are specific to the location (critical care being one) or task (be it administrative or clinical). Examples include some CISs encompassing all episodes from booking to theatre set-up, administration and payment. Others are specific to documentation and drug prescribing.

Not only do systems differ, but institutions may choose to use them in differing ways. Some prefer to maintain paper documentation, but interact with the pathology and pharmacy departments through an information system. Other CISs offer advanced features around clinical decision support, such as recommendations or alerts. The choice of utilization will depend on the requirements of the institution.

A significant difference between CISs is whether they are standard, customizable, or even customized by healthcare professionals. This changes dramatically how a CIS might be used and developed within an institution (Table 1.1).

Decisions

The range of available systems and possible applications underscores the number of decisions that need to be made when planning to introduce a CIS.

It is not possible to justify buying a CIS, or even to base a decision to buy one, entirely on proven benefit. As will be discussed throughout this book, benefits are specific to the suitability of a CIS to an institution and the way in which it is implemented.

Table 1.1 CIS and customization

Out of the box	The vendor sells a fully operational system – with no or little room for adaptation by the user.
Customizable	The vendor sells a system that can be tailored to some extent to the users' needs through interaction with a technical team (sometimes provided by the vendor).
User-customizable	The vendor sells the tools and training to allow the user to develop and maintain a custom-made system. The clinical team can customize the system.
Self-made	The system is made in-house by a team of enthusiastic medical computer experts. The clinical team is dependent on local expertise.

There may be many conflicting demands that will need to be resolved in choosing and implementing the CIS. For example, management might see the opportunity to collect data, but staff might resent having to spend an extra 30 minutes typing in data that they do not use. There may be other issues that arise between actual work practices and ideal work practices. The choice and implementation of a CIS requires careful consideration of the differing demands within the institution and realistic decision-making (Figure 1.5).

This book

This book discusses the issues that need to be considered when selecting and implementing a CIS in critical care. Common mistakes and pitfalls are highlighted. When appropriate, evidence is offered from research in health informatics and organizational change.

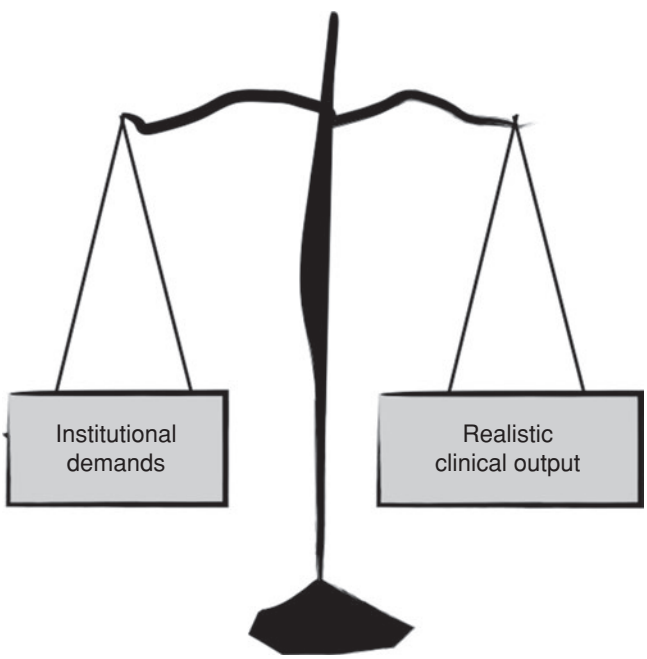

Figure 1.5

The authors and editors are healthcare professionals and university researchers who were all involved in the full implementation of a CIS in a large critical care unit.

The healthcare professionals bring their experience of leading the selection and implementation; the researchers add their knowledge from the research literature and the experience gained from observing and reflecting upon an implementation. These two viewpoints give this book a rich perspective from which to offer suggestions and guidance.

This book will not choose a system for the reader. The authors are not aware of specifics that will affect choices in a particular unit at various stages. They cannot resolve tensions in the institution that will result from the process of acquiring a CIS, such as differences in requirements and expectations of managers and clinicians.

This book is for all those involved in the selection, purchase, implementation and use of a CIS. This includes clinicians, nurses, allied healthcare professionals, managers and executives. It is key to the success of a CIS implementation project to include as many stakeholders as possible. This book can inform and support discussion between multiple stakeholders.

We hope this book will provide a useful guide to what may seem an opaque and risky process.

Chapter **2**

Deciding to purchase a CIS

Introduction

Investing in a CIS will affect the operation of a critical care unit in many ways. Adjustments will need to be made to the budget, and staff will need to change the way they work.

To justify such significant changes, it is necessary to establish a coherent case. This chapter describes the key stages that are likely to be involved in developing such a case: review of the clinical vision, review of critical care unit capabilities and priorities, and learning from others' experience.

The need for a clinical vision

It is undisputed that a CIS needs to deliver clinical benefits to be considered useful and successful. To do so, a CIS must support the clinical vision of the unit.

An important stage in considering whether a CIS is suitable for a unit is to articulate how it fits with its clinical vision.

When embarking on a CIS purchase, the critical care unit clinical vision should be reviewed, or one should be established if none exists.

Table 2.1 Elements to review when defining the unit clinical vision

Commonly shared ideas about how clinical care can best be delivered
Knowledge of best practice from other comparable units
Specific problems with current delivery that need to be addressed
Specific interests of influential unit staff

The typical elements contributing to the development of the clinical vision are listed in Table 2.1.

The articulation of the clinical vision should encompass the views of all involved in the unit at any level and from a range of disciplines. This should lead to a concise statement of the vision that can serve as a reference point for the subsequent selection and implementation of the CIS.

This statement and its development can be an opportunity for collective reflection on the future direction of patient care in the unit and can help build a consensus.

The clinical vision should remain flexible. Those involved should be reminded that it is expected to evolve over time.

Time spent outside the clinical environment, such as during an away-day for selected staff, may help to foment the vision.

It is best to develop the clinical vision independently of CIS choice to avoid the temptation of developing a vision that matches the expected capabilities of the CIS. That is not to say that there may not be some iteration between the clinical vision and expected CIS capabilities. Considering how a CIS could contribute to clinical care may identify new