Clinical Information Systems (CIS) of the future
The global market for hospital information systems, already substantial, is growing strongly. By 2017, estimates\(^1\) suggest that it will reach $17 billion. The US market’s growth is expected to outpace global averages, and is projected to increase by a compound annual rate of 19.3% over the next seven years\(^2\). The US market accounts for the majority of global IT healthcare spend (some 70%)\(^3\) and is likely to be further driven by regulatory reforms and the significant changes taking place in the market.

\(^2\) ibid
\(^3\) ibid
Clinical Information systems (CIS) are in widespread use across healthcare providers in many markets of Europe and the US. For example, nearly all of the hospitals with 200 beds or more in Germany have a CIS in place. However, their application tends to be largely restricted to administrative and financial functions, rather than having a direct bearing on patients’ wellbeing or supporting physicians and other professionals in their daily work. Other European countries have put considerable resources behind driving greater adoption of healthcare IT. Spain, for example, enjoys widespread use of electronic medical records; England has made considerable strides in making electronic patient records available throughout the National Health Service and large urban regions in France have made similarly rapid progress. Outside Europe, positive developments are taking place in many national health systems, such as Australia where IT adoption is particularly advanced in primary care settings and Singapore where diverse public sector healthcare providers have common access to electronic health records.

But these developments are just the start. As solutions evolve there will be significant opportunities to connect information, patients and health professionals in new ways, so that, unlike today, CIS will support a patient’s journey throughout a healthcare system. They will provide health professionals with data and applications that will make their work faster, more efficient and most importantly safer.

So what does the future of CIS look like, and what are the barriers that need to be overcome to get there?
A patient’s journey through a healthcare system follows a number of stages, according to their condition, diagnosis, the appropriate treatment and so on. These clinical pathways are supported by a range of different processes, with data collected and stored along the way. Operating with clear and defined clinical pathways is essential to optimize health outcomes, maximize patient safety and operate as effectively as possible. However, one of the major obstacles presented by current CIS is their inability to adapt to a hospital’s individual processes and to meet the needs of healthcare professionals – and of course patients- in the carrying out of their daily work. What that means in practice, is that the processes required by healthcare professionals during their day-to-day work with patients cannot be integrated in workflows that follow the patient journey through the hospital or wider healthcare system. CIS typically offer a broad repository of data, medical records, scans and so on. However, these are generally not accessible in a way that integrates with the patient journey though the system – ie from admission to diagnosis, through procedure to post-operative care. In addition, the inability to interface between in-patient and out patient care means that a variety of sub-systems are used that inevitably create duplication and inefficiency. The record of a patient’s progress through a healthcare system is therefore often fragmented and incomplete.

Current CIS also tend to lack the functionality to create and maintain processes as they evolve in order to optimize the workflow in healthcare facilities that support and respond to day-to-day work. The lack of, for example, readily accessible and easy to create reminders, to-do lists and schedules mean that other solutions are often adopted that do not integrate with the wider system. That lack of interoperability can mean that any individual healthcare worker will often not have access to the information they need to quickly and precisely understand a patient’s specific requirements at any one time.

The ability to exchange information about a patient from all and any part of the healthcare system is generally absent or inadequate. The lack of mobile integration means that it is generally not possible to have information available on the move where it would be most valuable. For example, using a connected tablet while making ward rounds offers a number of potentially game-changing benefits. Not only would it enable physicians to have immediate access to a patient’s up to date records, they can also use information and visual aids – such as scans - to help patients understand their diagnosis and likely options for treatment where and when they would be most valuable. Secure mobile connections to a clinical information system would also enable physicians to work remotely, increasing their efficiency.

Research among doctors in Germany, for example, shows that their demands for functionality from CIS are developing fast. They are looking for simple ways to access the information they need at the point of treatment. They are looking for simple access to research and diagnostic tools (eg online resources and forums that share information between specialists) and information that is prepared around the patient and the specific requirements of a physician – eg surgeon, oncologist etc. A good example of this in action is the use of shared online resources such as Tumor Board – a forum where physicians from different medical disciplines come together to discuss treatment approaches and successes regarding their cancer patients. A clinical and administrative information system is needed that brings all relevant data arising during the treatment process intelligently together and provides information about patients at the right place and at the right time. That means having all a complete view of data in one place, which is currently not possible owing to the proliferation of diverse sub-systems at any one hospital in addition to the main CIS.

In particular, physicians are looking for ways to improve patient safety with relevant information at the point of treatment about, for example, known adverse reactions to...
drug combinations or a patient’s specific allergies. They also want to have the ability to access relevant information simply and easily through mobile devices (such as tablets) as they make their rounds and be able to add to and update information held within a CIS to ensure each patient’s records are accurate and up to date.

**Opportunities for suppliers**

As healthcare providers increasingly understand the benefits and efficiency gains available from clinical information systems, their demands are opening significant opportunities for system providers. Government incentives to adopt greater use of ICT in healthcare, such as the Meaningful Use program in the US, are also encouraging greater interest in the possibilities of how clinical information systems can drive more efficient, effective and safer patient services.

The need to improve quality and at the same time optimize the use of resources throughout the health system is driving demand for information systems that can support streamlined, efficient processes and offer comprehensive support for clinical decision-making. The growing use of e-health records that provide a life-time view of a patient’s health history is also creating and appetite for effective and secure integration with clinical systems.

Other developments such as advanced voice recognition and the ability to record data in structured formats are attracting increasing attention. The greater use of mobility is fuelling demand for apps that can work with CIS to deliver information and services directly at the point of use.

However, realizing many of these potential gains will require overcoming a significant barrier, namely the inability of proprietary systems to interface easily and inexpensively with other systems or applications. While many smaller system providers are increasingly developing open applications and solutions to drive interoperability, the technical complexity and expense of larger providers’ systems remains a significant obstacle. The adoption of more open standards would help to realize many of the productivity gains that CIS promise to deliver. The extent to which large providers will meet those demands remains open to question.

**Working towards the CIS of the future**

We see two likely scenarios for the development of CIS in the future health landscape. The first in the near term, and the second a deeper transformation, which while a more distant prospect will eventually emerge to create a flexible and adaptable system to support all clinicians in their daily work.

**Web-Based Interface**

The first scenario we envisage will consist of a new control and presentation layer that sits on top of a hospital’s existing IT systems (CIS, LIS, RIS, PACS, etc). By providing a web-based interface to all subsystems, it will allow users to bring together the information and services they need in one place, in line with their roles and aligned to clinical pathways.

As the figure above shows, a web-based interface poses almost no migration risk as all subsystems remain undisturbed and in place. However, this approach does offer a different physicians and hospital management a far greater ability to customize the interface to meet their specific needs and their role. For the system manufacturer, it offers a solution that requires considerably less investment than developing a completely new CIS system from scratch. However, the solution is also only part of the way to addressing some of the key elements that would be required to deliver more dramatic improvements to the way that all system users are able to adapt and customize a clinical information system to their precise needs. Achieving that may require a more radical reinvention – as described below.
Cloud-Based Hospital IT App Store

The more distant CIS scenario, yet the one that offers the greatest potential for truly transformational benefits, would operate as a secure cloud-based service that replaces existing hospital systems altogether. Provided on a pay-as-you-go basis, this solution would enable maximum flexibility, with each user able to configure and constantly adapt their services according to their needs as they evolve. In any given clinical context, users would be able to download apps that provide the functionality they require from a hospital app store, along with additional applications for administrative and financial functions on an as-needed basis. Seamless integration across devices and platforms would enable any department to offer applications as required, fully customizable to user needs.

A cloud-based app store as shown in the diagram above, offers far-reaching benefits to all system users – from clinical staff to administrators. It would provide full cost-control and transparency to the hospital's management as the apps – the software – would be used on a pay-as-you-go basis, and used only by those who need specific functionality. As there would be no issues with complex software interfaces, users have full flexibility to build exactly what they need to perform their role, and manufacturers need only to maintain small packages of software for each application rather than a full, end-to-end system. By releasing many small apps in a series of disconnected release cycles and updates (exactly as is the case with app stores offered by Apple or Android) innovation can happen faster as development in each app are not dependent on a larger suite of software.