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### The Evolving Role of the CMIO

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Healthcare informatics lies at the hub of two forceful, fast evolving trends. The first is the IT industry's own drive to provide systems developed for the very specific needs of healthcare providers – ranging from pharmacies and specialised clinical research labs to large university hospitals. This has begun to make possible a more far-reaching use of tools and technologies, which enhance healthcare delivery. Meanwhile, the healthcare sector too is on the cusp of change, with IT spending by hospitals expected to sharply accelerate towards the levels seen in areas like banking and retail, as they ready themselves for the coming real-time, data-rich and interconnected era of e-Health. Given such promises, and their concomitant challenges, it is important to anchor new healthcare IT systems in a coherent and agile but still robust information ecosystem. It is also vital to systematically metamorphose the latter into a multi-dimensional value-adding knowledge ecosystem. Such a job is the principal responsibility of today's hospital CMIO.

#### Exciting Times, Unexpected Challenges

We are living in exciting times. Healthcare informatics is better able than ever to deliver the long-promised and long-awaited tools needed for improving the quality, safety and efficiency of healthcare processes, and ultimately, of the health of our populations. For many decades, these tools have only been available in advanced healthcare institutions, and were usually custom-built using research and development funds, tailor-made to fit the needs of the target institutions. These projects were not products, and could not easily be transferred to other settings. It is however important to remember that most of the scientific demonstration of the benefits of healthcare informatics come from these few pioneering institutions, typically teaching hospitals.

Meanwhile, the IT industry has been evolving from failed attempts to adapt generic enterprise IT tools for healthcare, to developing healthcare-specific systems, thus recognising the particular intricacies and needs of this domain. This domain is still one of the least IT-developed, although it represents a major portion of the economy. It is most of all an information-intensive domain where the ability to bring just-in-time information and knowledge to decision makers, whether clinical or administrative, can yield urgently needed improvements: the healthcare industry is one of the least safe there is, and society is now worrying about it.

This coincidence of a recognised urgency and of existing industrial solutions has generated much excitement in the healthcare community, and a frenzy of implementation of clinical information systems with their iconic computerised physician order entry tool. Unfortunately, in much publicised situations, such implementations have led to negative outcomes, not because of inappropriate technologies, but because, as the saying goes, the "soft stuff is the hard stuff", and human and organisational factors often tend to be underestimated.

While gaining hands-on experience, users of these systems recognise that the co-existence of multiple vertical applications, even if they are technically connected, limit the ability to implement actual systemic improvements. As care and logistical processes become more complex, fragmented and distributed, the need to connect the meaning of information in each of the participating systems becomes necessary: there is a true need for semantic interoperability and consistency.

So how can institutions get organised in order to enable the implementation of semantically coherent systems that take into account the many human and organisational factors that are essential to make these systems work and deliver?

#### Bringing Information Systems into a Coherent and Agile Information Ecosystem

Geneva University Hospitals, a 2,200-bed group of hospitals providing primary, secondary, and tertiary care to the population of Geneva, have been developing and deploying information systems since the 1970s and is currently considered as one of the most complete hospital and clinical information systems in Europe. In 1995, it was decided to split the responsibility of these information systems into two structures, one dealing with enterprise IT, the other with the core business of the institution, in order to clarify the reporting and budgetary allocations, and to better integrate these services within their respective decision-making environments. On the one hand: the IT division, an administrative division

in charge of the technical infrastructure (i.e., network, servers, and workstations) and the administrative applications, whose director, the CIO, reports to the Chief Executive Officer.

On the other hand: the Medical Informatics Division, staffed with clinicians, project managers, software engineers and a helpdesk, is a medical service whose director, the CMIO, reports to the Chief Medical Officer, and is responsible for the design, development and implementation of clinical information systems, imaging systems, and telemedicine. The Medical Informatics Service also has a research and teaching mission within the Faculty of Medicine of Geneva University.

This CMIO position may be somewhat atypical, as it combines the strategic duties of defining the overall architecture of the clinical information system, the operational duties of building and running a 24x7, integrated, institution-wide clinical information system, and an academic mission.

However, this combination provides the scientific researchers with a 2,200-bed laboratory for inventing innovative healthcare informatics tools, while offering healthcare professionals and their patients with advanced – sometimes cutting-edge – tools for improving their work processes and their decision-making capabilities, and for supporting their own translational and clinical research.

Obviously, a clear governance structure and close strategic and operational coordination between the CIO and the CMIO and their respective teams is essential, in order to maintain the overall coherence of the information system, as boundaries between administrative and clinical applications are getting more blurred. An overall IT strategic plan, developed jointly in 2002, and integrated in the enterprise strategic plan, defines the institution-level governance of the information system and serves as the reference framework for the urbanisation of the information system.

The Medical Informatics Division is therefore considered as a provider of transversal services by other clinical services, somewhat similar to radiology or anaesthesiology services. Clinical informatics projects can only be implemented if they comply with the architectural, technical and conceptual requirements of the strategic plan. In exchange for this discipline, which enables the tight integration of the systems, clinical services get methodological, technical and organisational support for their informatics projects, most of which get still developed or integrated by the Medical Informatics Division.

#### **Evolving Towards a Knowledge Ecosystem**

Although comfortable and efficient, this situation must evolve. It has managed to keep the institution's efforts focused during a decade of development and deployment, during which the system's users have also progressively learned to live in this digital world. These users are now in a stronger position to project their future needs, and thus assume a stronger steering role for the development of the information system. This becomes essential as the new challenges will deal ever more with the fundamentals of care production processes, and will require that the care professionals are in the driver's seat in order to achieve success.

Current challenges include the ability to manage flows and quickly reconfigure multidisciplinary care processes, the need to connect the physical world to the information world more closely and ensure end-to-end traceability of processes and materials, the need to measure returns on investments, and the mandate to prove safety, quality and efficiency gains. But these are new tasks and increased responsibilities and not all clinical leaders are ready or trained to take this charge, and specific support will be necessary.

Meanwhile, as the main elements of the information system are put in place, the time is ripe to fill them with the appropriate knowledge that will drive decision-making capabilities and systemic changes. Defining and enabling a framework for institution-wide knowledge engineering becomes a new role for the CMIO and his team. These pervasive, knowledge-driven tools become the true nervous system of the institution, the strategic instrument that enables adaptation and evolution, and therefore justify the involvement of the CMIO to the executive-level of the institution.

The role of the CMIO and his team has moved from supporting clinical information systems design and implementation, to the development of an information ecosystem that creates true synergies between humans and machines. The next step is to enable a genuine learning and knowledge-driven enterprise and guaranteeing that coherent and agile architectures and processes are put in place.

Having connected the nerves into a spinal cord, we are facing the challenge of building the electronic brain of our healthcare institutions.

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