THE EVOLUTION OF HEALTH INFORMATION MANAGEMENT AND INFORMATION TECHNOLOGY IN EMERGENCY MEDICINE

INTRODUCTION

The last 20 years have seen significant changes in the way medical professionals utilize and manage clinical data and health information resources. The Emergency Department (ED) has played a key role in health information technology developments.# The recent and rapid advances in health information management and information and communication technology (IM&ICT) present Emergency Medicine (EM) with unique challenges and opportunities. This article traces important developments in IM&ICT affecting EM, outlines the benefits and limitations and discusses what needs to be done at an organizational and health policy level to realize the potential of the information technology revolution.

PERSPECTIVE

Several IM&HCT developments over the years have had and will have impacts on the practice of EM.

Emergency Department Information Systems (EDIS) – The development and implementation of EDIS was pioneered in Australia and provided the benchmark for electronic patient registration and tracking systems. Its emergence has been instrumental in validating the Australasian Triage Score and benchmarking ED activity.# The functionalities of EDIS have been limited to patient registration, basic clinical documentation, tracking of patient movements within ED and laboratory test ordering.

TELEMEDICINE Telemedicine is defined as the use of information and communication technology to provide health care services to individuals who are some distance from the health care provider.# Modes of communication include radio, telephone, facsimile and full motion video. Its development and application in the late 1980s has seen important applications in rural medicine and the coordination of retrieval and emergency medical services.##.

INTERNET Pioneered in the late 1960s as a way of networking between individual computers, the Internet has had a profound impact on IM&ICT. The mid 1990s witnessed a rapid expansion of online medical information, making literature, clinical resources and guidelines more accessible.# The internet and intranet have facilitated the development of electronic clinical applications such as electronic order entry systems (EOS), radiology picture archiving and communications systems (PACS) and point of care applications such as bedside charting in intensive care units.# Over the last ten years, several attempts have been made at consolidating IM&ICT systems by aligning medical practices and hospital records into a more streamlined environment#.

ELECTRONIC HEALTH RECORDS (EHR). The limitations of traditional paper based medical records became evident from the early 1990s.# Records could only be in a single location at any given time and could not accommodate the evolution of multimedia storage of images. Medical records evolved from a record of doctor patient interactions to instruments for modern multidisciplinary practice, evidence based medicine and complex health administration activities. In 1991 the American Institute of medicine articulated a vision for the comprehensive role of EHR in future clinical practice#. EM has been slow to implement this technology.# A randomized study in a Singaporean ED

demonstrated significant improvements in documentation and coding after EHR implementation without affecting work flow.# Other smaller studies utilizing EHR and clinical decision support tools have seen similar benefits and improvements in the rate of medication errors.##

ELECTRONIC DECISION SUPPORT SYSTEMS (EDSS) EDSS or computerised clinical decision support systems have emerged as potentially powerful tools in patient care. EDSS is defined as electronic systems that assist in clinical decision making#. The concept is not new, as clinical practice guidelines and pathways have been around on paper for the last ten years. Research into EDSS applications in ED suggests improvements in process of care. Such processes include triaging for acute cardiac ischaemia and asthma management leading to reduced hospitalization rates without compromising outcomes.##

ARTIFICIAL INTELLIGENCE (AI) AI or Cognitive systems technology refers to intelligent systems that are capable of real time adaptive reasoning and predicting outcomes.# A recent paper described the development of an AI system for predicting haemorrhage in an animal model based on clinical and electrocardiographic parameters.# Such research could have important implications for EM in the future.

BARRIERS TO IMPLEMENTATION IN EMERGENCY DEPARTMENTS

There are several important reasons why implementation of recent information technology advances has been slow in EM.

COST – These range from capital costs of equipment, installation and implementation, to recurrent costs of maintenance, upgrades and depreciation and finally to overhead costs

such as training and support. A national health data network allowing seamless transfer of data would require enormous investments in research and development of IM&ICT infrastructure.#

DISRUPTION – The development and implementation of new systems will demand significant effort and commitment from entire institutions. The deployment of new online technologies in individual departments can lead to unpredictable disruptions in workplace practices.#

STRATEGIC ISSUES – Other important strategic issues have confronted Emergency Departments across the world. These include hospital overcrowding and access block, SARS and disaster planning and coordination. This has necessarily taken the focus away from the role of IM&ICT in advancing system and process reform in ED.

DATA SECURITY – An important limiting factor has been concerns regarding patient confidentiality and ownership and accountability of patient information. Patient privacy and confidentiality are one of the basic tenets of clinical practice. Issues such as Y2K, sophisticated viruses and unauthorized access have focused attention on the need for the strictest levels of information control.

LACK OF EVIDENCE: There is currently a lack of data regarding the effect of IM&ICT implementation on definable clinical end points such as patient mortality.# This has limited recommendations researchers make regarding IM&ICT on the basis of evidence based medicine. A recent systematic review of EDSS revealed that of 100 papers reviewed, only 5 suggested improved outcomes with none improving overall patient mortality.#

POTENTIAL BENEFITS AND REASONS WHY ED SHOULD TAKE A LEADERSHIP ROLE IN IMPLEMENTING IT FOR HEALTH SYSTEMS

PROCESS OPTIMISATION

Process optimization involves identifying inefficient points along the production chain that reduce quality and productivity.# Research into ED access block is one example where this has been applied to health care systems.# Implementation of process changes linked to efficiency is a concept that would appeal to most ED. Time wasting efforts such as tracking previous radiographs and laboratory results have been consigned to history as a result of clinical applications such as EOS and PACS. Researchers have attempted to model processes of care in ED, but they already exist in clinical practice.# Some examples are encapsulated in validated clinical decision tools and established clinical guidelines.# There are also countless clinical pathways that exist in individual hospitals for the management of common conditions. Future EHR products will allow incorporation of these pathways as EDSS.# These tools are not designed to replace sound clinical judgment based on experience and training but provide a uniform and accessible set of checks and balances, minimizing the risk of adverse events.

QUALITY CONTROL

Quality control refers to the monitoring of particular processes and the recording of any variation from expected outcomes with the aim of improving safety.# The landmark report ‘To err is to be human’ focused attention on the role of care systems in patient safety.# Unfortunately, reliance on levels of evidence has undermined the role of system changes in patient safety. This can be understood in the context of the operating theatre

where mortality for elective anesthesia has fallen ten fold over the last two decades. This remarkable achievement was brought about by graduated changes in process, technology, and organization, not evidenced based recommendations.### The small body of quality control research in EM has focused mainly on diagnostic, medication and documentation errors.# The EHR would potentially standardize documentation on clinical data and minimize the chances of lapses in quality through EDSS. IM&ICT tools would also maximize the ability to track departmental activity in real time and over a period of time, becoming essential tools for auditing and benchmarking. Perhaps more important is the realization that auditing and benchmarking have greater potential to advance system reform than EBM alone.

INTERCONNECTIVITY

The complexity of the health care industry means that health information currently exists in so called information silos.# This has the effect of retarding flow of information in the ED, where it is most critically important. Retrieving a past electrocardiogram in a patient presenting with chest pain or life threatening arrhythmia is perhaps the defining example. (see figure 1) Doctors and their critically ill patients stand to gain enormously from eliminating delays in vital patient information transfer.# Patient information privacy and confidentiality are valid concerns that will need to be addressed. Sophisticated online security devices such as firewalls and biometric authentication tools are now readily available and will need to play an important role in IM&ICT.# Interoperability within and between health care facilities is one attribute of IM&ICT that must be advocated by EM.# Other key functionality requirements are summarized in table 2.

WHAT NEEDS TO BE DONE?

LEADERSHIP

The importance of a unified national strategy for IM&ICT cannot be underestimated. Leadership should come from health policy makers and peak bodies such as Australian Health Information Council (AHIC). This is essentially a steering committee similar to the American Medical Informatics Association who in collaboration with information technology industry representatives addresses a number of issues such as standard clinical vocabulary, privacy and confidentiality and technical standards. The council is chaired by Professor Andrew Coates, Dean of the Faculty of Medicine at the University Sydney and membership includes pre eminent clinicians derived from various fields of medicine. The lack of Emergency Physician representation at this health policy level should be addressed.

GOVERNANCE

At an organizational level, the Australasian College of Emergency Medicine should address the following issues relating to IM&ICT development and implementation

1. policies and guidelines that promote equitable access to IM&ICT infrastructure across Australian ED
2. development of core competencies and curriculum development
3. Promote interest and research within its membership on these critical issues

4. Develop key performance indicators for IM&ICT systems such as system failures, breaches of confidentiality, and accountability.

COLLABORATION

A broad commitment to the goals of an interconnected IM&ICT strategy from all levels of government and stakeholders is required. This includes hospitals, general practices, aged care facilities, laboratories and pharmacies. Collaboration with the information technology experts with appropriate mission goals is essential to construct consolidated IM&ICT systems. Individual organizations should be empowered to research, develop and implement IM&ICT tools under the guidance and support of AHIC. Local enthusiasm and implementation of self developed projects was cited by one reviewer as a factor determining the success of EDSS research.# Communication of successes and failures is also essential through forums, conferences and literature.

CONCLUSION

The next 10 years has been coined by leading health policy experts as 'the decade of information technology#.' Emergency departments are one of few points of care where electronic patient data, processes of care, clinical decision support tools and integration of information occurs on a daily basis. IM&ICT has the potential to significantly advance the practice of modern EM. It is fundamentally important, therefore for emergency medicine as a specialty to take a leadership role in the development and implementation of IM&ICT in the health care system. Emergency physicians themselves must realize that the era of a fully integrated interoperable and intelligent health information technology

system is no longer science fiction. This is an emerging reality and they must be ready to grasp it.

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TABLES AND FIGURES

Table 1. PROPOSED 10 POINT FUNCTIONALITY REQUIREMENTS FOR IM&ICT IN ED

Safety and security	Conform to established standards in health information management
Compatibility	Integrate across established databases within hospitals
Interconnectivity	Interoperability across hospitals, private practices, laboratories and other points of care
Uniformity	Standard clinical vocabulary and area wide implementation
Accessibility	Training and development of core competencies
Reliability	Technical support infrastructure
Intelligence	Electronic decision support systems (EDSS) capabilities
Adaptability	Satisfy individual point of care requirements, upgrade as clinical practice changes
Affordability	Costs of implementation, replacement, upgrade, training and infrastructure
Accountability	Demonstrate benefits in process, quality, interconnectivity and outcomes

Figure1. Information silos – an emergency department perspective.