

Telecoms Infotech Forum

Briefing paper

# Health Informatics

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# Telecoms InfoTechnology Forum

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The output of the TRP is public domain research into economic, policy and regulatory aspects of telecommunications and related sectors such as IT, new media, Internet and e-commerce.

This TIF conference is supported by:

- Hong Kong General Chamber of Commerce (HKGCC)
- Hong Kong Information Technology Federation (HKITF)
- Hong Kong Internet Service Providers Association (HKISPA)
- Hong Kong Society of Medical Informatics Limited (HKSMI)
- Hong Kong Telecommunications Users Group (HKTUG)
- Hong Kong Wireless Technology Industry Association (WTIA)
- Information and Software Industry Association (ISIA)
- Internet and Telecom Association of Hong Kong (ITAHK)
- Internet Professionals Association (iProA)
- The Computing Technology Industry Association (CompTIA)
- The Office of the Telecommunications Authority in Hong Kong (OFTA)
- World Teleport Association (WTA)

The objective of TIF is to stimulate informed interest in the policy and regulatory aspects of information and communications technologies (ICTs), to foster greater transparency and a better understanding of the economic and technological dynamics of the sector, its impact on social welfare and its policy implications.

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## Introduction

So where are we today? We have ‘islands of data’ about patients, unconnected from each other. There is still a dependence on clinicians to remember vast amounts of information. Healthcare professionals spend a significant proportion of their time on paperwork, yet that paperwork remains poor and prone to error. Meanwhile there is a chasm between knowing and doing. Clinical science continues to expand rapidly; there is a huge growth in knowledge, but not in the ability of systems to deliver high-quality care.<sup>1</sup>

### ***Informatics of what?***

Been through Hong Kong’s international airport in the past two years? Then a thermal scanner checked you for SARS. Welcome to the world of medical informatics. Or is it healthcare informatics?

#### **Health or Medical Informatics?**

‘It is sometimes asserted that medical science is no different from any other science. I would strongly disagree with this view: medical science (human biology) in its describing, reasoning, explaining, and predicting, necessarily draws upon a number of lower-level sciences, while physics, for example, does not. This obvious state of affairs (that medicine rests upon a hierarchy of natural sciences) has profound consequences. Because medicine derives its experimental content from a set of sciences (including both “hard” and “soft” sciences), the processing of the observational data of medicine faces a number of problems. This is one of the reasons why there is a “medical” information science, and why there is not a “physics” information science.’ (Blois MS. *Information and Medicine: The Nature of Medical Descriptions*. Berkeley, CA: University of California Press, 1984.)

‘The health care process is very different from medical science. The former is more related to the art of medicine, whereas the latter is closely connected to the academic aspects and the basic disciplines of medicine.’ (*Handbook of Medical Informatics*.<sup>2</sup>)

‘Health Informatics is ... the use of computer technologies in healthcare to store, share, transmit and analyse clinical knowledge and data.’<sup>3</sup>

‘Health Informatics is seen as to be concerned with the individual and group behavior of all healthcare stakeholders’ interaction with information and information technologies. Medical Informatics is seen to be rooted in medicine and computer science to primarily support physicians in the care of individuals (the delivery of services). The social and organizational impacts of information technology have not historically been taken into consideration in Medical Informatics.’<sup>4</sup>

At the certain risk of over-simplification, if there is an important distinction it would seem to be that the science of medicine generates knowledge, and the art of healthcare

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<sup>1</sup> Prof Denis Protti ‘Health Informatics: Dare we predict where we are going in the 21<sup>st</sup> Century’ Public Lecture, CHIME, London 4 November 2004 (Report by Dr Henry W.W.Potts, CHIME, UCL)

[http://www.bmis.org/events/041104\\_protti\\_review.pdf](http://www.bmis.org/events/041104_protti_review.pdf)

<sup>2</sup> Handbook of Medical Informatics <http://www.mihandbook.stanford.edu/handbook/home.htm>

<sup>3</sup> Open Clinical <http://www.openclinical.org/healthinformatics.html>

<sup>4</sup> Denis Protti, School of Health Information Science, University of Victoria, British Columbia, Canada

applies that knowledge.<sup>5</sup> This can make a difference. The staff of a research and teaching hospital may have a different range of requirements and a different range of priorities and interests from those of a non-teaching hospital and from those of healthcare workers in community clinics. Yet clearly the fruits of medical science should be filtered through the system as efficiently as possible so doctors and nurses on the wards, and general practitioners (GPs) in the city, can be knowledgeable in the treatment they offer. Ideally, patients should also be informed. The requirements placed upon the information systems may be different, and the information and communication technologies (ICTs) may differ – a research laboratory needs different types of equipment from a hospital ward – but somehow, somewhere along the line they need to communicate for the benefit of all. The differences suggest an incremental approach is inevitable, whatever advances are made in the technologies.

### ***Health Informatics from different perspectives***

Medical, and more generally health informatics can be approached from several perspectives. From the viewpoint of the community there is a user's perspective, a social perspective and a state perspective. Users are first and foremost patients, but they are also relatives and friends of patients or members of the public with general enquiries. Society has good reason to fear the outbreak of pandemics, such as bird flu or SARS, and close monitoring systems, especially cross-border and regional information systems, should no longer be regarded as a luxury, certainly no more than can a tsunami early-warning system for the Indian Ocean.

Government has several concerns, including how to get the best value for tax money from the health system and how far IT can raise efficiency and productivity. Also how far can the state reasonably go in promoting a comprehensive health information system (HII) among the public and private healthcare sectors. How far can IT elevate Hong Kong's hospital and clinical networks into providing 'tradeable services' by attracting overseas patients on a commercial basis and is this a sensible strategy for a service-based economy? And a very practical issue is how far can or should Hong Kong's smart ID card be used to provide access to personal health and clinical information? Should the systems used by the hospitals be at all integrated with the systems used by the Health Department? What are the security and personal privacy issues involved?

From the viewpoint of the hospitals and clinics and healthcare workers, there are questions of cost-benefit, of who will foot the bill and who will enjoy the benefits.<sup>6</sup> There are questions about how comprehensive the IT systems should be within a group of hospitals, for example should they try to integrate all administration, financial and medical functions into one system. How far should the IT systems be designed to facilitate sharing between different groups of hospitals, for example, between the Hospital Authority and private hospitals and clinics and GP doctors, or

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<sup>5</sup> Two further definitions: Medical Informatics is 'the science of analysis, documentation, steering, control and synthesis of information processes within the health care delivery system, especially in the classical environment and medical practice.' Reihertz P Protokoll der Klausurtagung Ausbildungsziele, Inhalte und Method Protokoll en in der Medizinischen Informatik, Ulm: Reisenberg, 1973; Health Informatics is 'the study of nature and principles of information and its application and impact within a health care delivery system.' Protti DJ, 'A New Undergraduate Program in Health/Medical Informatics', *AMIA Proceedings*, Masson Publishing, 1982. (Cited by Denis Protti, School of Health Information Science, University of Victoria, British Columbia, Canada)

<sup>6</sup> There are other issues, such as 'many doctors are feeling uncomfortable letting other practitioners read their notes. They are worried they could challenge their diagnostics and conclusions.' FT-IT Healthcare Review, *Financial Times*, 21 May 2003.

with other branches of the social welfare services within Hong Kong, or between Hong Kong hospitals and hospitals in Mainland China or in other countries of the region?

### ***Health Informatics Becomes Big Business***

Whatever the answers to these types of questions, and we deal with some of the different approaches below, health informatics in general, and medical informatics in particular, is about to become really big business. According to a recent PricewaterhouseCoopers (PwC) report,<sup>7</sup> in 2005 the healthcare community within the USA is expected to spend approximately US\$14 billion on information technology, yet this only represents about 2.5 per cent of a typical hospital's operating costs. What the report calls 'digital hospitals' are likely to spend closer to 5 per cent. In Singapore, IDC estimates IT spending in 2003 in the healthcare sector was around Sing\$110 million and forecasts Sing\$130 million for 2005, about US\$80 million. By comparison, the annual Hospital Authority budget in Hong Kong for R&D, hardware and software maintenance and operation of these systems is around HK\$0.4 billion (US\$50 million) or 1.4 per cent of the annual operating budget.<sup>8</sup> This relatively low figure partly reflects the fact that up to now the HA has done its own in-house R&D, but also suggests that Hong Kong has a way to go.

Driving the global expansion of investment in health informatics are numerous factors. First, advances in information and communication technologies (ICTs) are rapid, industry standards are being established enabling different systems to inter-operate, and the cost of components is falling. But often R&D in software and systems development becomes increasingly complex, especially where legacy systems may be involved, so a second factor is the pressure on the health sector to outsource the development of modern health informatics. This seems to be the current thinking of the Hong Kong Hospital Authority. Third, advances in bio-medical scientific discoveries, in pharmaceuticals, in health treatment practices and so forth are so numerous and coming so quickly that efficient and effective information access and management systems are becoming essential.<sup>9</sup>

Fourth, health authorities around the world have generally lagged behind other industries in their adoption of ICTs, so there is a lot of catching up to be done. On the other hand, where authorities have a history of ICT adoption, and Hong Kong may be a good example, the time now seems ripe to extend these legacy systems into more fully integrated systems with tiered levels of access (to answer some of the questions above) and employ a wider range of access methods and devices. For example, up till now the Hong Kong Hospital Authority, rather like the Kong Hong Government, has been reluctant to risk the use of wireless access devices, yet wireless is being used successfully in other hospitals around the world (see the example below of the Indiana Heart Hospital).

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<sup>7</sup> 'Reactive to Adaptive: Transforming Hospitals with Digital Technology' PwC presented to the Health Information Technology Summit, San Francisco, March 2005 <http://healthcare.pwc.com/cgi-local/hcregister.cgi?link=reg/dh.pdf>.

<sup>8</sup> See 'eHealth Asia 2004' [http://www.ehealth.org.my/%5Cupload\\_pdf%5CT1D101\\_C.P.Wong.pdf](http://www.ehealth.org.my/%5Cupload_pdf%5CT1D101_C.P.Wong.pdf)

<sup>9</sup> 'There are 22,000 new journal articles per year, at least 30 new drugs per year, and more than 6,000 combinations of drug compatibilities to consider. The number of drugs has grown 500% in just the last decade to over 17,000 trade and generic names for pharmaceuticals marketed in America.' Prof Denis Protti 'Health Informatics: Dare we predict where we are going in the 21<sup>st</sup> Century' Public Lecture, CHIME, London 4 November 2004 (Report by Dr Henry W.W.Potts, CHIME, UCL) [http://www.bmis.org/events/041104\\_protti\\_review.pdf](http://www.bmis.org/events/041104_protti_review.pdf)

Fifth, governments and societies are becoming more aware of the efficiencies in using ICTs, while the ownership of PCs, notebook computers, tablets, PDAs, cellphones and similar access devices is reaching ubiquity in industrial countries and is spreading rapidly in urban areas of developing economies. Sixth, civil society is becoming more aware of the right to the 'freedom of information' including information about personal health, community health and environmental health. Seventh, there is a growing 'health consciousness' in society,<sup>10</sup> which is being helped along by advances in genetic research and the bio-medical sciences. The discovery of the human genome sequence is likely to prove a defining moment in medical history. Until twenty years ago the world was living under the threat of a Cold War nuclear catastrophe with healthcare systems that were clearly inadequate to cope with such an eventuality. Today the world is living under a more dispersed threat of terrorist attacks using biological, chemical and 'dirty' nuclear bombs, as well as natural threats of pandemics. The need to cope with disasters of the former kind and preventing disasters of the latter kind has to become another driver towards fast response information systems that can network the healthcare community with other government and non-government agencies in times of impending public emergencies.

### Hong Kong's Approach

Since 1990 the Hong Kong Hospital Authority has been developing its own proprietary software systems, at one time employing over 400 programmers and IT specialists, and it still employs over 250. Unusually for health authorities around the world, in Hong Kong the doctors even do their own input. The annual HA budget for R&D, hardware and software maintenance and operation of these systems is around HK\$0.4 billion. As the figures cited above seem to indicate, Hong Kong is spending less than Singapore on ICTs for health informatics despite being twice the size of Singapore in population and size of economy. Nevertheless Hong Kong is still among the world leaders in the adoption and use of IT, enabling everything from the registration of new patients to the prescription of drugs, and from the booking of appointments to the updating, storage and retrieval of patients' records. But advances in technology are now opening up so many new horizons, so many new possibilities to link databases, to combine and analyse data, transmit and access information in real-time, that the costs of keeping abreast of these developments, let alone undertaking R&D, is threatening to spiral beyond the means of any one agency or institution. Unsurprisingly therefore the HA is now thinking through its strategy, having issued requests for proposals and expressions of interest for future systems. Will this open the road to integrating non-HA medical sectors? Can and should this extend to Hong Kong social welfare services, for example, to care for the elderly?<sup>11</sup>

### ***Pandemics and Pandemonium: from SAR to SARS***

In 2003 SARS resulted in the HA developing a monitoring and alert system with the Health Department and the HK Police. The threat of pandemics such as avian flu and the spread of diseases such as meningitis and Japanese encephalitis call for greater coordination of information both within Hong Kong and across the border with

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<sup>10</sup> But this can take distorted forms, such as a growing dependency on pills as opposed to life style to fight obesity or depression or a cosmetic obsession to 'improve upon nature' with plastic surgery.

<sup>11</sup> Hong Kong's 12 private hospitals recently received unconditional accreditation from the medical quality assurance Trent Accreditation Scheme. One area identified for improvement was record-keeping by visiting doctors. (*The Standard* 3 March 2005). Would an electronic system help?

Mainland China. What steps should Hong Kong be taking to combine human agency coordination with the enhanced information and communication potential of technology?<sup>12</sup> A very noticeable feature during the outbreak of SARS in 2003 was the extensive use of ICTs at many different levels. The following is an extract from the TIF Briefing Paper, July 2003.<sup>13</sup>

#### **SARS and Telecoms, TIF Briefing Paper, July 2003**

In 2003, during the outbreak of SARS, a lack of reliable information gave portals a newfound function. On 31 March four Hong Kong IT engineers launched [www.sosick.org](http://www.sosick.org) to spread information about SARS to the community - in Chinese the website name sounds like the Song dynasty poet Su Shi. Only after this action had prompted the Hong Kong Government to start posting details of SARS-infected buildings from 11 April did they close the site. Internet portals on the Mainland reported SARS-related information inquiries as the number one search among China's 60 million registered Internet users, with search engine Baidu experiencing a 9 per cent daily increase. Under the watchful eye of the China Securities Regulatory Commission, securities companies posted up SARS-related financial analysis as online trading and phone-trading showed the first signs of takeoff. Once the scale of the threat was widely understood many large companies and organizations placed their staff on weekly shift working from home. To help companies set up teleworking and mobile work environments, the Hong Kong Computer Society and Microsoft Hong Kong set up a Work@Home programme. Business customers of Jardine OneSolution (JOS) received faxes telling them 'Work At Home solutions leverage a suit of IP telephony technologies to extend the coverage of LAN & office telephone features and functions to remote offices and home workers.' Business at the front end also saw the effects. Yahoo! Hong Kong experienced over 100 per cent increases in transactions and revenues. Sa Sa International, a cosmetics company, saw online sales surge 25%, especially of SARS-related products such as masks and hand moisturizers. HSBC's Internet banking transactions rose 40 per cent. For SARS patients, those in quarantine and their relatives, communications by phone was often the only way. On the other hand, monitoring of quarantine cases by electronic tags and webcams was the Singapore way.<sup>14</sup>

#### ***Ways Ahead?***

Mostly the focus of attention around health informatics falls on the work of the HA, but there are many other active agencies associated with community health, environment and welfare, such as the Hong Kong Council of Social Service.<sup>15</sup> What would be the benefits to the community of a territory-wide system of inter-operable networks linking all agencies? One answer was given by Government consultants PwC in 2002 when they estimated capex for a Health Information Infrastructure (HII) catering for health records and information would cost something over HK\$0.5 billion, with operating costs over ten years below HK\$2 billion, and financially such a

<sup>12</sup> Drawing from the combined inputs of Cisco, EDS, ESRI, HP, IBM, Microsoft and Oracle, iProA came up with proposals for the post-SARS do/IT campaign in their 'White Paper: the IT infrastructure of Hong Kong's Centre for Disease Control' [http://www.iproa.org/iproa/TTwhitepaper\\_v11.pdf](http://www.iproa.org/iproa/TTwhitepaper_v11.pdf)

<sup>13</sup> See TIF Briefing Paper, July 2003, <http://www.trp.hku.hk/tif/papers/2003/jul/telecoms-sars.pdf>

<sup>14</sup> April 1, 2003: Panic seizes Hong Kong after the Ming Pao Web site reports the city has been declared an infected port, chief executive Tung Chee-hwa has resigned and the Hang Seng index has collapsed. Shoppers rush supermarkets and thousands look for a fast passage out of the city before the report is discovered to be false, placed on a Web site allegedly tricked out by a 14-year-old boy. The Hong Kong government sends an unprecedented mass SMS to 6 million cellular users to reassure them that the port has not been closed.

<sup>15</sup> For affiliated welfare agencies, see [http://www.hkcss.org.hk/ma\\_corner/AMliste.asp?offset=0](http://www.hkcss.org.hk/ma_corner/AMliste.asp?offset=0)

system would pay for itself over a ten-to-fourteen year period.<sup>16</sup> Whether this is the way to go, or whether a more ‘organic’ and incremental approach is better remains to be fully thought through, but noticeably absent in the Government’s *2004 Digital 21* strategy is any mention of health informatics. Of course, *2004 Digital 21* is the responsibility of the Commerce, Industry and Technology Bureau (CITB) not the Health, Welfare and Food Bureau (HWFB), so is there a need for future cross-agency collaboration here?

What *2004 Digital 21* does emphasize is the need to fast track the promotion of e-Government across all agencies, and Government has now appointed a coordinating Chief Information Officer. One recent e-Government application is the new smart ID card. During earlier discussions on the introduction of the card it was proposed to include secure access to a community database for health information (without including any of that information on the card itself). Maybe the time is now ripe to revisit that idea, although both security and privacy issues may be complex.<sup>17</sup> There remains much to be done, and technology is all the time opening up new possibilities, so what may be necessary is an inter-agency and inter-organization working group to review the issues, an issue perhaps for the Health and medical Development Advisory Committee of the HWF Bureau?<sup>18</sup>

## United States

The US healthcare system is predominantly a commercial market.<sup>19</sup> Federal government runs various support programmes, including Medicare welfare, but support for hospitals and clinics to adopt ICTs mainly takes the form of promoting a standard for national electronic health records (EHR). On 27<sup>th</sup> April 2004, President Bush called for the widespread adoption of inter-operable EHRs within 10 years and established the post of National Coordinator for Health Information Technology (HIT) by Executive Order 13335. The Coordinator’s report identifies four principal goals.<sup>20</sup>

- Goal 1: Informed clinical practice centred around EHRs that ‘will reduce medical errors and duplicative work’
- Goal 2: Interconnect clinics that allows information to be portable, moving as patients move, to be achieved through three strategies
  - Strategy 1 – Regional collaboration
  - Strategy 2 – National health information network, including mobile authentication and Web-based data.

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<sup>16</sup> HWF Bureau (2002) ‘Health Information Infrastructure Project Definition Study’

<sup>17</sup> Malaysia, Taiwan and Thailand are among Asian countries that are currently using, or plan to use, smart ID cards to include medical information. See HBS Consulting ‘Smartcards in healthcare’ at <http://www.hi-europe.info/files/2004/9999.htm>, but also see ‘Privacy’ section below.

<sup>18</sup> Healthcare was the only category among fourteen at the Asia Pacific ICT Awards for 2004, hosted by Hong Kong, not to win an award. Reported *South China Morning Post* 13 December 2004, B6.

<sup>19</sup> ‘The federal government will provide a vision and a strategic direction for a national interoperable health care system, but will rely on a competitive technology industry, privately operated support services, and shared investments in HIT adoption. The private sector must develop the market situations to deliver the products and services that can transform the paper-based health care system into an electronic, consumer-centered, and quality-based system.’ Office of the National Coordinator for HIT [http://www.hhs.gov/healthit/public\\_privateleadership.html](http://www.hhs.gov/healthit/public_privateleadership.html)

<sup>20</sup> Sec. for Health & Human Services and the National Coordinator for Health Information Technology, ‘The Decade of Health information Technology: Delivering Consumer-Centric and Information-Rich Health Care’ 21 July 2004, <http://www.hhs.gov/healthit/hitframework.pdf>

- Strategy 3 – Coordinated federal information systems which should be interoperable.
- Goal 3: Personalized care through consumer-centric information to assist in their personal decision-making
  - Strategy 1 – Encourage use of personal health records (PHRs)
  - Strategy 2 – Enhanced informed consumer choice with information to allow consumers to choose their hospitals and clinics
  - Strategy 3 – Promote use of telehealth systems through remote access networks
- Goal 4: Improve population health
  - Strategy 1 – Unify public health surveillance architectures through interoperability and exchange of information within current laws
  - Strategy 2 – Streamline quality and health status monitoring by finding ways to capture local information for point of care delivery
  - Strategy 3 – Accelerate research and dissemination of evidence through use of ICTs in scientific medical research and development.

Supporting these goals will be the development of a Federal Health Architecture (FHA) which ‘will be coordinated and interoperable with the national health information network.’ Other initiatives include funding for community health information exchange demonstrations, the establishment of a Health Information Technology Leadership Panel to evaluate the costs and benefits of health IT, the creation of a Medicare beneficiary portal, trials of a Study Data Tabulation Model (SDTM) for representing observations from clinical trials (supported by 40 pharmaceutical companies) and clinical research organizations, a Consolidated Health Informatics (CHI) initiative including the Department of Defense and Veterans Association to adopt medical information standards across federal agencies, and the Public Health Information Network (PHIN) and National Electronic Disease Surveillance System (NEDSS) under the leadership of the Centers for Disease Control and Prevention (CDC) which have developed data models, standards and controlled vocabularies for electronic laboratory reporting and health information exchange.

### ***Digital Hospitals in the USA***

A recent report by PwC looks at the benefits of the growing wave of ‘digital hospitals’ in the United States and ‘finds that technologically advanced hospitals have greater potential to improve processes and outcome in patient care, reduce medical errors, increase productivity and compete for market share against other hospitals.’<sup>21</sup> At this stage ‘the strategy is primarily associated with new specialty hospitals and facilities but can also be applied to existing acute care facilities’ and these hospitals are seen as ‘the first step’ towards ‘an even more extended “Digital Health Community”’.

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<sup>21</sup>‘Reactive to Adaptive: Transforming Hospitals with Digital Technology’ PwC presented to the Health Information Technology Summit, San Francisco, March 2005 <http://healthcare.pwc.com/cgi-local/hcregister.cgi?link=reg/dh.pdf>. The reference to market competition between hospitals sounds alien to anyone brought up in a national health system centred around ‘rights’ and national insurance rather than around ‘individual responsibility’ and private insurance.

### PwC's Key Findings

- Research revealed differences between digital and national average hospitals, with digitally advanced hospitals seeing a larger drop in average length of stay and larger increase in operating revenues. These hospitals also ranked higher on seven of 10 process measures in the treatment of three sample conditions: heart attack, heart failure and pneumonia. These measures, determined to lead to high quality patient outcomes, are collected in response to the Centers for Medicare and Medicaid Services (CMS) Hospital Quality Initiative.
- When asked what was the most important benefit of increased information technology integration, patient safety ranked highest among hospital executives interviewed. (Approximately one-fifth of medical errors are due to inadequate availability of patient information.)
- Physicians, once barriers to clinical information systems implementations, are becoming supporters of technology, particularly so among younger physicians.
- Deep interconnectedness of technologies is important, but difficult. Migrating toward significant technology implementation requires costly and complex integration of many subsystems and technologies. The burden of implementation among the significantly digital hospitals studied was found to fall not on software vendors and IT departments but on hospitals executives who must drive significant organizational and process change to realize substantial benefits.
- The Digital Health Community will come of age as hospitals respond to outside pressures, such as pay-for-performance, consumerism and government reporting on quality, by better analyzing and reporting their clinical data.

In particular, PricewaterhouseCoopers has worked closely with The Indiana Heart Hospital, which opened in 2002 as the first all-digital heart hospital in the United States. Metrics compared to previous cardiac facilities in the health system show that in its first year of operation, The Indiana Heart Hospital achieved:

- An 85 percent reduction in medication errors
- A 65 percent reduction in inappropriate denials and delays with respective payers
- A 15 percent increase in market share acquisition in the first fiscal year
- Reduction of "chart management" costs from \$15 to \$3 per chart.
- A 45 percent reduction in medical transcription and dictation costs
- A 15 percent reduction in coding workload

The second of three articles in the *Financial Times* on medical informatics, dated 18 March 2005, cites the same case, especially mentioning the use of wireless technologies.

At the Indiana Heart Hospital, which cost \$60m to build, cardiologists carry wireless laptops, which they use to review patient records, x-rays, or video showing heart and artery blockages. Technicians remotely monitor patient vital signs from a "war room" near the emergency ward. Two more hospitals will come online this year for remote monitoring, and the room could be expanded to monitor patients with newly implanted heart devices that can send vital signs information from wherever they are.

Nurses use terminals near the patients to enter data into electronic records. Prescription drugs are bar-coded and scanned to prevent errors. There is no medical records department.

But what if the computers fail? ‘As for fears of a computer crash... there are three back-up systems and, more important, nobody forgets how to be a doctor or a nurse.’

### ***Integrated Systems or Incremental Systems***

A key point of the PwC report is that the most advanced digital hospitals go beyond advanced medical information systems to systems that integrate all administrative, financial as well as medical systems. By contrast, HIMSS Analytics who partnered with PwC for the overall study, took the view that most US hospitals would adopt an incremental approach to the adoption of IT and IMS. Top of their list of IT objectives was the reduction of medical errors. What they found was:

Most U.S. hospitals have a foundation clinical data repository environment that can be used to extend their clinical automation capabilities. Most of the laboratory, radiology, and pharmacy departments in hospitals are automated. But the key automations for preventing or eliminating medical errors (computerized provider order entry [also referred to as computerized physician order entry, or CPOE]; pharmacy dispensing; nursing medication administration as integrated application components) have been installed in less than 10 percent of U.S. hospitals at this time. One reason for this low percentage of installed applications for reducing or eliminating medical errors is the relative immaturity of CPOE applications and their lack of proven integration with pharmacy dispensing and nursing medication administration applications. However, over the next 24 months, these applications will become more robust in functionality, stability, and scalability. Thus, the risk factors experienced by the pioneers and early adopters of these clinical information systems today will be much reduced for hospitals that begin to implement these solutions in 2006.<sup>22</sup>

A key driver in the US will be the government’s approach to promoting electronic health record (EHR) standards

### **United Kingdom**

The ‘National Health Service’ (NHS) tradition of the UK stands in marked contrast to the market-driven approach in the USA and despite the reforms of ‘New’ Labour to introduce the concept of market competition within local clusters of NHS hospitals and clinics, the idea of ‘socialized’ health care services remains the bedrock of the system. The problem is paying for it. One solution is to increase efficiency as well as customer-care through the use of ICTs. The ‘one big system’ approach adopted by the NHS has been a gargantuan US\$12 billion IT project to turn the NHS into a world leader in the use of fully-integrated IT systems. This approach has its critics, following as it does the failure of other big ticket projects such as the over-elaborate attempt to place the London Stock Exchange online or to install an information network for the English courts system. Following those and other failures the UK government listed the eight most common causes of failure.

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<sup>22</sup> HIMSS Analytics ‘The US Hospital Clinical System Environment: Market Dynamics Drive Adoptive Models’ The Governance Institute White Paper, Fall 2004, Executive Summary. See [http://www.himssanalytics.com/docs/WP\\_FA\\_04Technology.pdf](http://www.himssanalytics.com/docs/WP_FA_04Technology.pdf)

### Lessons from Failure

- Lack of clear link between the project and the organization's strategic priorities
- No "senior responsible owner" and lack of ministerial ownership
- Lack of effective engagement with stakeholders
- Shortage of skills in project and risk management
- Poor contact with suppliers
- Project let on price, not long term value
- A "big bang" approach rather than breaking the project up into manageable steps.

A recent article in the *Financial Times* takes a critical look at the NHS IT programme, and cites several examples of sub-programmes getting bogged down and running late due to an effort to do too much, too quickly. One example are the delays in the trials of the 'Choose and Book' system, that allows patients or doctors referring patients to choose a clinic and book an appointment or an admission. The FT also cites the reluctance of Emis, a private provider of IT systems to 55 per cent of private doctors and GPs, to join the new NHS system, most probably according to the FT because 'the privately owned company is making so much money from the NHS that it does not want to cut its margins, or be reduced to being a supplier in just two or three regions.'<sup>23</sup>

### Singapore

In Singapore public hospitals and health clinics are organized into a western cluster under the National Healthcare Group (NetCare) and an eastern cluster under the SingHealth Group. NetCare has pioneered the use of an Internet portal <http://www.netcare.com.sg> to provide patients with access to their medical history and other health-related information. Patients are notified of appointments using SMS, of which over 7,000 are sent each month. Within the group is the Alexandra Hospital that is working on a system known as 'Hospital Without Walls' to let patients as well as their doctors access their medical records online. The project is part of Healthcare.Net, an initiative of the Alexandra Hospital and the Infocomm Development Authority (IDA) begun in November 2004. The first stage allows emergency hospital staff to file patient records electronically rather than fill in five different paper forms. Real time access to these records saves time and effort by doctors and nurses that can be devoted to saving limbs and lives.

The SingCare Group has introduced a shared electronic medical record (EMR) system housing 1.9 million records and 1 terabyte of X-ray images in JPEG format. Records include hospital in-patient discharge summaries, medical prescriptions, drug allergies, laboratory test results and radiography reports. In 2004 the Ministry of Health launched an EMRX, a platform to allow the exchange of electronic medical records between the two clusters, initially of in-patient discharges, but later to be expanded to other records and to the private sector healthcare institutions and workers. These initiatives are part of Health ONE launched in 1997 at the same time as Singapore One, the broadband infrastructure operated by Singapore Telecom and Singapore Cable Vision (later acquired by StarHub), a project initiated by the Government's National Computer Board. Without the support of the broadband infrastructure Health ONE would not be possible. In a paper published in July 2001 Joanne Tap-Yap and

<sup>23</sup> 'Health Services IT overhaul needs a tonic' *Financial Times*, 11 March 2005, p.9

Suliman Al-Hawamdeh noted that beyond simply websites, 'To date, local healthcare providers have not leveraged information technology to the same extent as US healthcare providers.'<sup>24</sup> At that time the most pioneering healthcare service was offered by the private sector, eHealth Online, a for-profit health resource organization that was already offering video conferencing between patients and health care providers, access to medical records and a professional forum.<sup>25</sup>

Healthcare in Singapore is now becoming consumer friendly through the use of ICTs, an idea that may challenge somewhat the hierarchy-authority concept of more traditional healthcare workers. But as Liak Teng Lit, CEO of Alexandra Hospital puts it, 'Our expectation of a queue is being shaped by McDonald's. Singaporeans are not used to waiting for service anymore. Healthcare has to keep up, and investment in IT and better data storage will come in handy in such situations.'<sup>26</sup>

### Privacy, Confidentiality and Trust

Singapore has followed Australia and Canada in adopting an 'implied consent' model rather than an 'expressed consent' model. The three categories of information that would not be shared are information about termination of pregnancy, HIV positive status, and mental illness.

Many in the healthcare industry – administrators and healthcare professionals alike – treated access to patient records for research and treatment as one issue, and took the position that a patient's expressed consent was required before his records could be accessed. Such an "expressed consent" model is unwieldy. It would pose significant operational difficulties for healthcare institutions ... The NMEC (National Medical Ethics Committee) has concurred that patients should accept that in order to receive maximum benefit from the healthcare system, they would have to allow the healthcare institution to store and share their medical information with the necessary providers. It was also agreed that an "implied consent" model is acceptable, but the healthcare institutions should ensure adequate data protection measures are in place, and inform their patients how their medical information would be shared...<sup>27</sup>

The adequacy of data protection lies at the heart of most people's concerns. Basically, any recorded information, whether it enters an electronic data base or not, is vulnerable to hacking or to human action, whether it be criminally motivated, or just careless behaviour or simply by the desire to cut-corners. A recent warning of this came from a Chinese team of researchers from Shandong University who demonstrated how the Internet hash encryption algorithm, SHA-1 used by the US Government as a secure mode of handling highly sensitive information, could be easily replicated and therefore broken.<sup>28</sup> For reasons such as these, critics in Taiwan

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<sup>24</sup> 'Health care providers have begun a slow transition to electronic medical records (EMRs). The low diffusion is due to the prohibitive costs of EMR systems, the difficulty in linking or drawing information out of legacy systems and limited data input devices that suit physician's needs.' Joanne Tap-Yap and Suliman Al-Hawamdeh (2001) 'The Impact of Internet on Healthcare in Singapore' *Journal of Computer Mediated Communications* <http://jcmc.indiana.edu/vol6/issue4/tayyap.html>

<sup>25</sup> In another initiative, the National University of Singapore is a member of the Star\* (Star Alliance) of eight institutions worldwide with an 'S' in their title, such as Stanford and University of Sydney, that offer modular courses in genomics, bioinformatics and medical informatics. <http://www.s-star.org/main.html>

<sup>26</sup> ITAsiaone [http://it.asia1.com.sg/newsdaily/news001\\_20041102.html](http://it.asia1.com.sg/newsdaily/news001_20041102.html)

<sup>27</sup> Prof. Goh Lee Gan 'The ENR Xchange (EMRX) and Beyond' at [http://www.sma.org.sg/sma\\_news/3605/commentary\\_9/g.pdf](http://www.sma.org.sg/sma_news/3605/commentary_9/g.pdf)

<sup>28</sup> 'Crack in Computer Security Code Raises Concern' *Asian Wall Street Journal*, 16 March 2005 p.A6

have raised alarm bells over the entering of healthcare data on smart ID cards and providing 'secure' access to sensitive medical information on a central data bank. In their paper to the World Summit on the Information Society (WSIS) in 2003 the Taiwan Association for Human Rights (TAHR) first describe the types of personal health information to which the smart ID cards give access.<sup>29</sup>

The smart card is designed to be a mobile data carrier held by the patient... Its health insurance related information section further registers major diseases, the number of visits and admissions to medical institutions, the last menstruation period and pregnancy exams, along with the records of the cardholder's insurance premium and accumulated medical expenditures and so on. Moreover, the smart IC card's medical services section bears sensitive information, including records of specific prescriptions for chronic diseases and general medical treatments. Its public health administration section includes the personal immunization records and the willingness for organ donation.

The TAHR then examine the security issue.

Just digging into news archive, we found that there were at least six million personal data records exposed or leaked due to theft or negligence in 2002. For example, a policeman was caught selling citizens' communication records. Other news revealed more similar cases in which the police have been trading with private detectives more extensive personal data than simply the communication records. A director of a public medical institution even downloaded over 3,000 individual medical records, placing them on his personal website. There were also two local governments that respectively provided over 10,000 personal data records of primary school students and their parents without permission upon the request by county local representatives, and sent out land tax forms to receivers without envelopes to secure the taxpayers' personal information. There were, in addition, five million personal data records of mobile phone users traded by the staff of prestigious communication service providers.

While electronic databases invite electronic hackers, none of the breaches of security, confidentiality and trust listed above even required hacking.

## Telecoms and Health Informatics

Without a well developed and low cost of usage broadband infrastructure, health informatics would remain a chain of isolated island databases and local area networks. The most headline-grabbing use of telecommunications comes in telemedicine. In Thailand webcams are used in remote areas to send video pictures of wounds and other physical conditions to doctors in Bangkok, and even remote surgery is performed in this way.<sup>30</sup> Part of APEC's APII (Asia Pacific Information Infrastructure) project involved similar link ups between Japanese hospitals and Thai hospitals. Examples such as these are spreading across developing countries worldwide.<sup>31</sup> Tele-medicine is also one of the flagship projects of Malaysia's Multimedia Super Corridor (MSC).

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<sup>29</sup> 'Human Rights Concern in an Information Society' WSIS, Asian Regional Conference, Tokyo Japan, Jan 13-15, 2003, at <http://www.tahr.org.tw/site/english/ws-is-chuang.htm>

<sup>30</sup> 'Bt30 crisis spawns tech revolution rural hospital' *The Nation* 24 February 2005, p. 1A.

<sup>31</sup> For some other examples, see 'Telecoms extends reach of medical care to world's remotest regions.' *SCMP Technology Post*, 15 February 2005, p. T4.

### ***Use of Wireless***

On a more localized level, telecommunications is enabling the use of a whole variety of IT applications. While modern cabling and Ethernet systems provide local area networks (LANs) and telecom provides the links to create metropolitan area networks (MANs), there is a gradual introduction of wireless technologies. Early on there was 2-way paging, now it is SMS and paging by cellphone, access to databases by PDAs and handheld computers, in many cases using wireless fidelity (WiFi). For out-patient care evidence is piling up that patients who receive reminders by SMS are far more likely to take their prescription drugs and to keep appointments than those who do not. The use of smart cards is also on the increase.<sup>32</sup> For hospital administration and in-patient care RFID (radio frequency identity) tags are becoming increasingly used to tag, authenticate and track drugs, patients, equipment and vital supplies. These types of devices can be 'passive' or 'active' and read locally or the information streamed to other places and users. There may be health and safety issues related to the use of wireless devices within certain areas of a hospital,<sup>33</sup> but most modern medical equipment comes with built-in shielding from electro-magnetic interference (EMI) and research seems to suggest the dangers are not great and can be rather easily safeguarded against.<sup>34</sup>

### ***The Internet***

The Internet is influencing doctors and patients alike. In 2001 a survey of 400 practicing physicians by Harris Interactive for the Boston Consulting Group's report *Vital Signs Update: Doctors Say eHealth Delivers* found that 'doctors are using the Internet in force for gathering medical knowledge and that they are beginning to embrace online tools that enhance patient care, such as electronic prescribing, online communication with patients, and electronic medical records. Even more importantly, doctors are reporting that the information they find online is influencing—for some, in a major way—the types of diagnoses they make and the prescriptions they write.'<sup>35</sup>

On the patients' side, as K.C. Lun of the International Medical Informatics Association notes, the Internet is helping to create online medical communities as well as providing health education and medical information.<sup>36</sup>

A recent survey reported in the Asian edition of *BusinessWeek* found that one-third of patients suffering from chronic diseases reported taking their medications more regularly after checking out information on the Internet. In addition, patients who share the same ailment are forming online communities to exchange experiences and advice on the management of their disease, as well as pressure groups to lobby for more research funding for their disease. A report entitled *Networking Health: Prescriptions for the Internet*, by the US National Academy of Sciences,<sup>37</sup> indicated that, in 1999, some 30 million Americans used the Internet to search for health-related information. Of these online users, some 32% shopped for health products.

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<sup>32</sup> Hong Kong used the MULTOS (Multiple Operating System) card OS rather than the Java OS.

<sup>33</sup> Although making cellphone calls in the operating theatre is apparently not unknown in Hong Kong.

<sup>34</sup> Dr Jeff Gilfor 'Wireless Devices and Electromagnetic Interference in Hospitals, Urban Myth?' reviews some of the evidence at <http://www.pdamd.com/features/interference.xml>. Dr. Gilfor founded DoctorPalmPilot.com, a commercial website for wireless applications for medical environments.

<sup>35</sup> Harris Interactive (2001) <http://www.harrisinteractive.com/news/allnewsbydate.asp?NewsID=388>

<sup>36</sup> K.C.Lun (2000) Online Healthcare – Smart International Partnerships  
<http://www.wma.net/e/publications/pdf/2000/lun.pdf>

<sup>37</sup> 'Networking Health: Prescriptions for the Internet' Report of the US National Academy of Science, February 2000.

## Conclusion

The most frequently cited, and rather alarming, reason (see above) for health informatics is to reduce medical errors, a good enough reason on its own. According to Professor Lucian Leape of the Harvard School of Public Health, the risk of dying while visiting a hospital is about on a par with the risk from bungee jumping, and is 10,000 times greater than from traveling on an airplane. The reason, he suggests, is that the air travel industry 'have accepted the fact that their employees make mistakes and designed systems that back them up.'<sup>38</sup>

Other good reasons are the efficiencies that ICTs offer with a better use of resource such as information, and increasing the scope and reach of healthcare services, which at the same time can become more inclusive of other healthcare professionals and of the patients and the community at large, and more systematic in coordinating across health and environmental agencies. This becomes very important when facing the threat of pandemics. Information coordination is especially urgent on a regional basis.

In Hong Kong the Hospital Authority is understandably the leading agency for the adoption of ICTs in healthcare, while the HWF Bureau is responsible for the community's ability to monitor health statistics and issue timely alerts. But is this sufficient? The Government certainly won worldwide praise for quick and assertive action when avian flu threatened the territory despite a few hiccups in coordination between agencies. SARS was a more complex situation, requiring even greater coordination and it is important the lessons learned are applied. One of those lessons should be the timely availability of reliable information. This is a complex issue. Some information will be on a 'need-to-know' basis for security or public safety reasons or for protection of personal data, etc., but the general principle of a well-informed community, and the ability to verify the veracity of information, is crucial.

There are clearly many different levels at which medical informatics, and more generally health informatics, is important. For example, the monitoring of pollution and of pollution-related health problems is an urgent task, and far more needs to be done in this area, but this involves bringing in even more government agencies into the healthcare picture. Regional and cross-border agency coordination is an even bigger issue. The convening of a working group, maybe under the Health and Medical Advisory Committee, to enter healthcare informatics into the next version of *Digital 21* could be a useful place to start.

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<sup>38</sup> 'Lucian Leape says bad systems, not people, cause medical errors.' Interview in *Hospitals & Health Networks*, July, 1998 [http://www.findarticles.com/p/articles/mi\\_hb3156/is\\_199807/ai\\_n7857823](http://www.findarticles.com/p/articles/mi_hb3156/is_199807/ai_n7857823)