

Emergency Healthcare: An Emergent Knowledge-driven System

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1 Introduction

This chapter presents a case study of efforts to apply information and communication technologies (ICTs) to strengthen the performance of the emergency health care system in the United Kingdom. The emergency health care system is an essential component of the wider National Health Service (NHS). It is comprised of numerous professional communities. The members of these communities rely heavily on their capacity to produce and share knowledge in order to deliver health care services that are widely perceived as 'public goods'. In this case study, transformations in the organisation and structure of the public organisations that provide emergency health care services are examined from 1992 to the present. At the start of the period, the knowledge generated, shared and applied within this part of the health care system involved very limited use of ICTs. By early 2002, there had been major efforts to reconfigure the activities of the health care professional communities in an effort to encourage their use of ICTs.

The case study illustrates why it is proving to be very difficult to apply ICTs in ways that transform the health care professional communities into more intensely knowledge-driven communities. The results suggest that there are many discontinuities in the knowledge-driven activities within and between the health care professional communities. These make it very difficult to encourage the learning that is necessary to build the capabilities and social networks that would enable the members of these communities to take advantage of the potential benefits of ICT-supported knowledge creation and sharing.

This study shows that the application of ICT systems within the emergency health care system has often been insufficiently tailored to the requirements of the professional communities that are expected to use them. Many potential users lack the time and resources to learn to use them effectively and to maintain them. These constraints are partly attributable to the turbulence created by constant organisational and structural change in the emergency health care system and in the wider NHS system.

One of the key features of the emergency health care system is resistance to changes in the way opportunities for learning are created and managed. There is a considerable emphasis on both human and technology-based services that can help to triage members of the public more effectively through the emergency health care system. However, these changes are occurring in an environment that is characterised by ongoing system-wide under-investment in training and education.

One consequence is that traditional social norms and practices are being perpetuated. These norms and practices govern when, and with whom, members of distinct professional communities are willing to share their knowledge and to use ICTs to hold and exchange information in an electronic form. In an institutional system that is as complicated as the emergency health care system, any changes in the delivery of services to the public must be negotiated and agreed among a large number of professional and administrative communities. There are many conflicting views about what services can best be delivered using the new technologies, what specific applications should be deployed, and what the expected benefits should be.

In the private sector, a relatively greater degree of clarity might be expected about the scale of investment in technology and in the strategies to achieve organisational change over a given time period. In the public sector there is continuing uncertainty about the funding that is available and the types of structural and organisational change that are to be implemented. This study demonstrates that the success with which new technologies are introduced is linked to the continuity and clarity of investment strategies for technical and organisational change. Changes in work practices and in the use of ICTs take time to achieve because of the complexity of the learning processes that are needed within and across the boundaries of the different professional communities.

The absorption and effective use of ICTs by the professional communities within the emergency health care system are also strongly influenced by the extent to which trust can be encouraged in the relevance and quality of the information that is embodied in decision support systems. There are many competing ICT projects involving a substantial number of expert ICT system designers. They work with the different professional user communities, but achieving the peer-to-peer networking relationships needed to facilitate learning is very difficult. Movement towards a more knowledge-driven health care system does not appear to be hampered by a deficit in the amount of ICT-related expertise that is available. Instead, it appears to be thwarted by insufficient attention to fashioning effective relationships between those managing organisational and technical change and to understanding the implications of changes in the knowledge-related activities in this sector.

Under-investment in the skills and competency base of both the professionals who deliver emergency health care and those who develop the ICT applications is slowing the process of change. Agreements must be negotiating between all those involved if the changes are to be perceived as being beneficial by technology designers and users. Policy measures are needed to address a continuing failure to invest adequately in the infrastructure that is needed to enabling effective learning to occur.

Social mechanisms are needed to enable greater opportunities sharing information about how the use of ICTs can be made more effective within the emergency health care system (and across the whole health care system). The emergency health care system is being re-organised at the same that the larger NHS system is being restructured. The changes within the NHS are creating greater organisational complexity. This represents a major barrier to the effective development and implementation of ICT systems to support the delivery of a key public service to citizens and patients.

The next section examines recent efforts to modernise the health care system in the United Kingdom and the method used to conduct this case study. Section 3 considers the characteristics of the emergency health care system. It focuses on the changes in the routes whereby patients may access health care and their implications for the knowledge-related activities of the professionals who provide services. In section 4, the organisational and technical innovations that have been introduced with the aim of achieving greater co-ordination and more efficient information exchanges across the system are examined. Particular attention is given to NHS Direct which is a key component of the health care delivery system. In section 5, we provide an analysis of

some of the problems of managing a transition towards a knowledge-driven system in this sector. Section 6 provides a consideration of the wider implications of recent changes for health and equality of access to health care. In Section 7, some of the key issues and challenges for more effective knowledge management in the health care sector are highlighted. Section 8 sets out the overall conclusions of the study.

2 Modernising the Health Care System

Government policy in the United Kingdom aims to enhance the performance of the public organisations that comprise the health care system. The Department of Health in the United Kingdom commanded a budget of £45.3 billion in 2000-01 of which some £44.6 billion was net expenditure on the NHS in England, a 9.3% increase in real terms over the previous year.¹ The NHS is financed mainly through general taxation but has an element of National Insurance contribution. In 2000-01, some 92.6% of expected expenditure was to be met from these two sources.² This is an intensely knowledge-driven component of the public sector. It relies on a combination of public and private financing to provide outputs in the form of services that are widely perceived as public goods. In order to achieve the Government's performance targets, there are ongoing programmes of investment in ICTs to provide decision support tools and to facilitate communication between the many professional and patient communities that make up the health care system.

In January 2001, the Secretary of State for Health, Alan Milburn, set out a strategy for the NHS entitled *Building the Information Core – Implementing the NHS Plan*.³

Implementing the NHS Plan will make the NHS a modern public service meeting modern public expectations. Redesigning and delivering care and services that are based around the needs and circumstances of patients is a massive transformation ... Reforming the system to create new and more effective clinical practices, care processes and ways of working relies on good quality information and modern information and communication technology. Building the information core is vital. ... The better capture, management and use of information – analysed, communicated and shared through modern systems and networks – is central to managing change and modernising the front-line delivery of care, treatment and services to patients.⁴

The relationship between the NHS Plan and the role of new technologies was depicted as a knowledge management system that encompasses the whole range of stakeholders in health. These include policy makers, patients and the public, clinicians, and managers. It also includes delivery channels (call centres, online services, telecare, and other channels), modes of delivering information (information services, electronic record systems, national and local applications), the infrastructure (education, training and development, connectivity, access, clinical, information management, security and confidentiality, and communications), and support for implementation (encouraging innovation, improving procurement and the market, and performance). The use of advanced technologies is expected to facilitate:⁵

- the rapid and safe sharing of information;

- access to individual patient and client records for both emergency and routine care;
- access to the latest knowledge, evidence-base and clinical guidelines for improved decision making and professional development;
- improved use of up-to-date and high quality aggregate information in managing and monitoring performance and planning future services;
- modern and streamlined procedures for all staff, to ensure better services to individuals and to increase the internal efficiency of care organisations; and
- faster communications with colleagues and patients.

Some of these measures to create an effective health care knowledge system are regarded as successful by the members of the professional communities that are expected to benefit. In these cases, the organisational and technical changes are being integrated to improve the performance of the health care system. Other measures are being strongly resisted partly because of a failure to invest in the necessary infrastructure for enabling the development of an effective learning system.

In the emergency health care component of the health care system there are many distinct professional communities whose roles are ‘oriented towards the production and reproduction of knowledge through decentralised and co-operative processes’.⁶ The members of these communities have been encouraged within the framework of the Government’s implementation of the NHS Plan to intensify their knowledge-driven activities. They have been encouraged to incorporate ICTs-based decision support systems which are intended to facilitate new means of capturing and exchanging knowledge. Measures have been introduced to create new social norms and practices that are compatible with knowledge sharing and distribution across the boundaries of these professional communities.

The emergency health care system of the NHS is divided into regions. The overall spend on hospital provision for care is weighted by population size. General Practitioners (GPs) are required to form ‘primary care groups’ (and from April 2002 Primary Care Trusts serving populations of approximately 200,000 people) to support the general community care system. GPs are expected to ‘buy-in’ the services they need to support their populations and the NHS is increasingly seeking to outsource various specific kinds of care. In this study, we focus mainly on the emergency health care system in the London area.

The study is based on a review of policy and related documentation on the structural and operational changes aimed at improving the efficiency of health care provision. It draws on existing research on the changes underway throughout the health sector in the United Kingdom and on a small set of supplementary interviews with representatives of the professional communities in the Ambulance Service, Accident and Emergency Departments, NHS Walk-In Centres, NHS Direct and those responsible for the design and implementation of new ICT systems for the health care sector. The six interviewees were selected because they were known to be key individuals with considerable experience of the areas of emergency health care provision that are examined in this study. Unstructured interviews were conducted between November 2001 and February 2002.⁷

The interviewees were invited to provide their views on: 1) the overall structure and changes in the emergency health care system and the broad aims of government policy; 2) the functional activities of professionals within key components of the emergency health care system and their perceptions of the benefits and risks of changes in the system, including the greater use of ICTs; 3) the organisational and technological problems and opportunities that are being experienced by health care professionals and their adaptations and resistances to those changes; and 4) the perceived priorities for the further development of effective knowledge networks within the emergency health care system.

3 The Emergency Healthcare System

In 1997, the then Chief Medical Officer for the United Kingdom, Sir Kenneth Calman, reviewed the provision of health care services and concluded that they needed to be co-ordinated, planned and managed so that assistance could be available to people twenty-four hours a day. His view was that citizens should be helped to recognise and to deal with health care emergencies themselves.⁸ There have been many initiatives to increase the capacity of the emergency health care system. However, some observers have warned that despite the benefits to patients of quick and improved access to health care services as a result of these initiatives, 'there is potential for confusion and duplication of services, leading to inconsistent responses, variable quality of care, and inefficiency'.⁹

In 2001, a report on stakeholder views on access to health care highlighted 'the complexity of the concept of 'access to health care'. It was acknowledged that there is a lack of agreement about its meaning.¹⁰ The authors drew a distinction between 'access-entry', i.e. access into the health system, and 'in-system access', i.e. treatment of patients once in the system. Various dimensions of access were considered including geographical, temporal, financial and other factors; the influence of individual, community and health service factors on access; and 'absolute' access which is determined by the overall availability of different services and 'relative' access, i.e. access which are experienced differently by different population groups. In this case study, we focus mainly on 'access-entry' and the procedures and processes involved in the management of knowledge in a part of the much larger health care system.

3.1 Managing a Complex Knowledge System

An emergency health care system is composed of many relatively discrete areas of activity. In most cases, failures in health care delivery are traceable to difficulties (and even complete breakdowns) in information flows within an activity area or between areas. Health care delivery requires the timely transfer of high quality information and there are many initiatives to use ICTs in an attempt to improve information flows within and between these areas of activity.

The discrete nature of health care activities serves as an information filter within a complex knowledge system. For example, the ambulance crew knows the condition of a patient's home (and this is reported on their log sheets) when they respond to an

emergency. However, since the trauma team that manages the patient's condition does not require this information, it is ignored as the patient moves through the health care system. When the patient is ready to return home, the information is required again by the discharge co-ordinator, but it is not available and it either has to be gathered again or it is simply not taken into account.

Universal electronic health records that can be consulted and amended by all authorised persons have been under discussion for many years.¹¹ If agreement on standards including measures to protect individual privacy could be reached such records could support improved information management within the emergency health care system. The complexity of the development of these records is considerable, but if supported by the use of 'smart card' technology, electronic records could reduce the number of failures in care delivery that result from the poor quality of information or from misinformation in the system. These records could also allow for the improved measurement of short and long term clinical and care outcomes.

Knowledge management systems are being developed in relation to discrete areas of activity within the health care system. The training of the health care professionals involved in emergency care is developed by different, usually national, bodies. For the most part, the systems that support emergency health care are being developed on a local basis. For instance, the accident and emergency assessment process in a hospital and the subsequent care pathway may differ from one another.

Knowledge about good examples of the operation of emergency care, i.e. 'best practice in Accident & Emergency', is frequently not circulated throughout the system. The organisations involved in emergency health care have very different cultures and approaches to creating, circulating and applying their accumulating knowledge base. For example, doctors and consultants have a Royal College of Physicians.¹² As a professional body, dissemination of information is through academic meetings and there are few overt pressures to change practices or procedures. The ambulance service, in contrast, is a trade organisation and training and retraining are more formal.¹³ In this case, there is a stronger ethos of sharing of knowledge.

The ambulance service is better able to capture individual learning and to turn it into a corpus of corporate knowledge than is the Accident & Emergency (A&E) Consultants organisation. Most of the knowledge that is created as a result of individual patient encounters by doctors in the A&E Departments is personal knowledge and it leaves the Department when a doctor rotates to another hospital. In the case of the A&E Departments, patients self-refer, they are brought in by ambulance, or they arrive with a letter from a GP. Information comes with the patient in varying quantities and qualities (see Table 1)

Table 1 Patient Information Quality and Quantity

Referral Source	Type of Information
Self Referral	Qualitative, variable quality
Ambulance	Physiological data, basic patient history
GP	Recent medical history

Source: Interview with Consultant Physician¹⁴

Patient histories are taken by Senior House Officers (SHOs). These are typically young doctors who have graduated two years before. They arrive at a diagnosis and order confirmatory investigations with the object of moving patients to wards or of sending them home.

SHOs work to a protocol that is learned during their undergraduate training, but they are expected to exercise independent judgement. The Consultant Physician monitors the performance of the SHOs by identifying inconsistencies and incompletenesses in their reports. This offers a learning opportunity as information is fed back to the juniors. If a patient presents with a condition about which the Consultant is unsure, the Consultant will contact a trusted peer by telephone to obtain a second opinion. There are some well-known resources such as the Poisons Unit at Guy's Hospital and the Institute of Tropical Diseases both of which are accessed and mediated by human information intermediaries.

Within this framework, ICTs might be used to support several areas of activity such as the handover from one health care professional to another, although the information would need to be accurate and concise. ICT applications might support A&E activities where information would need to be specific to the immediate need as there is no time or facility for searching through information. ICTs could also support departmental learning processes to enable feedback to the A&E Department on the outcomes of interventions. In addition, ICT systems might support knowledge transfer from the Consultant Physician to the juniors or from peers since this knowledge is not captured formally and is lost. ICTs could support a more robust corporate learning process if multimedia teaching aids could be developed. However, this type of learning tool would be difficult to use because of time pressures.¹⁵

In the case of A&E Departments, any use of ICTs to support decisions must operate in a highly pressurised environment and, in their current form, the ICT systems are not perceived to be helpful because of technical weaknesses in the information sources and human-computer interfaces that are perceived to be of poor quality. There is a need for the further development of mobile computing applications and for faster delivery of relevant information. Organisational problems also slow the implementation of ICT systems. These include the lack of resources to mobilise knowledge and learning networks, the need to develop standardised assessment forms and procedures for recording information, and the need for greater emphasis on multidisciplinary team working.

The operation of the emergency health care system requires multidisciplinary team work and extensive knowledge sharing. It is expected that the use of ICTs could help to facilitate the information flows that underpin the learning process, leading to the creation and circulation of new knowledge. This requires numerous cultural and organisational changes to be made in parallel with the design and implementation of all the new systems. The organisational changes in the emergency health care system in recent years are described in the next section which highlights changes in the structure of the relationships between the members of the professional communities.

3.2 Access Routes to Emergency Health Care

The access routes to emergency health care have expanded over the decade of the 1990s. Figures 1, 2 and 3 show the various access routes between 1992 and 1999. The development of the new organisations – Minor Injuries Units (MIU)/Walk-in-Centres (WICs); NHS Direct and the expanded role of the Ambulance Service – has been enabled by ICT applications. These applications are supporting new forms of telemedicine, improved decision support systems in some areas, and new forms of electronic record keeping.

The processes of decision making that govern the passage of a member of the public through the NHS emergency health care system have become increasingly complex as Figures 1 to 3 show. The emergency health care system is also part of a much larger system that creates additional layers of complexity that are beyond the scope of this case study.

The early 1990s ...

By way of illustration, in the case of a perceived health problem associated with a heart condition, Figure 1 indicates that in the early 1990s a member of the public had two choices in seeking assistance: their GP or the ambulance service. The person seeking assistance would have been routed to a hospital Accident and Emergency (A&E) centre where professionals would take decisions with regard to assessment, diagnosis and treatment leading to the patient's dispersal to the home, inpatient accommodation, or treatment as an outpatient. Alternatively, the patient might be taken directly to a Coronary Care Unit (CCU).

At this time, the role that ICTs would have played would have included a basic telephony link between the Ambulance crew and the CCU, or between them and the A&E Department. Information about the condition of the patient might have been collected at each stage, but it would not have been held in electronic form. It would not have passed through to the consultants, nurses, home carers or GPs who might have benefited from it.

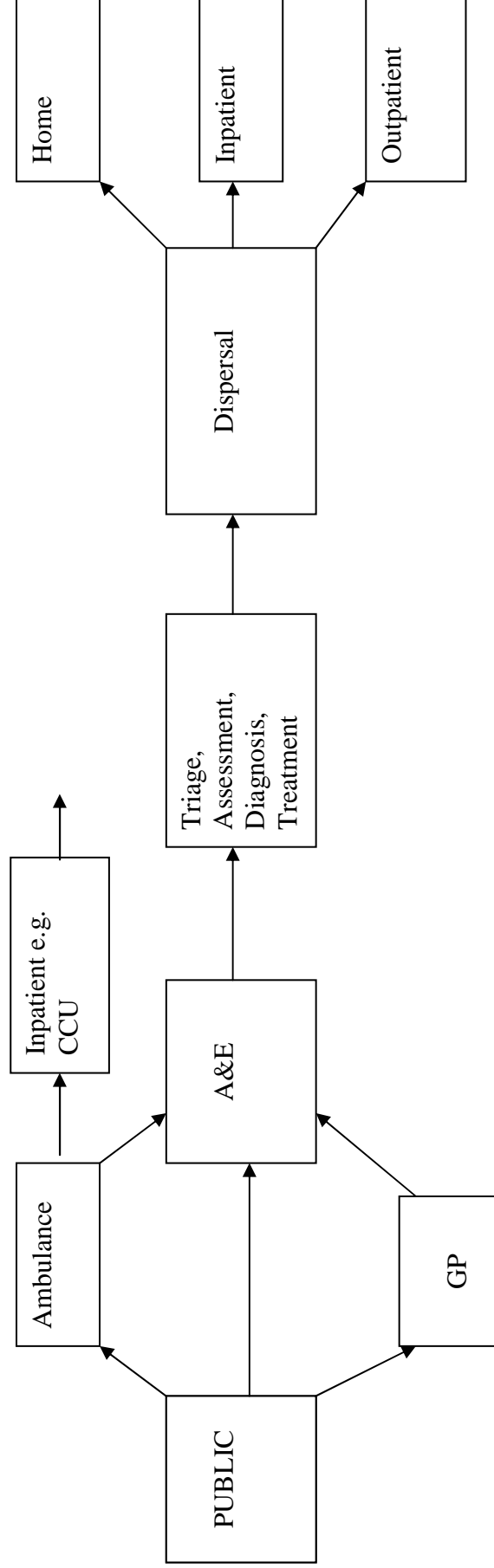
The mid-1990s ...

By the mid-1990s (see Figure 2), an effort was being made to improve the efficiency of the system by creating alternative means of gaining access to treatment. The creation of new organisational layers in the system did not prevent members of the public from pursuing treatment in the pre-1996 manner. However, with the introduction of MIUs and WICs, the aim was to achieve cost reductions and to alleviate pressures on A&E Departments.¹⁶ The Centres are staffed by nurses who are available from early morning to late at night without an appointment and are linked to GPs and to A&E Departments. The goal was to provide a facility that might resolve patient problems at the local level. At about this time, electronic videoconferencing facilities were introduced so that nursing staff could communicate directly with Consultants in the A&E Departments. In addition, Ambulance crews began to exchange data about patients' conditions directly with CCUs.

The late 1990s ...

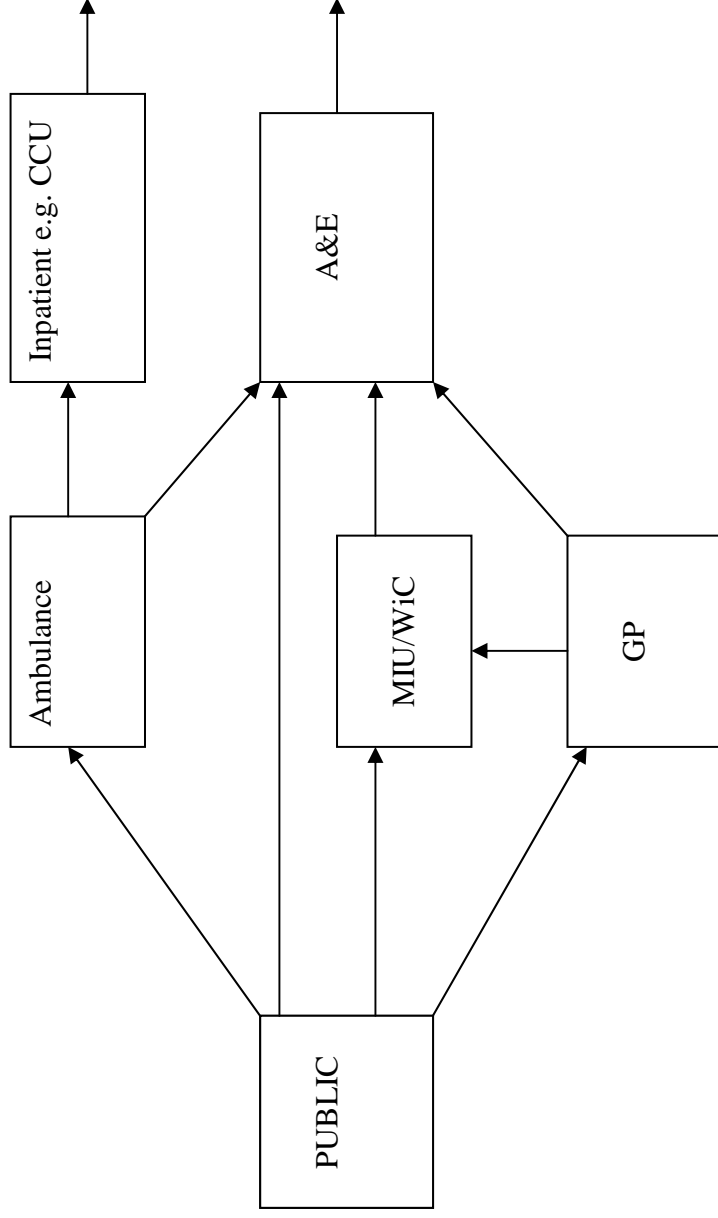
Pressures on the NHS emergency health care system continued to grow throughout the 1990s. Further efforts were made to achieve efficiency gains and greater effectiveness of health care provision through the introduction of new technology. By 1998, the NHS Direct service (see section 4.2 below) was introduced.

Figure 1 Accident and Emergency Hospital Admission, (c. 1992)



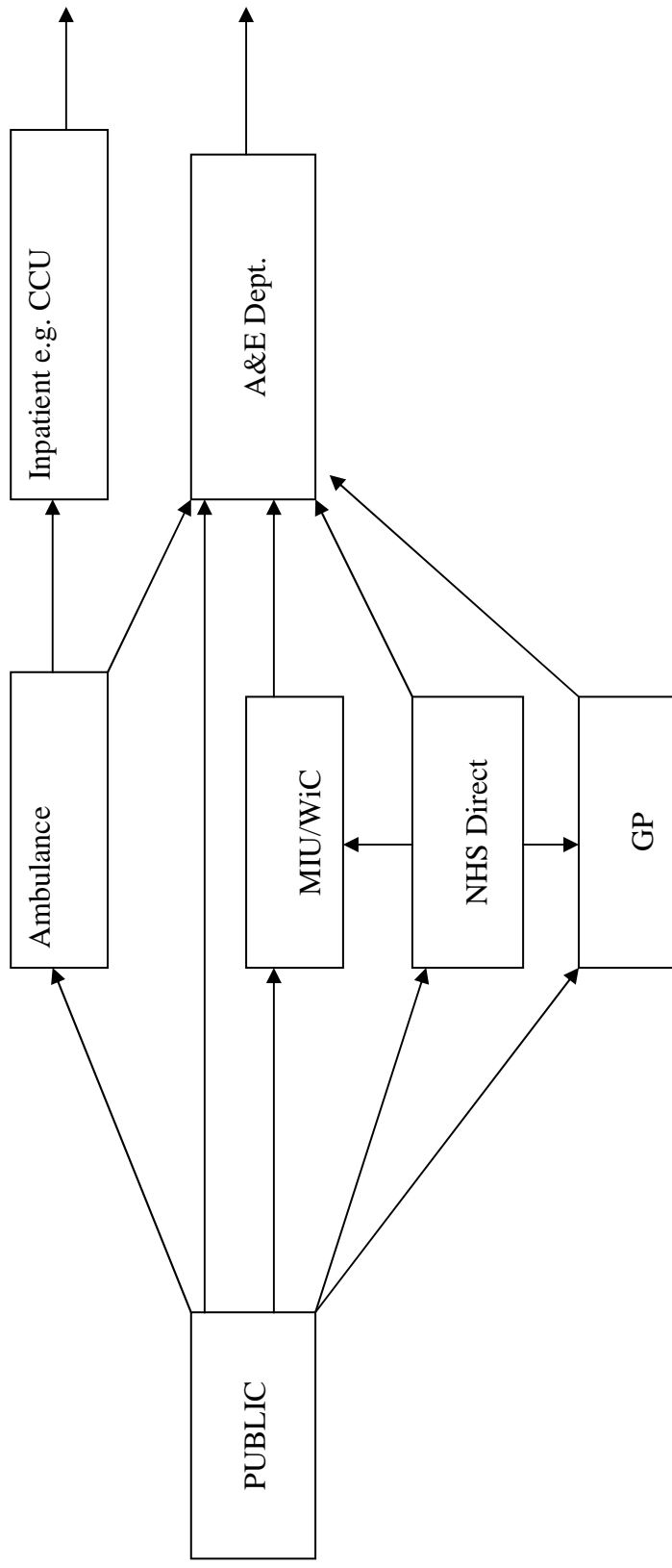
Source: by authors

Figure 2 Accident and Emergency Hospital Admission, (c. 1996)



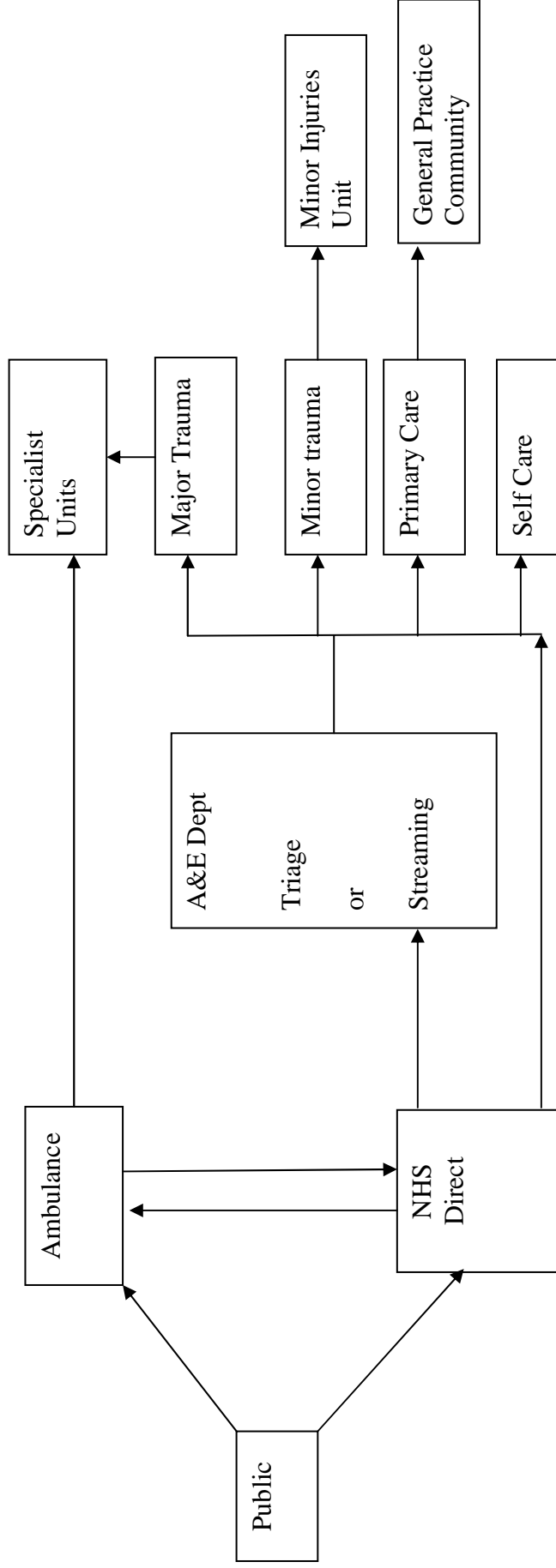
Source: by authors

Figure 3 Accident and Emergency Hospital Admission, (c. 1999)



Source: by authors

Figure 4 Accident and Emergency Hospital Admission, (c. 2002 proposed)



Source: by authors

The overall structure and division of labour governing the progress of a member of the public through the emergency health care system remained in place, but NHS Direct was located as an intermediary as shown in Figure 3. The intention was to enable a patient to contact a professional and to undergo a mini-triage that would clarify how the patient might be most effectively routed through the health care system.

The initiative was perceived as being 'technology driven' and was based on a model borrowed from the United States. The NHS Direct service provides individuals with access to 'talking head' professionals who provide access to information that is expected to enable the patient to conduct a mini-triage for him or herself, thereby optimising the decision about how best to pursue care.

The communities of professionals who play a role in each of the components of the emergency health care system differ substantially from each other. The Ambulance Service is staffed by members of a 'craft' union which manages an evolving set of standards and protocols for patient care that forms part of a corporate learning process. The patient dispersal options presented to ambulance staff are dependent on the facilities provided by the local AcuteTrust hospitals and these can vary across the country. For instance, for a heart attack patient they can be focused on the choice as to whether to take a patient directly to a CCU or to an A&E Department. The staffs of the MIUs and WICs are nursing professionals who are able to acquire a profile of a patient's circumstances, as are the Ambulance crews, but their knowledge is not passed on to those who may subsequently provide care for the patient.

The accumulating knowledge bases of all those located within the boxes shown in Figure 3 are held by professionals who perceive themselves as having 'within' group specialist knowledge about both patients and the medical support that should be offered. The components of the system do not provide or encourage feedback between each other, or between others who may have continuous contact with patients in the community.

Early 21st Century ...

The NHS Direct service has not alleviated pressures on the provision of emergency health care. The Department of Health is considering proposals that would reposition NHS Direct as shown in Figure 4. Under these proposals, the role of MIUs and WICs would be changed (as shown in Figure 4). The options available to a patient, apart from access via a GP, would be limited to either the Ambulance service or NHS Direct. It is envisaged that patients would be 'empowered' to use the NHS Direct service to decide for themselves whether to proceed to an A&E Department, to call an ambulance, or to practice self-care.

The new structure of the system is based on several assumptions. It is assumed that there is a high level of public awareness of the available options. Members of the public are expected to have confidence in their own capacity to discern what routes towards treatment are appropriate and to have the capacity and resources to take the required actions. The development of the concept of the 'informed patient' and measures to achieve this are issues beyond the scope of this case study. However, it is important to acknowledge that further elaboration of this idea will have an enormous

impact on emergency health care provision and on the circulation of knowledge about health care.

The professionals within the A&E Departments who conduct the triage or streaming leading to the disposition of a patient are expected to rely increasingly on databases and other electronic service support mechanisms. The aim is to build up an large knowledge base to identify the appropriate route through a range of alternative care facilities. Unfortunately, to a large extent, they are expected to do so in the absence of the contextual information that, in the past, would have been available from Ambulance crews, GPs and others.

The objective is now to use ICT supported systems to build a corpus of knowledge representing categories of patient experience upon which individual decisions can be based. The organisational changes in the structure of the emergency health care system shown in Figure 4, combined with the use of ICTs, are expected to provide the foundation for the more efficient delivery of mass health care.

Multiple Access Routes ...

The three historic routes to emergency health care via an ambulance, attendance at an Accident & Emergency (A&E), and referral via a General Practitioner (GP), continue to be the main routes used by citizens. Citizens - mostly those who are technologically literate and middle class - use all these avenues, selecting the one that is likely to give them what they regard as the desired result. Certain members of the public, particularly the elderly, the chronically ill, and those ethnic minorities who have developed access routes to emergency care, have not changed their patterns of behaviour in response to these new access routes.

In an effort to address some of the problems created by the use of multiple access routes, overcrowding and long waiting times in A&E Departments, the new structure for the emergency health care system is being proposed (as in Figure 4). The overall aims are to achieve: 1) a consistent response to a request for help throughout the system; 2) better exchanges of information; and 3) a focus on 'triage' or streaming in the A&E Departments

These structural modifications focus mainly on the processes that members of the public are expected to follow when they seek care. However, it is essential to consider these changes in the light of perceptions of success or failure. Successful implementation of planned structural and organisational changes will depend upon the scale and continuity of investment in managing information flows throughout the entire system through the use, in part, of ICTs. These changes also need to be considered in terms of whether their impact can be measured in terms of the outcomes of the immediate care process and the contribution that the emergency health care system makes to the long term well-being of the individual.

Changes in the Funding Base ...

In parallel with the changes described in this section there has been a major shift in resources for health care. As from April 2002, for example, some 75% of available spending is controlled by Primary Care Trusts, that is, at the GP level. These

professional communities are expected to be able to make effective decisions about routing patients through the system. They are expected to use their access to a large corpus of knowledge held in databases and the NHS Direct system. The pressures on the A&E Departments are expected to become more manageable because patients and all the professionals involved are theoretically able to exchange and share knowledge about individual patients and to compare those individuals' circumstances with 'best practice' experience. In practice, the professionals within the A&E Departments proceed on the basis of 'individual patient events'. They argue that each event requires a special set of decisions that cannot be deduced from any given 'category' of experience. It is unclear how the proposed new organisational system will provide a foundation for citizens to make 'rational' choices about health care in the way that officials in the Department of Health assume that they will.

The potential benefits and difficulties that are likely to be encountered as the new structure for emergency health care is put in place are considered later in this study. The nature of the knowledge management processes and cultures that exist in different activity areas within the system of emergency health care need to be understood to assess the nature of any transition towards more knowledge-driven activity. The role of ICTs is closely bound up with the broader system of knowledge creation, circulation and application. The technology designers have made a variety of assumptions about the motivations of the members of disparate professional communities. For instance, it is often assumed that these professionals have the time and financial resources to make far-reaching changes. It is also frequently imagined that these disparate professional communities are building up commensurate knowledge bases and that they have strong incentives to share these knowledge bases. There is a strong presumption that citizens will be reasonably well-placed to make the choices about how to proceed through the health care system to obtain the care they need.

The following section considers some of the ways in which ICTs are being applied within in the structure and organisation of the emergency health care system.

4 Emergency Health Care Innovations

As indicated in Section 3, emergency health care is provided by several organisations in the United Kingdom that are expected to work together as components of the emergency health care system. The number of components has increased over the last decade. The system consists principally of the Ambulance Service, NHS Walk-In Centres, A&E Departments, and NHS Direct. Members of the public could access all of these directly in early 2002 or they could be referred by a GP. Each of these components is using ICT applications which have been introduced over the past decade.

Research and development on the use of ICTs to support health care has resulted in many innovative means of linking up the components of the health care system.¹⁷ Some of these are highlighted below and detailed consideration is given to the development of NHS Direct. This service illustrates how the preferences and motivations of those developing and using the service have influenced its deployment.

4.1 ICTs Across the Emergency Health Care System

The Ambulance Service

ICT applications are enabling this service to become a more important part of the emergency health care system and to move away from its former image as a transport service. Each of the ambulance services is county-based and the uptake of ICTs varies regionally. However, there is an association of ambulance services which is trying to co-ordinate these developments across all the ambulance services.

The use of ICTs is enabling ambulance staff to: navigate easily to an incident site; allow paramedics to follow procedures from hand-held computers; record basic patient information and send it to A&E departments; send still images of incident sites to hospital trauma specialists; and send patient vital signs (up to and including ECG) to A&E departments.

In early 2002, the technology was not yet in place to allow searching of databases, e.g. to discover a patient's recent medical history, or to transfer information gained by the paramedic team to a central Electronic Patient Record (EPR). This was because the NHS community had not reached agreement on a universal standard for an EPR.

NHS Walk-In Centres (WICs)

WICs are staffed by Nurse Practitioners (NPs) who, through the use of agreed protocols, can treat minor conditions. These protocols are developed by the NPs in conjunction with their local GPs and A&E Departments. The technology installed in the WICs allows them to record basic information on patient encounters that is similar to the Patient Administration Systems (PAS) in hospitals. There has been a move to standardise these systems across WICs by installing a patient encounter and decision support system.

Several sites are using videoconferencing links between WICs in the same locality and the central A&E Department. These links have been installed to enable NPs: to communicate with staff in the A&E departments by exchanging still and video images to obtain second and higher opinions; to pass comprehensive information to staff in the A&E departments on referrals; and to have the opportunity for education and training and to obtain peer support. The finding of evaluation studies is that the use of these videoconferencing links decreases with time as NPs become more skilled.

A&E Departments

These departments use the Patient Administration System (PAS) which integrates them with the main hospital and with the CASS. The use of ICTs is not highly developed in the A&E Departments. Although the staff have adopted the ICTs provided by the hospitals, they have not developed links with, for example, the GPs or, until recently, with the WICs. The major obstacle appears to be that ICT applications are not perceived to offer clear advantages to A&E Department staff. Application interfaces are perceived as being cumbersome and the information that is available is not presented in a format that A&E personnel believe they require.

4.2 Fostering Innovations in Health Care - NHS Direct

NHS Direct is enabled by ICT (telephony and Internet-based computing). It uses ICT applications such as call line identification, decision support software, and tools for database creation and searching. It also requires highly trained operational staff to handle requests for information and to give clinical advice.

Launched in March 1998, NHS Direct was a twenty-four hour health information and advice help line with a remit to provide faster and easier access to advice and information about health, illness and the services provided by the NHS.¹⁸ Three small pilot projects were expanded to include twenty-two call centres covering England and Wales, all of which can be accessed using a single telephone number. A contributing, but by no means the only, factor to the successful development of the NHS Direct service is the underlying software – CASS (Computerised Assessment Software System). The selection and deployment of this software illustrates some of the implications of this system for health care professionals and the public.¹⁹

Goal Setting and ICT System Design ...

The White Paper on *The New NHS: Modern and Dependable* in December 1997 set out a political vision for health care in the United Kingdom. The aim was to reduce inequality in access to health care. The Department of Health set up a team with a remit to implement the vision. Members of the team visited the United States to assess health care innovations that had been developed by the Health Management Organizations (HMOs). At the same time, Professor Jeremy Dale, then at King's College London, had been developing a prototype public domain software product. This might have provided a basis for the implementation of a concept that would provide a new means of accessing health care information and clinical advice. Several additional systems were also under development in the United Kingdom at the time. The NHS Project Management Team initiated three pilot trials using three different pieces of software with a view to selecting an appropriate system for further development.

The NHS Project Management Team was introduced to the CASS product during the trial period. AXA Insurance, one of the largest insurance companies in the world, had developed this software system. This company had been developing proprietary software systems for managing claims by its clients on a worldwide basis for some time. The software system and the capacity for providing support, back up, maintenance and upgrading had been much more fully developed for the CASS than for the British prototypes that were being tested in the United Kingdom. The CASS had been applied within the United States. The NHS team had to work closely with AXA software developers to localise the CASS product to accommodate linguistic differences in the United Kingdom as well as differences in health care processes and procedures. The NHS team secured a license for the further development of the CASS including an agreement that, should the NHS sell the modified CASS product overseas, it would be entitled to retain a share of the royalties.

As a result of the early steps to localise the CASS product, the NHS and the AXA software developer teams became closely integrated and they have remained so. The AXA proprietary software system platform was selected over the prototypes in the United Kingdom that were based on open platforms. The choice has been reported as being based, not so much on the technical superiority of the AXA system, but on the scale and scope of the AXA team's experience in the field. It is unclear how the NHS team became aware of the CASS. It may be that they 'found' or discovered it during their visit to the United States or that the AXA marketing team discovered a potentially lucrative opportunity in the vision set out by the Labour government in 1997.

The goals of the NHS Direct service were understood by the NHS Team as being to provide a response to a political vision calling for greater equity in access to health care. The goal was to create a system to alleviate growing pressures on GPs and A&E professionals. The new technical system was expected to take advantage of the convergence of telephony and computing which had led to innovations in the development of user-friendly decision support software and the growing sophistication of database manipulation techniques. The potential of the technology was believed to have reached a stage where it would be feasible to offer an effective electronically supported health care management system. The long-term goal was to develop a single 'virtual call centre' that could support and complement the activities of all the components of the health care system.

Since its initial implementation a new national NHS Clinical Assessment System (CAS) has been installed at the twenty-two NHS Direct sites enabling the service to provide the virtual contact centre. The CAS system enables calls to be moved between sites to match demand and capacity and provides back-up in cases of service or system failure. It enables sites to be moved to areas where it is easiest to recruit staff and the flexibility to close sites to provide time for training and quality improvement activities. In 2001 a new NHS Direct search engine was introduced provided by AXA under an NHS CAS contract.

The service provides multiple services including NHS Direct Online,²⁰ Information Points, NHS Direct inVision (a digital TV project) and a Self-Help Guide. It is also being integrated within the wider NHS. The aim is to work 'with frontline staff and managers to devise new ways of working alongside existing services'.²¹ This goal that implies a necessity for sharing knowledge across the boundaries of the many health care practitioner communities. Each NHS Direct site has a Lead Nurse and a Medical Director who share responsibility for clinical governance within a national framework.

Developing NHS Direct Online ...

NHS Direct Online was launched in December 1999 and receives approximately 4.6 million hits per month (or about 140,000 visitor sessions). Typical users view 30 to 40 text pages and spend about 10 to 15 minutes online. The software platform is intended to enable the use of electronic feedback and to allow nurses and other clinicians to obtain live feedback. The nhs.uk searchable database of local NHS services has been expanded to include hospital and community health services, GP practices, dental services, pharmacies, opticians and health authorities.

The online service was re-launched in November 2001 with a new structure and a new health information enquiry service. This includes a system whereby skilled health information professionals research enquiries and send out individual responses. There is also a health encyclopaedia covering 400 topics with information on illnesses, tests, treatments and operations supported by illustrations and multimedia content. There is an NHS Direct Online Editorial Board, which prioritises content requirements, commissions content development from external developers, and undertakes quality assurance.

NHS Direct Online is working with the NHS Information Authority to develop a joint citizen and patient reference group that can be consulted about information-related initiatives. In addition to making the service available via NHS Direct Information Points, the content is available through three NHS digital TV pilots (Living Health – Telewest, Birmingham; Channel Health – Sky Digital, national; and Communicopia – Hull and Chiswick). The NHS Direct inVision service allows NHS Direct nurses to consult on the telephone while the patient sees the nurse on the television and photographs or videos can be shown.

Evaluating the New Health Care Service ...

By November 2001, NHS Direct had handled 8.2 million calls from patients in England. The service handles about 10,000 calls per day across the sites, each of which has a catchment area of between 1.3 and 4 million people. It is expected that call levels will rise from about 7 million in 2001-02 to 18 million in 2003-04 as a result of increased awareness and service development. Since its initiation in 1998, NHS Direct has grown into the biggest telecommunication-based health care system in the world. The idea was borrowed and modified from the United States where HMOs had promoted the concept of effective management of patient care at all stages of an individual's life including their critical health care experiences. The use of the telephone as a tool, together with supporting software systems, provided a major opportunity to rethink the operation of the emergency health care system in the United Kingdom.

Published evaluations of the telephone help line services indicate that they are well-used. These services have increased access to advice and information without increasing demand on other parts of the NHS. NHS Direct appears to provide an entry point to the NHS that is deemed to be as safe as other entry points. Some 95% of callers report that they are satisfied with the service.²² Evaluations of the NHS Direct service suggest that about 90% of callers follow all or most of the advice they are given by NHS Direct.

In March 1999, the NHS Direct Access Issues Group was formed to identify and agree common policies, mechanisms and standards to ensure that NHS Direct provides an open access service, but the usage profile suggests that the service is not perceived to be open to all. The age and gender profile of NHS Direct users is shown in Table 2. Those under seventeen years of age and young adults from up to 25 years of age are the main users of the services. About 20% of calls to NHS Direct are for health information and are handled by health information professionals without any consultation with a nurse. Decisions with respect to the routing of patients through

the health care system were distributed during 2001 as shown in Table 3. This table shows that many visitors to the NHS Direct site (34%) are advised to engage in self-care rather than to enter one of the access routes in the NHS.

Table 2 Age and Gender of NHS Direct Patients

Age Group	Female %	Male %	Total %
<17 years	29	42	34
17-25 years	17	10	14
26-45 years	30	22	27
46-65 years	14	13	13
>65 years	11	13	12
Total	61	39	100

Source: NHS Direct monthly returns 2001 *NHS Direct – A new gateway to health care*, London

Table 3 Recommendations by NHS Direct

End-Point	Patients %
Transferred to 999	3
Accident and Emergency	8
GP immediate (within 4 hours)	16
GP urgent (between 4 and 24 hours)	9
GP routine (over 24 hours)	13
Other non-GP NHS adviser	6
Self-care	34
Other	11

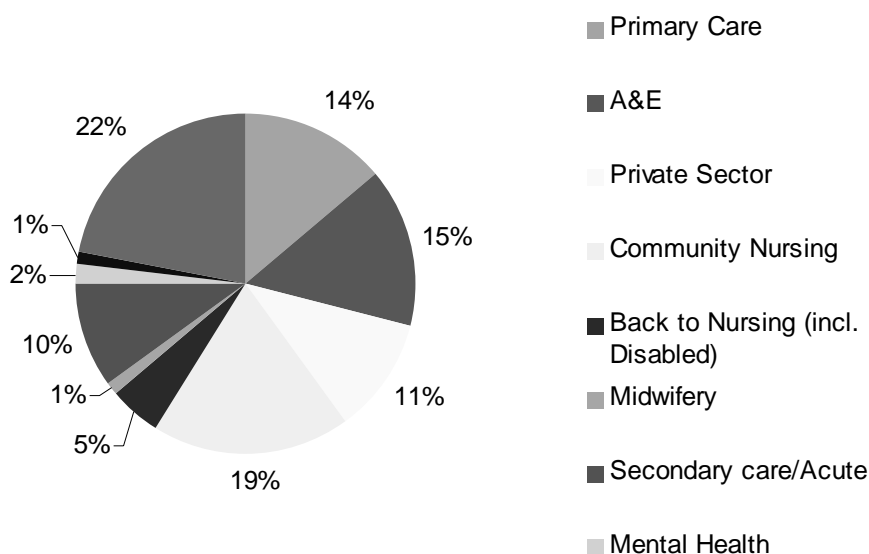
Source: NHS Direct daily information returns 2001 in *NHS Direct – A new gateway to health care*, London

The NHS Direct call handling and health information staff come from a range of backgrounds and are trained in providing health information at the appropriate level. They use a range of quality-assessed resources in both electronic and print formats. Experienced nurses handle clinical calls. Over 60% of the staff are part-time workers and many combine working at NHS Direct with work in other parts of the NHS. NHS Direct rotates staff between the telephone service and face-to-face clinical placements, and especially between NHS Direct and NHS Walk-in Centres. The backgrounds of the nursing staff are shown in Figure 5 indicating the variety of professional communities that are involved.

There are moves to encourage some knowledge sharing across professional boundaries. For example, at the NHS Direct West London site, the Exocet project (Exchange of Clinical Electronic Triage) is operating between NHS Direct and Harmoni (the GP's co-operative), which enables GPs to have an electronic copy of consultations carried out by NHS Direct nurses (only with the patient's permission).

We examine the way that the NHS Direct system and other uses of ICTs within the emergency health care system is perceived by members of the professional communities in the next section.

Figure 5 NHS Direct Nursing Staff Backgrounds



Source: *NHS Direct – A new gateway to health care*, London 2001.

5 Benefits and Risks of Innovations in Health Care Provision

An examination of the way that the NHS Direct system has been positioned within the emergency health care system offers insights into the perceived benefits and risks of this ‘top down’ ICT development plan. This ICT initiative was intended to augment the knowledge management process throughout a very complex organisational system. NHS Direct was developed as a result work undertaken by a project team charged with selecting and implementing services. They led a process of negotiation which was intended to facilitate a shared understanding of the desirable features of the services. The team interacted with key groups of professionals.²³

Mandating Technical Standards ...

The Computerised Assessment Software System (CASS) system was introduced as a mandatory standard by the team charged with developing NHS Direct services. Evaluations of the services show that NHS Direct has been a success from a technical point of view. However, interviewees for this case study suggested that there is substantial ambivalence towards the new services within the health care professional community. The software does appear to provide a more effective means of managing and circulating information that is essential for improvements in health care management. However, there appears to be very little co-ordination between the communities of professionals who must become ‘enrolled’ in the new procedures and processes that NHS Direct supports.

Fostering New Communication Relationships ...

One source of resistance to the NHS Direct system arises from poor communication between those who gain experience of the NHS Direct system and those within the

wider health care system who do not. Another source of resistance arises from the impermeable boundaries of the professional communities within the health care system. NHS Direct is intended to establish links between the GPs, the A&E professionals, the Minor Injuries professionals, and the Ambulance personnel. However, there is a need for innovative organisational strategies to overcome barriers to effective communication between these groups.

The communication relationships between the Ambulance Service and NHS Direct personnel are strongest because the Ambulance personnel have always been good at collecting information that has the potential to be circulated and used by others within the health care system, assuming it is retained. The Ambulance Service seems to have moved quickly to adopt ICTs because paramedics tend to codify information and to share knowledge in the local context of their work. However, this knowledge only circulates when the ambulance service lends paramedics to A&E Departments when there are shortages of nurses.

Others in the health care community, including the A&E professionals, suggest that NHS Direct is forging ahead because of the substantial funding base that it has received and the high profile it has attained because it operates on a national scale. There is a perception that because the other emergency health care components are organised regionally or locally, their ICT initiatives receive much less attention and publicity.

The national scale of NHS Direct is also important because new developments in procedures or in software 'patches' can be shared easily through out the twenty-two locations. In addition, the introduction of the system was imposed on a 'green field' site. This appears to have created advantages in terms of the effectiveness of the learning and problem-solving process. Because it is an entirely new system, the barriers to replication of the new organisational and technical routines throughout the health care system may also be lower than in cases where disparate routines are already in place.

Competing ICT Systems ...

During the period that the NHS Direct service has been implemented, the NHS Walk-in Centres (WICs) have been developing computer-based decision support systems independently of each other and in line with the policies and funding provided by their respective hospital Trusts. These systems are proprietary and the variety of developments has made it difficult to circulate information across the institutional boundaries of the Trusts. Nevertheless, having invested in these systems and the associated training, the WIC staff are resisting the introduction of what they perceive as a 'top down' NHS Direct solution.

There continues to be uncertainty and debate about the clinical effect of the technical and organisational innovations that are embodied in the NHS Direct system as well as its links to the other components of the emergency health care system. One of the initial goals was to reduce the workload of GPs, but patients still follow many pathways through the health care system including care by GPs. In addition, the amount of cooperation between GPs and other components of the health care system is reported to be relatively small.

Barriers to Knowledge Circulation ...

There is ongoing debate about the effects of inconsistencies in the information, advice and decisions regarding health care and treatment that are present. These can be attributed to a lack of co-ordination between the members of the many professional communities. The organisational incentive structures perpetuate this lack of consistency despite the use of ICT-based knowledge management systems. Most members of the professional communities believe that they have reasonably good internal information and decision support systems, albeit using different standards and platforms.

The NHS Direct development is creating some momentum for significant change and the NHS Direct team has some authority to cause others to adopt the system. However, even when the team's developers can demonstrate to the members of the professional communities that there is no potential harm or risk to the quality of health care, they cannot claim that there are no ongoing costs. There are substantial and ongoing costs associated with the adoption of the new ICT supported emergency health care system. With constraints on budgets throughout the health care system, the experience is that software based innovations have a very low chance of being regarded favourably by professionals. This is especially so when legacy information systems are in place.

Overcoming the barriers to the circulation of knowledge between the professional communities may be achieved as a result of encouraging more intensive interactions between them. One response to the need to achieve greater interaction has been to encourage the circulation of individuals who can share and report their experiences with the new development of NHS Direct. However, this organisational change is proving difficult to implement.

New Professional Communities and Training Issues ...

NHS Direct employed about 12,000 full time equivalent nurses and 800 call handlers in 2002. The Health Information Call Handlers are developing into a community of skilled employees who have acquired the knowledge to make important health care decisions. They acquire the capability to differentiate between NHS Direct callers who are seeking information from those who need a clinical judgement and response. There are problems in maintaining and building this new community of employees since their remuneration must reflect their accumulating skills and knowledge base. The nurses employed by NHS Direct have to be highly trained and must work unsocial hours and there are recruitment problems.

The staffs of other health care institutions are concerned about the threat of 'poaching' of hospital staff. To alleviate this concern, a procedure for the circulation of staff from their institutions (using rotation posts) to and from NHS Direct has been introduced. There are also opportunities for the circulation of the Call Handlers from NHS Direct back into the A&E Departments. This is helping to promote peer-to-peer networking that can facilitate the circulation of information about NHS Direct and help to build up a more favourable knowledge base with respect to the system.

The problem of improving information exchanges within the hierarchy of the various professional communities is more intractable. Although nurses and Call Handlers interact with others up and down the knowledge (professional) hierarchy, this is not necessarily so for other professional groups. There are several factors that militate against these kinds of knowledge sharing activities. Among these are major constraints on the availability of time for learning how to use the new systems, for maintaining them, and on the funding for the necessary training.

To cover the costs of training in all areas, for example, the NHS allocates nurses a total of around £150 each per year. This is a derisory amount given the rapid rate at which new skills need to be acquired through training. For nurses and other professionals, even where the skills base exists, time constraints make it very difficult to encourage personnel to capture the knowledge they acquire as a result of their changing practices. This is so even when the necessary ICT systems are in place to receive the relevant information. For example, the NHS WICs could devote resources in terms of person-days to capturing new protocols and writing them down so that solutions might be shared and circulated to others, but this rarely occurs in practice. Even though common technical systems have the potential to reduce inconsistencies in the practice and delivery of health care, the members of the professional communities continue to develop their own local practices.

Competing Priorities for Acquiring New Competencies ...

A major source of resistance to the introduction of ICT decision support and knowledge management systems such as NHS Direct reportedly comes from the doctors (including both GPs and A&E Consultants). These professionals argue that in the fourth and fifth years of their medical training and in their first years as junior hospital doctors, there is no time (especially with EU restrictions on working hours) for training in the use of the ICT systems. This is because of the multiple demands on trainees to acquire their specialist knowledge through clinical work. In the view of one interviewee for this study, it is simply impossible to fit in the training needed to accumulate experience with new technology alongside the specialist knowledge training that is needed. Peer-to-peer knowledge sharing could be encouraged by the circulation of trainees in and out of WICs, but this too is being resisted.

Doctors are perceived as being resistant to efforts to change what they have learned as 'best practice' during their early training. One interviewee claimed that he relied entirely upon his tacit (internal) knowledge in his emergency health care work. He had little positive to say about the use of ICT systems. He argued that there is no time for 'fancy systems'. This interviewee flies to accidents by helicopter together with paramedics upon whom he relies to a substantial degree and in whom he places great trust. The problem as he saw it was that no corpus of explicit knowledge embedded within an ICT system could be sufficiently context-specific to meet his needs in an emergency. In addition, he argued that no amount of ICT use could substitute for the trust relationship he has with the paramedics.

This interviewee appeared to assume that the use of ICT decision support systems necessarily substitutes for other relationships rather than complementing them. For instance, his present practices and relationships might be expected to continue if ICT applications were introduced. Applications might be used to support the preparation

of other health care services before he attends an incident or afterwards during the follow-up care that may be provided. Improved access to digital information might enhance those practices that will continue to rely on trusted, time-critical, and internal knowledge.

Promoting Equitable Access to Health Care ...

The implementation of NHS Direct, at least in its first years of operation, has shown that a service can be provided in this way and that it appears to be offering a successful route into the health care system for the young. However, it cannot be said to be providing greater 'equity of access'. The development of NHS Direct does not mean that everyone is a beneficiary. Such an assessment would require a much deeper understanding of who has difficulty accessing health care services and why this is the case.

NHS Direct is offering a means of reducing the technical heterogeneity of ICT systems in the emergency health care system. This heterogeneity has been created by the independent and uncoordinated initiatives of the many professional communities within the system, including the ICT developers. Some regard NHS Direct as a major catalyst for organisational change and for information sharing and knowledge creation. There are, however, many professionals who are resistant to the changes that are underway. In the Section 6, some of the broader implications of these changes are considered.

6 Organisational Change in the Health Care System

The discussion in Section 5 illustrates that a standard ICT solution such as NHS Direct can be imposed in a way that brings considerable benefits. However, it also suggests that new knowledge management processes have substantial implications for all the professionals who work within the health care system. The introduction of the new ICT systems creates the need for far-reaching organisational change, the development of new modes of working and information sharing, and ongoing investment in ICTs throughout the health care system.

The Costs of Change ...

Including the costs of rotation posts for staff, the overall indirect costs of recent changes in the organisation of the health care system were estimated by one interviewee as being five times those of the direct costs of the NHS Direct system's development and implementation. Achieving the desired externalities throughout the health care system may be expected to incur ongoing costs. There is a need for investment in people, new institutions, and technology over a twenty year period of transition to a more knowledge-driven public sector health care delivery system. During this time further innovations in technology may be introduced, giving rise to new cycles of investment and learning.

The targets set by those charged with evaluating the impact of the new ICT system are generally set so as to show evidence of major improvements in health care within three to five years. In the 'classic' diffusion process, early adopters may galvanise the

enthusiasm of others during an initial period of rapid take-up of a new system like NHS Direct. But when the diffusion curve begins to level off, the major question is whether those who finance ICT developments within the NHS will remain committed or whether they will shift their focus (along with funding) to new areas to address, as yet, unknown or currently low priority problems.

Uneven Perceptions of Benefits among NHS Professional Communities ...

The NHS Direct system was intended initially to improve health care access for the socially excluded and, specifically, for elderly people. The latter represent only 12% of the users (see Table 2 above) and it is young people and young adults who represent the major users of the service. It is uncertain whether their usage patterns will be maintained as they move into older age cohorts, an uncertainty that is common to experience with new ICT applications in other fields. Although NHS Direct may be evaluated as being successful by criteria such as helping to reduce GP's work loads or improving 'equity of access' overall, it is not alleviating the underlying disparities between groups within the population such between the wealthy and the poor or the elderly. There is evidence that the elderly and the poor still go mainly to GPs.

In addition, the contextual information that is essential for the application of information exchanged using ICTs is proving very difficult to circulate across professional communities. The unified NHS Direct system appears to be helping to create incentives for the circulation of contextual information, but it cannot overcome deeply held resistances to the use of the new technologies or a lack of time or funding for training and education. As successive governments curtail the funds available for education and training across the health care system, the potential for encouraging innovative knowledge management practices is being reduced.

Islands of Effective Knowledge Management ...

The 'islands' of effective knowledge management within the emergency health care system suggest that this system may have moved about a third of the way along the diffusion pathway towards full absorption of the new ICT systems that are available today in terms of the integration of ICTs in a way that yields an improved co-ordination of the knowledge base of all the professional communities. Much of the experience needed to achieve even greater integration and use of the new technologies is being circulated by the personnel through their social networks within their professional communities.

Further progress may be impeded by several factors: 1) the high cost of the continuous development and redevelopment of the underlying technology requires sustained funding. A plateau in the perceived improvement of health care services could threaten the flow of funds for initiatives such as NHS Direct; 2) a failure by the Department of Health to recognise that investment in education and training is essential to support further integration could slow progress in achieving the necessary organisational transformations. Resources are needed both for training and in-service training; and 3) worsening time constraints such that professionals must work 'flat out' to deal with immediate problems and crises, means that they have little time for reflection, for developing new organisational routines, or for using and maintaining the information that is essential to effective ICT supported knowledge systems.

Mutual Interdependence of Professional Communities ...

The results of this case study appear to confirm those of another study of the development and transfer of 'best practice' more generally within the NHS.²⁴ That study examined the potential for the transfer of 'best practice' with respect to cataract surgery. It was concluded that,

'at least in situations where the practice involves a complex process that is poorly understood by those involved and where the practice is divided up between groups of interdependent professionals, the effective transfer of "best practices" cannot occur independently of or in sequence to the generation of knowledge about current practice. This is because ... the processes of knowledge generation and transfer are mutually dependent'.²⁵

This mutual interdependence of the processes of the generation and transfer of knowledge may explain why there are high barriers to the circulation of new knowledge within the health care system and why there is some resistance to using ICTs.

Scarce Time and Funding Resources Create Major Constraints ...

Additional factors may account for the difficulties in achieving a more rapid transformation of the emergency health care system. The 'top-down' imposition of ICT system standards, protocols and information resources has helped to establish the NHS Direct system by creating a strong momentum for change. However, under-funding of training and education for the intended users is a continuing problem. Without the time and resources for training and to introduce organisational change, health care professionals are likely to continue to resist wider use of ICTs. Their perceptions of the benefits of ICTs may not be indicative of insurmountable difficulties in achieving the goal of moving towards a more knowledge-driven health care system.

Citizen and Patient Perspectives ...

It was not feasible in this study to assess patient perspectives on the redesign of the pathways through the emergency health care system. Patients' representatives have been included in discussions about the proposals for the reorganisation of the health care system that are under consideration. However, interviews with such representatives would not shed light on questions about whether the proposed system is likely to improve equity of access to health care. This would require an examination of the way citizens perceive the trends towards an increase in the variety of pathways through the health care system. It would require consideration of the implications of standardised ICT-supported knowledge bases to assess whether this encourages reduced variety in the health care offered in response to specific health events. The benefits of the growth in the number of sources of professionally accredited and lay health care information (via web access) also need examination.

In assessing the impact of the health care system on patient care, it is important to recognise that patients divide into several groups in terms of their 'adherence' to

medical advice. Studies of pharmacy practice, for example, suggest that even if prescriptions are evidence-based and appropriate, at least one-third of all prescribed medication will not be taken as directed and that non-adherence to prescribed medication may be intentional as well as accidental.²⁶ Health psychology theories often focus on self-regulatory behaviour and ‘common sense models’ of healthy living. Many of these perspectives treat the patient as an ‘active problem solver’.²⁷ Patients’ ideas about their illnesses may be organised around their identities, beliefs about the time line of an illness, its causes and consequences, and the likelihood of a control or cure. Their ideas about an illness may have a stronger influence on their behaviour than the advice of health care practitioners.

Intentional non-adherers cannot be assisted by any system of knowledge management. Intentional adherers, who slip up, however, may benefit from a more knowledge-driven health care system. However, these intentional adherers who tend to be wealthier and better educated are likely to progress through any health care system successfully. The reconfiguration of the emergency health care knowledge system is likely to offer the greatest benefit to those intentional adherers who slip up. They may benefit from improvements in their own knowledge base and in that of the professional communities with whom they interact.

Some people may feel overwhelmed by the information intensity of emerging emergency health care system, while others will relish opportunities to seek information. At present no evidence-base is being accumulated to assess these potential outcomes. The assumption is that an improved knowledge base and greater circulation of knowledge will yield a more effective and efficient emergency health care delivery system. It is this viewpoint which is forcefully motivating the champions of the new ICT systems. However, it is important to assess the conditions under which the new systems are being introduced. Their use may alter the perceived reliability, salience, and cultural specificity of the information that circulates through the health care system. This may involve changes that are valued by the health care professionals and by the public, but it may also involve changes that are not welcomed by some citizens and professionals.

Whether the use of ICTs is leading to better outcomes for patients and to better health care is difficult to measure. This is because of the relatively short-term targets that are established in monitoring the effects of the changes and because of the limited nature of the indicators selected for evaluation purposes. The National Institute for Clinical Excellence (NICE) was set up as a special health authority for England and Wales in 1999.²⁸ Its role is to provide patients, health professionals, and the public with authoritative, robust, and reliable guidance on current ‘best practice’. It manages the collection of data that can be used to relate health care activity to outcomes on the basis of the consequences of medical interventions. However, this work is based on clinical data. It is therefore medically biased and unable to provide a full picture of a patient’s health as experienced in his or her own social or economic context.

Future Policies for Knowledge Management in the Health Care System ...

In January 2002, the Government published a response to an inquiry into a hospital's record of children's heart surgery.²⁹ The overall goal of the response was to 'put patients at the centre of the NHS'. Of the many detailed recommendations, the second stated that, 'the education and training of all health care professionals should be imbued with the idea of partnership between the health care professional and the patient'. Several recommendations dealt with information that should be available about treatments and care and the need to tailor information to specific needs and circumstances. Greater emphasis is to be given to providing information based on currently available evidence in a form that is comprehensible to patients. Efforts are to be made to use various means to convey information, to improve the quality of information in relation to content and dissemination, and to provide guidance about the sources of information about health and health care and their reliability.

The Government's response identifies the need for a National Knowledge Service (NKS) for the NHS 'to support the delivery of high quality information for patients and staff'. The NKS is expected to integrate existing systems such as Department of Health websites, NHS Direct On-Line, and the National Electronic Library for Health. NKS will be accessible at 'different levels of understanding' and for 'meeting the needs for knowledge to support patient care'. A first step in the development of the NKS has been to install a unified system in A&E Departments, Walk-in-Centres and Minor Injuries Units based on the NHS Direct system protocols in order to assist with patient triage and diagnosis. A long term goal is to create 'expert and informed patients' with the implication that the public will adopt healthier lifestyles, self-medicate, or refer themselves appropriately through the health care system. This is expected to take a burden off the NHS; a system which has a throughput of one million patient encounters every 36 hours. The system developers of the new NKS, which is aimed at patients, informal carers and health and social care professionals, will clearly need to negotiate a shared understanding of the ICT system that is needed and of the service they want to deliver.

Promoting Knowledge Sharing ...

The greatest challenge is to give much greater consideration to how ICT services can be used effectively to contribute to knowledge sharing. Plans to link websites together suggest a mechanistic approach rather than one that is primarily concerned with improvements in health care outcomes and that has a patient focus. Government-supported initiatives to develop knowledge systems in the health care field may be focusing on too broad a range of initiatives. Priority is not being given to the 'usability' of the new systems for *all* those who are expected to benefit from their development.

The transformation towards a more knowledge-driven health care system requires an assessment of changing perceptions of what it means to be 'healthy'. It also requires greater insight into the views of the health care professionals and policy makers who are promoting the use of ICT systems. Their perceptions of what is needed and desirable will be influential in mobilising resources for the further evolution of the health care system.

7 Knowledge Management for Health Care Delivery

This case study illustrates the significance of 'knowledge management' as an issue for health care delivery. The emergency health care system in the United Kingdom is characterised by substantial complexity and the health care system as a whole is undergoing considerable transformation. There is a high risk of failure especially if inequality of access persists. The emergency health care system is making increasing use of ICTs, but the deployment of new applications is uneven across the system. This is producing new problems for the co-ordination of information and for the knowledge sharing practices of health care professionals.

The importance of knowledge management in the health care system is being acknowledged, but the strategies to develop new norms and practices and ICT tools are very diverse. In many cases, new initiatives are justified by general statements of goals such as 'improving outcomes of patients'. There are many reviews and evaluations of the 'tractable problems', but few in-depth considerations of the emergency health care system as a venture in social problem-solving. Social problem-solving involves working with complex systems that suffer from 'impairments' at all levels.³⁰ The greatest challenge is to alleviate some of these impairments by tackling knowledge management difficulties at the micro- and the macro-institutional levels.

In this study the principal focus is on the information flows and knowledge base that play a role in the activities of professionals who triage patients through a complex health care system. The introduction of ICTs to support decision-making is expected to alleviate the crisis of a growing mismatch of capacity and demand in the emergency health care system. The goal is to achieve an optimal use of scarce health care resources, partly by creating an efficient knowledge-driven health care system.

Changes in the organisation of the emergency health care system are altering the way information is accumulated and exchanged between members of the professional communities. Some of the new ICT systems are being resisted by the professionals they are intended to benefit. Two sets of problems are being encountered during the process of transformation. The first set of problems is concerned with organisational issues with respect to information collection, retention, and distribution. The second set of problems is concerned with technical issues with respect to establishing agreed standards and protocols for ICT system interoperability and for human-computer interaction. The aim is to develop systems that yield timely, relevant, and usable information for health care professionals.

The measurement of progress in the use of ICTs to support improved health management currently focuses mainly on patient outcomes rather than on the nature of the activities of the professionals themselves or of citizens. The activities of professionals and citizens are much more difficult to examine, but they must be considered if the health care system is to become more effective and efficient.

The emergency health care system is characterised by a relatively rapid rate of technological change, but this is complemented by a very slow rate of learning to take

advantage of the new technologies, especially where this involves changes in the circulation of information and the build up of a more integrated knowledge base. The risk is that this sector – and the NHS more generally – is becoming trapped and unable to generate the kinds of organisational change and social learning infrastructure that is required to move towards a more knowledge-driven operation.³¹

The health care system in the United Kingdom is the recipient of substantial public funding. It is also a system that is reliant on scientific knowledge and the fruits of evolving clinical practice. It is a sector in which there is substantial technological change to support innovative clinical techniques and interventions that aim to improve the health of citizens who pass through the system. Yet, apart from the professionals who are designing and implementing ICT-related innovations, there are few signs that the capacity for learning to take advantage of these innovations is being developed. In fact, there is an ethos within some of the relevant professional communities that is antithetical to further development. For some members of these communities, the notion that greater time and resources should be allocated to pursuing increased dependence on electronic information resources and means of communication is simply the wrong strategy.

Nevertheless, growing emphasis on knowledge-driven activities is evident in the emergency health care system and many concurrent and mutually reinforcing technological and social transformations are underway. There is the potential for health care professionals and citizens to benefit from these changes. However, the existing learning processes are discontinuous and discordant and, in some cases, valuable information is being lost. Although health care professionals acknowledge that this may contribute to the deepening problems of the emergency health care system, many do not see the need for technological solutions. The preference is for further development of traditional social networks. It is also proving difficult to enable the professional communities to negotiate agreements about the design and use of the new technologies and about improved procedures for managing knowledge.

In this case study, we have focused on the flows of clinical knowledge for professionals but the insights about the role of ICTs and the importance of knowledge management are relevant to health knowledge for patients and other individuals. The health care knowledge base needs to be built up through feedback mechanisms. However, the mechanisms in place currently do not appear to be the best way to achieve this. If ICTs are configured and used in ways that facilitate feedback, they are likely to support the emergence of more robust knowledge management practices.

Policy is needed to address the failure to invest in an infrastructure that would enable an effective learning system. Policy measures need to focus on the social processes that underpin negotiations about how ICTs should be used to provide health care services. Patient expectations of the service they can expect to receive are rising and the changes in the NHS are creating uncertainties and additional complexity. This study provides evidence of the growing application of ICTs to support knowledge-driven activities. However, several key issues need to be addressed urgently.

ICT Applications are not Tailored to the Needs of Users ...

These technologies are not necessarily tailored to the requirements of communities of professionals or to the requirements of citizens who are already disadvantaged. In some instances, ICTs are being used to capture knowledge and to enable its more effective distribution. In others, there are substantial difficulties due to lack of time and resources available to professionals. This constraint pervades the emergency health care system and is exacerbated by continuing turbulence in the wider NHS system.

Professional Hierarchies and Boundaries ...

There is evidence of resistance to changes in the way the learning system operates within the emergency health care system. Personal knowledge, interpersonal trust, and the hierarchies within professional communities govern what knowledge is collected and available for reapplication. At the same time, some professionals within these communities are developing new opportunities for learning based, in part, on the use of ICTs.

Under-investment in Training and Education ...

Innovative information services such as NHS Direct are being developed to provide decision support in the health care system. Increasing emphasis is being given to the human and technology-based NHS Direct services to triage members of the public through the health care system. However, at the same time, under-investment in training and education is perpetuating, and perhaps even entrenching, traditional social norms and practices that govern when and with whom knowledge can be shared.

Building Trust between Interdependent Professional Communities ...

There is much potential to build trust in the relevance and quality of the information embodied in ICT decision support systems. This is occurring principally as a result of the enhanced mobility of professional workers who acquire familiarity with new norms and practices for knowledge generation and exchange through their experience with the new ICT systems such as NHS Direct. They are sharing their experiences through peer-to-peer networking across various professional communities.

This study does not provide a basis for drawing general conclusions about the overall health care sector. However, there must be an effort to reverse the declining rate of investment in the learning system. Efforts must be made to forge better relationships between those who are responsible for organisational and technological change.

Transforming Norms and Practices ...

The professional communities in the emergency health care sector show signs of innovative performance, but there are also significant indications of dysfunction. The latter is attributable to an overemphasis on technology rather than on the purposes for which knowledge must be generated and applied to enhance the quality of the health care system. It has been suggested that ‘... a knowledge society is not simply a society of more experts, more technological gadgets, more specialist interpretations. It is a society permeated with knowledge cultures, the whole set of structures and

mechanisms that serve knowledge and unfold with its articulation'.³² Although, the application of ICTs might be expected to support the improved co-ordination of the highly distributed health care knowledge system,³³ the professionals in this sector tend to perceive their knowledge bases as being distinct. Collective knowledge about any set of practices and procedures generally develops through communication and through recursive iterations aimed at building a consensus on how technology should be deployed.³⁴ However, studies of knowledge management processes from this perspective are often highly situated or local and some analysts conclude that there is little scope for the 'mechanisation' of knowledge through the application of advanced technologies.

However, others suggest that ICTs can play a role in 'the creation of individual and organizational memory, the reproduction of successful practices across organizational units, and the reconstruction of knowledge exploration and discovery'.³⁵ In the emergency health care system, there is a continuous need to remember, to reproduce and to reconstitute knowledge. This system exhibits many of the features that would be expected in a transition towards a more knowledge-driven sector.

8 Conclusion

The varying reception of ICT applications to support the management of the knowledge upon which health care professionals rely to deliver health care services may be explained by several key features.

Effective Learning Takes Time ...

The learning process that is needed to stimulate movement towards more effective use of ICTs to deliver a public service such as emergency health care occurs over an extended period of time. 'Islands' of acceptance of the new technologies must be expected to emerge and the challenge is to enable the circulation of professionals who are able to share both their positive and negative experiences of the new applications for knowledge management.

Building capabilities and competencies for effective ICT design and use ...

Designing and absorbing ICTs is hampered by the relatively impermeable boundaries between professional communities and the hierarchies within them which creates significant co-ordination problems. It is necessary to encourage greater interaction between the numerous technical experts who are designing new decision support systems and other applications and the professionals who are the intended users. Transferring the new technologies into the public sector requires attention to the negotiation of the goals for the delivery of services and of the purposes of the application of technology in response to the existing and changing organisation of public service delivery. In the absence of successful negotiated outcomes, there is a high risk of failure and resistance to a more knowledge-driven culture.

Creating a basis for greater certainty and continuity of the funding base ...

In the emergency health care sector and more generally in the delivery of public services there are numerous stakeholder organisations including the professional communities which are the focus of this study. These include a large number of administrative agents, budget holders and government regulatory bodies (at local and central government levels). Citizens and patients, together with these stakeholders have varying views about what service should be delivered. The definition and delivery of the public service is therefore likely to be more complex and contested than is the case for the delivery of a good or service that is subject to direct signals of demand in the marketplace. This suggests that the chronic under-investment in training and education in the United Kingdom health care sector will only be addressed successfully when a more stable regime of financial decision making with clear priorities and targets is introduced.

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Notes

- 1 Department of Health (2001).
- 2 Other sources of funding include funding for health , education and the environment from the National Lottery, funds from the governments New Opportunities Fund, and local authority expenditure.
- 3 The NHS Plan published in July 2000 is at <http://www.doh.gov.uk/nhsplan/index.htm> accessed 7 December 2002 and NHS (2001a).
- 4 NHS (2001a), p. i. The targets set out were as follows: by March 2001, 95% of GP practices and 25% of Trust clinical staff with NHSnet connections and using NHS information services such as the National electronic Library for Health; by March 2002, desktop connections for NHS clinical staff to basic e-mail, browsing and directory services, and roll out of NHS cryptography support services to begin; by March 2003, migration to national standards for e-mail, browsing and office systems completed and all NHS staff with desktop access, and clinical information systems start to use the 'SNOMED' Clinical Terms; by March 2004, major national payroll/HR systems implemented' and by 2005, a vibrant networked NHS, with booking systems in place, electronic transfer of records within primary care, all acute Trusts with level 3 Electronic Patient Records and first generation Electronic Health Records, p. 7. These initiatives were all set within the wider framework of the Government's e-government 'strategic framework for public services in the Information Age' which was published in September 2000.
- 5 NHS (2001a), p. 23.
- 6 David et al. (2002).
- 7 Face-to-face interviews were conducted by Dr. Richard Curry of an average duration of one hour per interview. Interviewees included:
Dawn Hall, Project Manager, Woking NHS Walk-in Centre
Dr. Nick Robinson, Medical Director, NHS Direct, West London
Dr. Beverley Castleton, Consultant Physician, Ashford St. Peter's Hospital, Chertsey, Surrey
Dr. Jonathan Bengier, Specialist Registrar, Acute Medicine, Royal London Hospital, Whitechapel, London
Alan Kennedy, Chief Executive, Surrey Ambulance Service
Ben Toth, Head of Knowledge Management, NHS Information Authority
- 8 See Calman (1997). The report gave special emphasis to setting up emergency telephone lines, the expansion of first aid training for members of the public, and the improvement and standardization of first aid kits. It examined emergency health services, community health services, and primary care.
- 9 Salisbury (2000).
- 10 See Department of Health (no date). and Department of Health, Winter and Emergency Services Team, <http://www.doh.gov.uk/emergencycare/reform.htm> accessed 7 December 2002 for resources on capacity planning in the emergency health care service. Also Rosen et al. (2001).
- 11 See NHS (2001a) and Electronic Record Development and Implementation Programme (ERDIP) and papers from conferences on e-health, <http://www.medrecinst.com/> accessed 7 December 2002.
- 12 See <http://www.rcplondon.ac.uk/> accessed 7 December 2002.
- 13 See <http://www.asu.org.uk/> 7 December 2002.
- 14 The Ambulance Service crews say they have much more information to give that could help in the process of diagnosis and care planning, but there is no facility to transfer this information. The quality, usefulness and accuracy of information supplied by GPs is variable and the problem for A&E Departments is worsening as GPs send patients with a full printout of their record in which it is difficult to find the relevant information.
- 15 Based on interviewee suggestions.
- 16 See NHS (2001b).
- 17 New and Emerging Applications of Technology (NEAT) is one of the three main national programmes funded from the NHS R&D levy, the others being Health Technology Assessment (HTA) and Service Delivery and Organisation (SDO). NEAT fills a perceived

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- funding gap by supporting work which applies recent advances in fundamental knowledge and technology to the development of new products and interventions for improved health and social care or for disease prevention and treatment. The programme covers all areas of health and social care where new or innovative technological approaches can be developed. The annual budget is £1 million and the programme is open to all research providers in the academic and NHS communities, see <http://www.neatprogramme.org.uk/> accessed 7 December 2002.
- 18 NHS Direct was launched following the UK Government White Paper (1997).
- 19 There are parallel developments of Computer-based Clinical Decision Support Software which is 'any software designed to directly aid in clinical decision making in which characteristics of individual patients are matched to a computerized knowledge base for the purpose of generating patient-specific assessments or recommendations that are then presented for consideration', see Hunt et al. (1998: 1340). and Montgomery et al. (2000). It is widely agreed that there are substantial gaps in knowledge about the effectiveness of these systems and patient outcomes have yet to be sufficiently evaluated.
- 20 See <http://www.nhsdirect.nhs.uk/> accessed 7 December 2002.
- 21 NHS Direct (2001).
- 22 Continuous evaluations have been conducted by teams at Sheffield University (see <http://www.shef.ac.uk/uni/academic/R-Z/scharr/mcru/reports.htm>), Kings College London and Southampton University. See NHS Direct (2000), Munro et al. (2000) and O'Cathain et al. (2000).
- 23 Brown and Duguid (1991).
- 24 Newell et al. (2001), p. 5-6.
- 25 Newell et al. (2001).
- 26 Horne (2001). 'The term adherence has been adopted by many as an alternative to compliance, in an attempt to emphasise that the patient is free to decide whether to adhere to the doctor's recommendations and that failure to do so should not be a reason to blame the patient. ... the term, concordance, has been used to denote the degree to which the patient and clinician agree about the nature of the illness and the need for treatment', p. 166-7.
- 27 Leventhal et al. (1992) cited in Horne (2001).
- 28 See <http://www.nice.org.uk/cat.asp?cn=toplevel> accessed 2 December 2002.
- 29 The report was prepared by Professor Sir Ian Kennedy, Chairman of the Inquiry covering a period between 1984 and 1995. The response by Alan Milburn, Secretary of State for Health (2002).
- 30 Lindblom (1990).
- 31 As David et al. (2002) argue, The public dimension of knowledge-driven activities is important because, 'there is a risk that low learning capabilities give rise to externalities that have the effect of slowing the pace of private investments in technological and organizational innovations. Some sectors of the economy can, thus, be trapped in an equilibrium state in which there is very little technical change, implying the need for improving learning capabilities and learning infrastructures'.
- 32 Knorr Cetina (1999). p. 7-8.
- 33 Lave and Wagner (1991).
- 34 Cook and Brown (1999).
- 35 Steinmueller (2000), p. 362 and Cowan and Foray (1997) and Cowan et al. (2000).