Emergency Healthcare: An Emergent Knowledge-driven System

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Interim Report
6 March 2002

An interim report for the OECD/CERI project on ‘Public Dimensions of the Knowledge-driven Economy’
Executive Summary

This report presents a case study of the emergency health care system in the United Kingdom. This is an intensely knowledge-driven sector that relies on public and private financing to provide outputs in the form of services that are widely perceived as ‘public goods’. The health care system comprises multiple knowledge-driven communities of professionals. This study examines their perceptions of transformations in the organisation and structure of emergency health care services from 1992 to the present.

The results demonstrate that there are many discontinuities in the knowledge-driven activities within and between the health care professional communities. Important features of the transformation of the emergency health care system include:

- the application of information and communication technology (ICT) systems that are insufficiently tailored to the requirements of their users. Many potential users lack the time and resources to learn to use them effectively or to maintain them. This is partly due to the turbulence created by constant change in the wider National Health Service;
- resistances to changes in the way the learning system operates within the emergency health care system;
- the emergence of a dual system of knowledge-driven activities. There is a considerable emphasis on human and technology-based services to triage members of the public more effectively through the emergency health care system. This is occurring alongside systemic under-investment in training and education which tends to perpetuate traditional social norms and practices that govern when, and with whom, knowledge can be shared;
- the potential to build trust in the relevance and quality of information embodied in ICT decision support systems and in new knowledge-intensive systems through peer-to-peer networking.

The results provide insights into the problems that occur when investment in technologies for improved knowledge management is accompanied by under-investment in the skills-base. Greater attention needs to be given to fashioning the relationships between organisational and technological change and to understanding their implications for knowledge-driven activities within the emergency health care sector.

Policy needs to address the continuing failure to invest in the necessary infrastructure for enabling the development of an effective learning system for a knowledge-driven emergency health care system. It needs to become more focused on how social mechanisms can be put in place to enable greater opportunities for embedding the use of ICTs more effectively within the system. The emergency care service is being re-organised at the same as the larger NHS system is being restructured. The various changes within the NHS create uncertainty and complexity which also represent barriers to the effective development and implementation of knowledge-driven systems and networks.
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1 Introduction

This report presents a case study of the emergency health care system in the United Kingdom. Current Government policy aims to enhance the performance of the public organisations that comprise this system. In part, this is to be achieved through the use of information and communication technologies (ICTs) to provide decision support tools and to facilitate communication. 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 National Health Service (NHS) in England, a 9.3% increase in real terms over the previous year. 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. This is an intensely knowledge-driven sector that relies on public and private financing to provide outputs in the form of services that are widely perceived as ‘public goods’.

The OECD/CERI project on ‘the economics of knowledge and the public dimensions of the knowledge-driven economy’ aims to identity and analyse the changing conditions for the creation and growth of public knowledge-driven activities and this case study is a contribution to the project.

The health care system comprises multiple knowledge-driven communities of professionals. In this case study, the 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 the emergency health care system involved only very limited use of information and communication technology (ICTs). By early 2002, there had been major efforts to reconfigure the structure and activities of the relevant professional communities and to intensify their use of ICTs. 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.

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.

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 was expected to facilitate:
• 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 and are being integrated to improve the performance of the system. Others, however, are being strongly resisted partly because of a failure to invest in the necessary infrastructure for enabling the development of an effective learning system. This is a key observation of this case study.

Knorr Cetina has demonstrated how ‘epistemic cultures … create and warrant knowledge’. She has emphasised that, especially in science, there is little detailed comprehension of contemporary ‘machineries of knowing’ or of the nature of the transition of contemporary societies to ‘knowledge societies’. As she puts it, … 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.6

It might be hypothesised that an emerging health care system that is enormously dependent on the circulation of information and the application of vast amounts of knowledge will display a highly distributed, and co-ordinated cognitive system. As Lave and Wagner have argued, ‘cognition, observed in everyday practice is distributed – stretched over, not divided among – mind, body, activity and culturally organized settings’.7 It might further be hypothesised that the epistemic cultures within this system would be strongly overlapping. As Cook and Brown have suggested, collective knowledge of any given set of practices and procedures is developed through interaction and communication; it is a ‘generative dance’.8

Most studies of the knowledge management process at the micro-level of analysis are highly situated and informed by social constructivist viewpoints on the importance of ‘tacit’ knowledge. These studies often suggest that there is little scope for the ‘mechanisation’ of learning or knowledge management through the application of advanced technologies. They also demonstrate how difficult it is to negotiate the introduction of new technologies and to reach a consensus among multiple stakeholders on new strategies and organisational practices.

However, Cowan, David, Foray, Steinmueller, and others have questioned whether the tacit knowledge, which is the principal concern in much of the organisational change literature, must always be treated as the main determinant of organisational behaviour.9 Steinmueller, for instance, has considered the extent to which new 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’.10 Given the need throughout the emergency health care system, to remember, reproduce and reconstitute
knowledge, that is, to ‘codify’ knowledge, it is not unreasonable to expect that this system will exhibit many of the paradigmatic features of knowledge-driven economic activities. There should be receptivity in the system to the potential benefits of the use of ICTs to support the strategic management of the complex knowledge base upon which health care professionals rely.

**Case Study Methodology**

In this case study, knowledge communities are defined as communities of professionals who are ‘oriented towards the production and reproduction of knowledge through decentralised and co-operative processes’. The study examines the evolution of emergency health care professional communities over a decade. During this time, they have been encouraged as a result of explicit government policy to intensify their knowledge-driven activities and to incorporate ICTs-based decision support systems to facilitate new means of capturing and exchanging knowledge. New social norms and institutions have also been created within the emergency health care system to support knowledge distribution and to build trust among the members of the professional communities as well as between them and the members of the public who seek health care advice and treatment.

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. The study focuses mainly on the system in the London area. The research is based on a review of policy and related documentation on a decade of structural and operational changes aimed at improving the efficiency of health care provision.

In addition to drawing upon on-going research on the changes underway throughout the health sector in the United Kingdom, a set of six interviews was conducted specifically for this case study 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. These interviewees were selected because they were known to be key individuals with considerable experience of the specific areas of emergency health care that have been chosen for examination in this study. Unstructured interviews were conducted between November 2001 and February 2002. In view of the relatively small number of interviews conducted specifically for this case study, the findings are indicative of the nature and consequences of the issues identified. Interviewees were invited to provide their views on:

- the overall structure and changes in the emergency health care system and the broad aims of government policy;
- 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;
• the organisational and technological problems and opportunities that are being experienced by health care professionals and their adaptations and resistances to those changes; and

• the perceived priorities for the further development of effective knowledge networks within the emergency health care system.

Section 2 examines the emergency health care system as a complex knowledge system. It focuses on the changes in the routes whereby patients may access health care together with their implications for the knowledge-related activities of the professionals who provide services. In section 3, 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 now a key component of the health care delivery system. In section 4, the focus shifts to an analysis of some of the systemic problems in managing the knowledge system that occur between and within the relevant ‘communities of practice’. Section 5 provides a brief consideration of some of the wider implications for health and for equality of access to health care that are raised by the approaches to monitoring and evaluating the transformations in the emergency health care system. Section 6 sets out the conclusions of the study.

2 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 people also should be helped to recognise and deal with emergencies themselves.13 Although there have been many initiatives to increase the capacity of the system, some have warned that despite the benefits to patients of quick and improved access to health care services, ‘there is potential for confusion and duplication of services, leading to inconsistent responses, variable quality of care, and inefficiency’.14

In 2001, a report on stakeholder views on access to health care highlighted ‘the complexity of the concept of access to health care and demonstrated the lack of agreement about its meaning’.15 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. They considered various dimensions of access 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, the focus is mainly on ‘access-entry’ and the procedures and processes involved in the management of knowledge in part of a much larger health care system.

2.1 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 areas of activity.

The discrete nature of the health care activities acts as a form of information filter within a complex knowledge system. For example, the ambulance crew know 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. 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 process of these records should not be underestimated. But 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 or 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 care have been 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 A&E’, 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. As a professional body, dissemination of information is through academic meetings and there are few overt pressures to change practices or procedures. On the other hand, the ambulance service is a trade organisation and training and retraining are more formal. 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 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 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

<table>
<thead>
<tr>
<th>Referral Source</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Referral</td>
<td>Qualitative, variable quality</td>
</tr>
<tr>
<td>Ambulance</td>
<td>Physiological data, basic patient history</td>
</tr>
<tr>
<td>GP</td>
<td>Recent medical history</td>
</tr>
</tbody>
</table>

Source: Interview with Consultant Physician

Patient histories are taken by Senior House Officers (SHOs) who are young doctors who have typically graduated two years before. They arrive at a differential 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, although 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, one interviewee argued that ICTs could be used to support several areas of activity:

- handover from one health care professional to another with the caveat that the information would need to be accurate and concise;
- knowledge to support A&E activities that needs to be specific to the immediate need as there is no time or facility for searching through information;
- departmental learning. At present there is little or no feedback to A&E of the outcomes of their interventions and the knowledge transferred from the Consultant Physician to the juniors or from peers is not captured formally and it is lost;
- corporate learning. Greater use of multimedia teaching aids but corporate learning will remain difficult due to time pressures.

In this context, 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 work in this way. There are perceived technical weaknesses with the information sources (poor human-computer interfaces, the need for the further development of mobile computing, and the need for faster delivery of relevant information). There are also organisational problems with the implementation of systems (including the lack of resources to construct knowledge and teaching networks, the need to develop standardised assessment forms and procedures for recording information, and the need for greater emphasis on multidisciplinary team working).

Nevertheless, the operation of the emergency health care system requires multidisciplinary team working and knowledge sharing. It is widely expected that the use of ICTs could help to facilitate the information flows that underpin the creation of new knowledge and the learning process. However, sharing knowledge is essential for the successful use of ICTs. This requires that numerous cultural and organisational changes be made in parallel with the design and implementation of all the new systems.
2.2 Access Routes to Emergency Health care

The access routes to emergency health care have expanded over the decade of the 1990s (see Figures 1, 2 and 3 which show the various routes between 1992 and 1999). The development of the new entrants – Minor Injuries Units (MIU)/Walk-in-Centres (WICs); NHS Direct and the expanded role of the Ambulance Service – has been enabled by ICT applications that support telemedicine, improved decision support systems, and various 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. 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 played would include 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 be collected at each stage, but it would not be held in electronic form and would not pass through to the consultants, nurses, home carers or GPs who might benefit from it.

By the mid-1990s (see Figure 2), an effort was being made to improve the efficiency of the system by creating alternative means of 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. But with the introduction of MIUs and WICs, the aim was to achieve cost reductions and to alleviate pressures on A&E Departments. 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.

Pressures on the NHS emergency health care system continued to grow and 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 3.2 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 ‘technology driven’ and 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 are quite different. 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.

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 recent proposals, the role of MIUs and WICs would be changed (as shown in the figure). If this occurs, 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, 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, that members of the public have confidence in their own capacity to discern what routes towards treatment are appropriate, and that members of the public have the capacity and resources to take the required actions. The development of the ‘informed patient’ is an issue outside the scope of this study but it is one that is potentially having an enormous impact on emergency 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 support mechanisms. The aim is to build up an increasingly large
knowledge base to identify the 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 by 2002 had become one of using ICT supported systems to build a corpus of knowledge representing categories of patient experience upon which individual decisions can be based. Organisational changes in the structure of the emergency health care system as shown in Figure 4, combined with the use of ICTs, are now expected to provide the foundation for the more efficient delivery of mass health care.

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 the public. The public (mostly the technologically literate, middle class) use all these avenues, selecting the one that gives them what they regard as the desired result. Certain sections 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:

- a consistent response to a request for help throughout the system
- better exchange of information, and
- a focus on ‘triage’ or streaming in 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 also essential to consider these changes in the light of several factors: a) the perceptions of the success or failure of these changes on the part of both the public and the health care professionals who themselves need to learn how and when to call on the components of the new system; b) the scale and continuity of investment in managing information flows and in knowledge management throughout the entire system through the use, in part, of ICTs; and c) the whether the impact of the changes can be measured both in terms of the outcomes of the immediate care process and in terms of the contribution that the emergency health care system makes to the long term well-being of the individual.

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 will be controlled by Primary CareTrusts, that is, at the GP level. These communities are expected to be able to make effective decisions about routing patients through the system because they are supported by their own access to a large corpus of knowledge held in databases and by the NHS Direct system. Similarly, the pressures on the A&E Departments are expected to become more manageable because patients and all the professionals involved are now (theoretically) able to exchange and share knowledge about individual patients and to compare those individuals’ circumstances with ‘best practice’ experience. However, the professionals within the A&E Departments report that they proceed on the basis that there are ‘individual patient events’. Each requires a special set of decisions that they argue cannot be
deduced from any given ‘category’ of experience. It is also unclear how the proposed new system will provide a foundation for the ‘rational choices’ on the part of members of the public that the Department of Health officials appear to presume will occur.

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 in subsequent sections of this report. An assessment of these requires a more detailed analysis of the nature of the knowledge management processes and cultures that exist in different activity areas within the system of emergency health care. The role of ICTs is closely bound up with the broader system of knowledge creation, circulation and application. Assumptions are being made about the motivations of those within disparate professional communities. It is widely assumed that they have the time and financial resources, as well as commensurate knowledge bases, that provide sufficient incentives to link up and share their knowledge bases. It is also assumed that members of the public are reasonably well positioned to make choices about how to proceed to obtain the care they need to maintain healthy lives.

3 Emergency Healthcare Process Innovations

As indicated in section 2, 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 as indicated above. Today, 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 at the time of writing in March 2002 or they could be referred by a GP. Each of these components is using ICTs and there have been many developments from 1992 to the present.

3.1 The Use of ICTs in Emergency Health care

Research and Technology Development (RTD) on the use of ICTs to support health care has resulted in many innovative means of linking up the components of the emergency health care system. Some of these are highlighted below. Detailed consideration is given to the development of NHS Direct in the following section to illustrate the ways the preferences and motivations of the actors involved have influenced the development of this emergency health care knowledge system.

In the case of the Ambulance Service, ICT is enabling the 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 the developments across all 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;
• allow paramedics to record information basic patient information and send it to A&E department;
• send still images of incident sites to hospital trauma specialists; and
• send patient vital signs (up to and including ECG) to A&E departments

At the time of writing, the technology was not 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 is because the NHS has yet to reach agreement on a universal standard for an EPR.

**NHS Walk-In Centres** (WICs) are a recent addition to the emergency health care system. They 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 version of the patient encounter and decision support system used by NHS Direct. This system is known as Computerised Assessment Software System or CASS (see section 3.2).

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 get second and higher opinion;
• 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 general finding of evaluation studies is that the use of the links decreases with time as NPs become more skilled.

**A&E Departments** are the original component of the emergency health care system. They use the Patient Administration System (PAS) which integrates them with the main hospital and more recently, with the CASS. The use of ICT 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 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.

**NHS Direct** is the most recent addition to the emergency health care system. It 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. The development of this service is examined in the next section.
3.2 NHS Direct

NHS Direct is a twenty-four hour health information and advice help line, which was launched in March 1998 with a remit to provide faster and easier access to advice and information about health, illness and the services provided by the NHS. Three small pilot projects have been expanded to include twenty-two call centres covering England and Wales, 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 history of the selection and deployment of this software illustrates a number of key observations about the way the new knowledge system has been designed and implemented and about the implications for health care professionals and for the public.

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 which was aimed at reducing inequality in access to health care. The Department of Health set up a team with a remit to take action 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 Kings College London, had been developing a prototype public domain software product that 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.

However, the NHS Project Management Team was introduced to the CASS 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 software based proprietary 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, so the NHS team worked 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 of access to health care and 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 lead 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 components of the UK 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 moves to areas where it is easiest to recruit staff and 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, 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’, a goal that implies a necessity for sharing knowledge across the boundaries of the many healthcare practitioner communities. Each NHS Direct site has a Lead Nurse and a Medical Director who share responsibility for clinical governance within a national framework.

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.

By 1 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 experience of HMOs in the United States. They 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 an 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; that they have increased access to advice and information without increasing demand on other parts of the NHS; that NHS Direct provides an entry point to the NHS that is as safe as other entry points; and that 95% of callers are satisfied with the service. 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.

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.

### Table 2 Age and Gender of NHS Direct Patients

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Female %</th>
<th>Male %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;17 years</td>
<td>29</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>17-25 years</td>
<td>17</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>26-45 years</td>
<td>30</td>
<td>22</td>
<td>27</td>
</tr>
<tr>
<td>46-65 years</td>
<td>14</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>&gt;65 years</td>
<td>11</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>39</td>
<td>100</td>
</tr>
</tbody>
</table>

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

The decisions with respect to the routing of patients through the health care system were distributed over the year 2001 as shown in Table 3.
Table 3 Recommendations by NHS Direct

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

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.

![Figure 5 NHS Direct Nursing Staff Backgrounds](image)


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).

In the next section, the way in which the NHS Direct system and related uses of ICTs within the emergency health care system is being accommodated and, in some cases, resisted by members of the health care professional communities is considered. The
aim is to indicate some of the perceived benefits and risks associated with the new means of managing this complex knowledge system.

4 Systemic Problems Between and Within Communities of Practice

The development and positioning of the NHS Direct system within the context of the principal components of the emergency health care system offers insight into some of the advantages and disadvantages of a ‘top down’ ICT initiative that is intended to augment the knowledge management process. The system was developed as a result of the work undertaken by a team charged with the selection and implementation of the services. Their efforts gave rise to a ‘community of practice’ in which shared understandings of the desirability of the features of the services were developed through their interactions with key groups of actors.

The CASS system was introduced as a mandatory standard by those charged with developing NHS Direct services. In 2002, despite the successful development of NHS Direct from a technical point of view and on the basis of published evaluation studies, interviewees for this case study suggested that there is substantial ambivalence towards the new services within the health care professional community. The software system appears to provide a more effective means of managing and circulating information that is essential for improvements in health care management. However, there is very little co-ordination between the communities of professionals who must be ‘enrolled’ in the new procedures and processes that the system supports.

A source of resistance to the NHS Direct system may be attributable to poor communication both between those who have experience of the NHS Direct system and those within the wider health care system who do not, and between various categories of personnel within the health care system whose professional communities are relatively impermeable. NHS Direct is intended to establish links between the GPs, the A&E professionals, the Minor Injuries professionals, and the Ambulance personnel, but 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 perceived as being the 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 is regarded as having moved most quickly to adopt ICTs because paramedics do tend to codify and share knowledge in the local contexts of their work. But this knowledge does not circulate except in circumstances where ambulance services lend 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. The other emergency health care components are organised regionally or locally and their initiatives receive much less attention and publicity.
The national scale of NHS Direct is important because new developments in procedures or in software ‘patches’ can be shared easily throughout the twenty-two locations. 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 system may have been lower.

During the same 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 also continues to be uncertainty and debate about the clinical effect of the technical and organisational innovations that are embodied in the NHS Direct system and 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 people 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.

There is debate as well about the effects of the continuing inconsistencies in the information, advice and decisions regarding health care and treatment that can be attributed to a lack of co-ordination between the 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).

NHS Direct creates some momentum for significant change, and the NHS Direct team has some authority to cause others to adopt the system. But even when the developers can demonstrate that there is no potential harm or risk to the quality of health care, they cannot demonstrate 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, and that this is especially so when legacy 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 people who can share and report their experiences with the new development of NHS Direct. However, this organisational change is proving difficult to implement as well.
NHS Direct employed about 12,000 FTE 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 decisions that 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.

The NHS to cover the costs of training in all areas, for example, allocates nurses a total of around £150 each per year. This is a derisory amount given the rapidity with which new skills and knowledge bases need to be accumulated. For nurses and other professional groupings, even where the skills base exists, time constraints make it very difficult to encourage personnel to codify the knowledge they develop 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. It is also the case that, although common technical systems have the potential to reduce inconsistencies, professional communities will continue to develop their own local practices.

Another major area of professional resistance to the introduction of decision support systems and new means of knowledge management such as the NHS Direct service 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 supported 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 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 supported decision 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 into the context of the preparation of linked services before attending an incident or afterwards during the follow-up care that may be provided. That is, improved access to explicit codified knowledge might enhance the practices that continue to rely on trusted, time-critical, and internal knowledge bases.

In summary, 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’ in the sense that it does not mean that everyone is a potential beneficiary since this 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 that has been created by the independent and uncoordinated initiatives of the many communities within the system. Some regard NHS Direct as a major catalyst for organisational change and for information sharing and knowledge creation. There are, however, many professionals who remain highly resistant to the changes that are underway. In the next section, some of the broader implications of these changes are considered.

5 A Complex Emerging Health Care System

The changes in the emergency health care system described in the preceding sections, and the particular instance of the NHS Direct design and implementation, illustrate that a standard ICT system can be imposed, but that the new knowledge management processes have substantial ancillary implications for the rest of the health care system. The introduction of the new ICT supported systems creates the need for changes in the existing modes of working and for ongoing investment in ICTs throughout the system. Including the costs of rotation posts for staff, the overall indirect costs were estimated by one interviewee as being five times those of the direct costs of the NHS Direct system 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, during which time yet further innovations in technology may be introduced, giving rise to new cycles of investment.
The targets set by those charged with evaluating the impact of the new 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.

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) 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 that can be 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 or a lack of 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.

On the basis of this case study, the ‘islands’ of effective knowledge management within the emergency health care part of the NHS might be deemed to have moved about a third of the way along a pathway towards the integration that may yield improved co-ordination of the knowledge base. Even so, however, much of the experience needed to achieve even greater integration is being circulated by the personnel through their social and professional networks within their professional communities.

Further progress may be impeded by several factors.

- the high cost of the continuous development and redevelopment of the underlying technology, which 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.

- a failure by the Department of Health to recognise that investment in education and training is essential to support further integration. Resources are needed both for training and in-service training.

- worsening time constraints such that professionals must work ‘flat out’ to deal with immediate problems and crises, and have little time for reflection, for the development the organizational routines, or for using and maintaining the information that is essential to effective ICT supported knowledge systems.
The results of this case study, from one vantage point, may appear to confirm the results of another study of the development and transfer of ‘best practice’ more generally within the NHS. 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’. This may explain why there appear to be high barriers to the circulation of new knowledge within the health care system and there is a considerable resistance to using ICT systems.

Although the situated character of knowledge generation and exchange needs to be acknowledged, in the present study, the evidence suggests a more complicated explanation. On the one hand, top-down imposition of new ICT system standards, protocols and information resources, has helped to establish the NHS Direct system by creating a strong momentum for change. On the other hand, the evidence of under-funding of training and education for the intended users is substantial. This factor is likely to influence the perceptions and behaviours of professionals, creating resistance to change that may not be indicative of any particularly insurmountable difficulty in achieving the goal of ‘codifying’ certain aspects of the knowledge base.

In this case study, it is not feasible 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 reorganization 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 members of the public perceive:

- trends towards an increase in the variety of pathways through the health care system;
- the implications of standardized ICT supported knowledge bases to if this encourages less variety in the health care offered in response to specific health events; and
- the benefits (or lack of benefit) of the growth in the number of sources of professionally accredited and lay health care information (via web access).

In addition, in assessing the impact of the emerging health care system, it is important to recognise that patients appear to 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. Health psychology theories often focus on self-regulatory behaviour and ‘common sense models’ of healthy living. Many treat the patient as an ‘active problem solver’. 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, may benefit from changes in the health care system. And, intentional adherers (who tend to be wealthier and better educated) will 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 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. This view is forcefully motivating the champions of new ICT-supported systems. However, this view deserves scrutiny to assess the conditions under which the new systems are introduced and how their use alters the perceived reliability, salience, and cultural specificity of the information that circulates through the health care system. In some instances, this may involve changes that are valued by the professionals and the public; in others it may not.

Whether the use of ICTs is leading to better outcomes for patients and to better health care is difficult to measure 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. 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 and is therefore medically biased and unable to provide a full picture of a patient’s health as experienced in his or her social and economic context.

The Government published its response to an inquiry into the Bristol Royal Infirmary’s record of children’s heart surgery in January 2002. The overall goal of the response is to ‘put patients at the centre of the NHS’. Of the fifty-six detailed recommendations, Recommendation 2 states 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 other recommendations deal specifically with information that should be available about treatments and care. They also address the need to tailor information to specific needs and circumstances, provide information based on currently available evidence in a form that is comprehensible to patients, use various means to convey information, and improve the quality of information in relation to content and dissemination, as well as the need for 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, thus taking 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 need to address the issues identified in this case study.

In particular, there is a crucial need to give far greater consideration to how ICT supported information and communication 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. The indications are that government-supported initiatives to develop knowledge-driven systems in the health care field are focusing on too broad a range of initiatives and that priority is not being given to the ‘usability’ of the new systems by all of those who are expected to benefit.

Consideration of these and other implications of changes in the emergency health care system require analysis in the context of the health care system as a whole and assessments of changing perceptions of what it means to be ‘healthy’. It is also important to obtain greater insight into the views of the professionals and policy makers who are promoting the new ICT based systems. Their perceptions of what is needed and desirable are influential in mobilising resources for the further evolution of the health care system.

This case study demonstrates the significance of ‘knowledge management’ as an issue for health care delivery. It highlights the substantial complexity of the system; a system that embeds the technological and the social; the organizational, the economic and the political. This system is dynamic and subject to numerous risks of failure especially if inequality of access persists.

6 Conclusion

The emergency health care system in the United Kingdom is making increasing use of ICTs. The latest development - NHS Direct - is predicated on the effective use of ICTs to support the reconfiguration of the knowledge base of a very complex system. The uses of ICTs in the components of the emergency health care system vary substantially. The use of ICTs is producing new problems for the co-ordination of information and for the knowledge sharing practices of professionals who work in the various components of the system.

The role of knowledge management in health care has been recognised but the strategies to develop new norms and tools are very diverse. In many cases there are bland statements of goals such as ‘improving outcomes of patients’. There are
reviews and evaluations of the ‘tractable problems’; rather than in-depth considerations of the evolving emergency health care system as a venture in social problem-solving. Charles Lindblom acknowledged that social problem-solving involves working with complex systems that suffer from ‘impairments’ at all levels. 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 case study, the overall structure of the emergency health care system has been examined. The principal focus has been on the information flows and knowledge bases that play a role in the activities of professionals who triage patients through an increasingly complex health care system. The introduction of ICTs to support this process of decision-making is widely expected to alleviate the crisis of a growing mismatch of capacity and demand in the components of 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.

By focusing on the health care activities within the key components of the emergency health care system as they have changed over a decade, this study provides insight into how the system is developing and repositioning the processes through which information is accumulated and exchanged between members of the professional communities. It also shows the extent to which some of the ICT systems that are being put in place are being accommodated or resisted by the professionals they are intended to benefit. This case study identifies two key sets of systemic problems that are encountered within a dynamic process of change:

- organisational problems specifically with respect to information collection, retention, and distribution; and
- technical problems specifically with respect to establishing agreed standards and protocols for ICT system interoperability and for the human-computer interactions that yield timely, relevant, and usable information within the contexts of their application.

The case study highlights a problem that is particularly crucial in the context of health care. The measurement of progress in the use of ICTs to support improved health management focuses mainly on patient outcomes rather than on the nature of the activities of the professionals themselves or of the members of the public who seek treatment. Although the latter clearly are much more difficult to examine, these aspects must be considered if the health care system is to become an efficient knowledge-driven system. Perceptions of improvements and the risks of failure with respect to these activities influence whether ICTs are embodied effectively within the emerging health care system.

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’. The health care system in the United Kingdom is the recipient of substantial public funding. It is also a system that has been, and continues to be, 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 members of the public who pass through the inter-dependent components of the emergency health care system. Yet, the evidence in this case study is that, apart from the professionals who are designing and implementing ICT-related innovations, there are few signs that the capacity for learning how to take advantage of these systems is being developed. In fact, there is an ethos within some of the relevant communities that is antithetical to the notion that greater time and resources should be allocated to pursuing a transformation to a new state in which there is increased dependence on electronic information resources and means of communication.

A greater emphasis on knowledge-driven activities is certainly an ‘emergent property’ of the emergency health care system. There are many concurrent and mutually reinforcing technological and social transformations underway that suggest the potential for professionals and members of the public to benefit from the fruits of a new learning system based on organisational change and technological innovation. But there are also indications that the learning process is remarkably discontinuous and discordant. In some cases valuable information is simply being lost from the system. Though they acknowledge that this may be a contributing factor to the deepening problems of the emergency health care system in meeting the growing demands placed upon it, many of the professionals do not see the need for technology-based solutions. They would prefer to invest in the further development of their traditional social networks. There appear to be considerable difficulties in enabling all the relevant stakeholders within the health care system to negotiate and reach closure on appropriate uses of the new technologies and on improved procedures for managing knowledge.

In this case study, knowledge refers to clinical knowledge for professionals but it could also refer to health knowledge for patients and other individuals. This knowledge base is built up through feedback and the social mechanisms that are currently in place do not appear to be the best way to achieve this. If ICTs were to be correctly configured and used, they could facilitate such feedback and, therefore, contribute to the emergence of robust knowledge networks.

This observation only heightens the salience of the main finding of this study. Policy needs to address the continuing failure to invest in the necessary infrastructure for enabling the development of an effective learning system for a knowledge-driven emergency health care system. It also needs to become more focused on how social mechanisms can be put in place that enable greater opportunities to embed the use of ICTs more effectively within this system. The emergency care service is being re-organised at the same time as the larger NHS system within which it operates is being restructured. Over the period covered by this study, patient expectations of the service they can expect to receive have risen. The various changes within the NHS create uncertainties and additional complexity which are also likely to represent a barrier to the effective development and implementation of knowledge-driven systems and networks.

The results of the present study demonstrate that there are many discontinuities in the knowledge-driven activities within and between the health care professional communities. The results bring to light several important features of the transformation of the emergency health care system.
• There is substantial evidence of the application of ICT systems to support knowledge-driven activities, but that these systems are not necessarily being tailored to the requirements of key communities of professionals or to the requirements of those members of the public who are already disadvantaged. In some instances, ICTs are being used to capture knowledge and to enable its more effective distribution, but in others, there are substantial difficulties. These are explained to a significant extent by the lack of time and resources available to professionals; a constraint that pervades the emergency health care system. Some barriers may also be attributable to the continuing turbulence in the wider NHS system.

• There is considerable 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 that 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.

• There is an indication that a dual system of knowledge-driven activity may be an ‘emergent property’ of the emergency health care system. Innovative information services (NHS Direct) are being developed to provide decision support. Increasing emphasis is being given to the human and technology-based NHS Direct services to triage members of the public more effectively through the emergency health care system. But 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.

• There is considerable potential to build trust in the relevance and quality of information embodied in ICT decision support systems. This process 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 knowledge-intensive systems such as NHS Direct, and who then share their experiences through peer-to-peer networking.

The emergency health care system in the United Kingdom is evolving within the social and economic context of the health care system as a whole. It is not, therefore, appropriate to draw general conclusions about the nature of the public dimensions of knowledge-driven economy activities throughout the sector. However, the results of this case study provide insights into the problems that occur when investment in technologies for improved knowledge management is accompanied by under-investment in the skills-base of the professional communities that are intended to use the technologies. This combination of ‘emergent properties’ in the emergency health care system has damaging consequences for the individuals who work within the system and, ultimately, for the public. The lesson for public policy is clear. There must be an effort to reverse the declining rate of investment in the creation of an appropriate learning system. Greater attention must also be given to fashioning the relationships between organisational and technological change and to understanding their implications for knowledge-driven activities within the sector.
Systematic comparison of the results of this study with transitions underway in the emergency health care systems in other countries will be necessary to detect whether the observations for the United Kingdom are attributable mainly to sector-specific difficulties in managing knowledge or primarily to the specific economic and social conditions in the United Kingdom. The professional communities in this case study show signs of innovative performance, but there are also significant indications of systemic dysfunction. This results from 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.
Notes and References

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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.


4 Ibid, 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 Governments e-government ‘strategic framework for public services in the Information Age’ which was published in September 2000.

5 Ibid, p. 23.


12 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 Benger, 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


17 See http://www.rcplondon.ac.uk/.

18 See http://www.asu.org.uk/.

19 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.

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 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 2 March 2002.


R. Horne, ‘Compliance, Adherence and Concordance’ in *Pharmacy Practice*, pp.166-83

[reference to be completed]. ‘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).


