

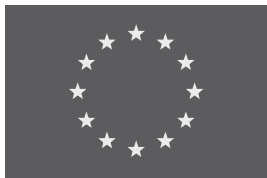


**Collaboration and communication  
technology at the heart of  
hospital transformation**

**This report is published by ACCA in collaboration with Nottingham University Hospitals NHS Trust and the European Commission Information Society Directorate – General.**

**March 2010**

**Nottingham University Hospitals**   
NHS Trust



European Commission

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**I welcome this report from the Association of Chartered Certified Accountants (ACCA) and Nottingham University Hospitals NHS Trust (NUH), which offers an assessment of the central role of new information communication technologies in the transformation of one of the biggest emergency departments in Europe.**

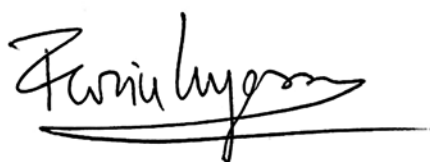
The report provides a persuasive account of the huge impact the new communications infrastructure deployed at NUH has had on re-engineering the day-to-day working processes of its emergency department. The report highlights the role of communications tools in creating a more efficient, streamlined and peaceful working environment in which NUH can deliver high quality care to patients.

Since the deployment of the new communications tools, patients at NUH spend significantly less time waiting for treatment while doctors have increased their available time for direct patient care time by around 40 minutes per day. It goes without saying that these positive results have had a huge impact on both patient and staff satisfaction.

The focus of the report is very timely in the year that marks the 20th anniversary of the European Commission's programme on eHealth. In 1990, the European Commission began funding research on what is now referred to as eHealth. From the 'advanced informatics in medicine' programme, through the 'health telematics' programme to the 'ICT for health' programme, our work shows that eHealth has developed from a specialised set of tools for discreet areas of healthcare to taking its rightful place at the heart of every day healthcare delivery.

I am sure this report will become a valuable reference point sitting alongside the previous assessments undertaken by ACCA. This is the third such report published by ACCA in association with the European Commission and builds on ACCA's previous work on the impact of eHealth on citizens, patients and health services.

This report provides important food for thought as many useful lessons can be drawn in addressing the challenges Europe faces in delivery of safe, efficient, high quality and accessible healthcare for all citizens.



**Florin Lupescu**  
**Director, ICT Addressing Societal Challenges**  
**DG INFSO**  
**European Commission**

**Europe is in the midst of a healthcare revolution, accelerated by the development and adoption of powerful new Information and Communication Technologies (ICT), which are changing the complexion of our daily lives and have become a vital component of efficient and effective health systems' management.**

While the European Union (EU) continues to move towards a 'European eHealth era', progress to date has been fragmented. To drive through the widespread implementation of eHealth and more 'patient-friendly' healthcare services, we need to fully understand the best mechanisms for designing and delivering effective eHealth communication processes, and align our strategy accordingly.

As a member of the European Parliament actively involved in the field of public health, I very much welcome the European Commission's eHealth Action Plan and its subsequent measures. I also strongly support initiatives – such as this one – that will facilitate faster development of eHealth across the EU and encourage increased ICT investments in healthcare.

I am convinced that accurate and relevant empirical research is an essential part of the process. The acute financial analysis – illustrated with concrete facts and figures – that is presented in the findings of this study demonstrate that the use of new technology in a major hospital emergency department has improved efficiency, reduced cost and sped up the patient journey, thereby improving the overall patient experience.

Meanwhile, in an era of ageing population and escalating health costs, many questions remain with regards to how best to harness new information technologies to address serious health threats and promote well-being. To prevent market fragmentation we must work towards stronger co-ordinated actions, better synergies between related policies and stakeholders, and better dissemination of best practice.

Initiatives such as this one will help pave the way towards the implementation of a EU-wide eHealth architecture and have my whole-hearted support.



**Antonyia Parvanova MEP**  
**Committee on the Environment, Public Health**  
**and Food Safety, European Parliament**

**Information and communication technology (ICT) is widely utilised in the commercial world to support both day to day business operations and whole scale business transformation. However, in the health sector, whilst ICT is commonly used to deliver discrete, often isolated projects such as the picture archiving and communication system (PACS), its full potential for service redesign is still to be realised.**

This must change. Just as a reliable ICT system is an essential component of any forward-thinking business in the 21st century, so it is a vital component to the delivery of modern health care.

This report tells the story of how one acute teaching hospital, Nottingham University Hospitals NHS Trust (NUH), has embraced ICT and used it to engineer change and to begin to revolutionise service delivery across its emergency department – one of the largest and busiest in Europe.

In 2006 the emergency department (ED) was faced with the challenge of managing forecast patient growth of 5% per annum over the next five years – with the department already operating at near maximum capacity. An operational review was undertaken and found that the department suffered from severe communication problems, caused by the sheer size of the department, which delayed patient care and put the Trust at risk of breaching government access targets for treating emergency patients.

The solution, proposed and developed by Cisco working in association with its delivery partners, was a medical grade network to provide both wired and wireless (WiFi) network foundation and architectures to enable all communication, including advanced clinical applications and biomedical devices, to operate in a protected, interactive, resilient and responsive environment.

Utilising telephony services provided by fixed and portable handsets, the new system enables staff to instantly contact any other member of the ED team – wherever they are located within the department and beyond. The new processes make finding and speaking with people much more efficient and add governance to person-person process steps.

These changes have fostered a more collaborative working environment with all staff working together to ensure the new system's success. They have also resulted in an increase in patient satisfaction due to shorter waiting times and improved comfort levels.

Having taken the decision to make a significant investment in both new processes and new technologies the Trust was committed to assessing the benefits. This report begins that process.

At the time of writing the new collaboration technology had only just been introduced to the emergency department of NUH. However, significant improvements are already evident, including:

- a reduction in the patient journey time of 23% for adult patients and 33% for paediatric patients
- an increase in productivity of doctors treating minor injury patients equating to a potential time saving of over seven hours per day or one doctor per year
- cost containment that will allow a full return on investment in the new technology to be realised in just 14 months.

The report explores in further detail the benefits outlined above and the considerable positive impact the new technology has had on patient satisfaction and the day-to-day work of the medical and care staff in the emergency department.

# The study

## NOTTINGHAM UNIVERSITY HOSPITALS NHS TRUST

Area	46.325 hectares
Population served	2.5m
Budget	€780m*
Staff	over 13,000
Beds	1,600
Patient numbers (2008/09)	755,000 first and follow-up outpatients 90,000 day case and elective inpatient admissions 90,000 non-elective admissions 160,000 emergency attendances

\*All figures based on an exchange rate of £1 = €1.1444. Correct on 20/02/2010

On 1 April 2006 Nottingham City Hospital (NCH) and the Queen's Medical Centre (QMC) merged to form Nottingham University Hospitals NHS Trust (NUH): one of the largest and busiest acute teaching trusts in the country. The new Trust has over 13,000 staff, a budget of €780m and provides acute medical services to a local population of 650,000 and a range of specialist services to a wider population of around 2.5m.

The two hospitals operate from separate campuses; therefore upon merging, to ensure that the new organisation would provide a seamless health service to patients, the Trust instigated a number of work programmes. The aim was to improve patient outcomes, patient experience and value for money (VFM) and to establish NUH as the best acute teaching trust in the country by 2016.

The new Trust set the following strategic objectives:

- to be a leading centre of excellence in selected specialities, recognised nationally and internationally for research, teaching and clinical care
- to be a distinguished general hospital providing more care in 'out of hospital' settings in an integrated manner.

To achieve these objectives the Trust needed to improve productivity by making major changes to working practices. Due to the sheer size of the organisation the management team realised that this could only be achieved through the significant underpinning of the day-to-day work of the Trust with new technologies.

A review undertaken by Cisco<sup>1</sup>, one of the world's leading networking solutions manufacturers, found that existing processes and infrastructures were not of an adequate standard to support the Trust's strategic objectives. The resulting report<sup>2</sup>:

- described slow and inaccurate information processes with ad hoc growth leading to multiple information systems holding inconsistent data
- identified 'the significant... risk to clinical service delivery from a growing reliance on information provided through ageing and increasingly unreliable technology'
- noted that staff were using outdated stand-alone equipment that led to duplicate data entry
- found that integration across departments was rare, leading to multiple patient data entry and limited knowledge of bed status
- highlighted the minimal system integration across the two sites.

1. [www.cisco.com](http://www.cisco.com)

2. Internet Business Solutions Group  
connected hospital study Report on Findings on  
Nottingham University Hospitals April 2006

The report recommended that the Trust adopt a more strategic approach to information and communication technology (ICT) investment that would improve cost efficiency and help transform NUH into a centre of excellence. It proposed that the Trust implement a medical grade network to provide both wired and WiFi network foundation and architectures that would enable all communication, including advanced clinical applications and biomedical devices, to operate in a protected, interactive, resilient and responsive environment.

A fundamental element of this would be telephony services, provided by both fixed and portable handsets, with the portable units utilising the WiFi network. The portable phones could be used for internal calls throughout the hospital at no operational cost, and offered a range of 'smart' messaging options, including automatic updates from clinical systems, and the ability to provide the location and work status of users.

Following on from this review the Trust agreed a significant investment with NextiraOne (Cisco's delivery partner) which, in addition to the supporting infrastructure, incorporated leading health technologies including:

- *Wireless data access* to give staff access to information systems at the point of care
- *Wireless telephony, unified communications and presence* to show real-time availability of staff and to enable staff to be contacted wherever they are in the hospital
- *Cisco Unified Application Environment*, a messaging system linking ED to Pathology and Radiology systems for notification of when results are ready and patients ready for collection from X-ray
- *Radio Frequency Identity (RFID) and tracking* to enable geographic location of equipment.

The introduction of the new technology is, however, just one thread of the change programme being introduced at NUH. The Trust was one of only two sites chosen nationally to pilot the NHS Institute for Innovation and Improvement's *Releasing Time to Care Productive Ward Programme*<sup>3</sup>. The programme focuses on the introduction of lean processes and the elimination of inefficient working practices to give nursing staff the time they need to spend on direct patient care. Running alongside this work is the Trust wide improvement programme '*Better For You*' which also focuses on lean working practices. While the new system was being designed, therefore, the Trust began the complex task of completely reviewing working practices across the hospital with the aim of synthesizing the service redesign agenda with the new technology to deliver caring, safe and thoughtful care to patients.

Due to the size of the change programme it was decided to stage the ICT implementation over a period of 18 months, starting in July 2009. It was agreed that the emergency department (ED) should be first to go live for two reasons: first because the department is geographically distinct so it was easier to deploy the new technologies here than across multiple areas of the Trust; and second, and perhaps more importantly, because ED, as the 'front door' to the hospital, is key to managing the flow of patients through the hospital.

Having taken the decision to make a significant investment in both new processes and new technologies the Trust was committed to assessing the benefits. This report begins that task by considering the impact that the new ICT system has had on ED and the anticipated benefits over the next few years.

## Implementation timeline



3. [www.institute.nhs.uk/quality\\_and\\_value/productivity\\_series/the\\_productive\\_series.html](http://www.institute.nhs.uk/quality_and_value/productivity_series/the_productive_series.html)

## NOTTINGHAM UNIVERSITY HOSPITALS NHS TRUST EMERGENCY DEPARTMENT

Budget	€15m
Floor area	2,470 sqm
Total staff	254
Doctors	27 trainee doctors 8 middle grade doctors 14 (12.5 FTE) senior doctors
Emergency Nurse Practitioners	11
Nurses	110
Emergency Department Assistants	54
Radiographers	30

### PATIENT NUMBERS:

	Total	Increase
2007	135,552	
2008	137,457	1.4%
2009	146,020	6.3%

Nottingham University Hospitals NHS Trust Emergency Department (NUH ED) is one of the largest and busiest emergency departments in Europe. It covers a floor area of over 2,470 sq m, has 254 staff and a budget of €15m. The department treated over 146,000 patients in 2009; a rise of more than 6% on the previous year. The majority of these patients (60%) were treated and then discharged home; around 25% were admitted to NUH and the remainder were referred to other services as outpatients.

The department offers training for all disciplines: nurses, doctors, paramedics and allied health professionals, and is well recognised in the UK for its Paediatric Emergency Medicine training programme. It also has excellent links with local schools and has undertaken 20,000 visits over the last seven years to talk about accident prevention.

The department is split into three distinct areas: paediatric ED, adult ED and X-ray. The adults section is then subdivided into a further four areas:

Area 1 – resuscitation, critical care

Area 2 – walking wounded

Area 3 – stretcher patients requiring full medical examination

Emergency Nurse Practitioner (ENP) – patients treatable by Nurse Practitioners

Patients arrive at ED either by ambulance or on foot. Those arriving by ambulance are taken directly to the most appropriate area by the ambulance crew – usually Area 1 or Area 3. Those arriving on foot are streamed on arrival by nursing staff.

#### Area 1

Patients admitted to Area 1 are generally in a critical condition. They usually have arrived by ambulance and are in need of lifesaving intervention.

The patient is seen immediately by a triage nurse who commences care and orders appropriate blood tests, X-rays etc. A doctor examines the patient immediately if required, otherwise within 10-15 minutes, and commences emergency treatment while organising any additional tests (magnetic resonance imaging [MRI], ultrasound etc) required.

### Area 2 & ENP

Patients who arrive at ED on foot register at reception then, unless they are particularly unwell in which case they are seen immediately, are asked to sit in the waiting area until called to Area 2 or ENP for treatment.

Patients sent to ENP are seen by an Emergency Nurse Practitioner (ENP) rather than a doctor.

### Area 3

Patients arriving at Area 3 are visually assessed by the Nurse Co-ordinator and allocated to a bay for treatment.

Patients treated in Area 1 are normally admitted to the hospital whereas patients seen in Areas 2, 3 and ENP are generally discharged home after treatment.

**Table 1**  
**Clinical staffing requirements to meet forecast demand in NUH ED**

	<b>2009 Actual</b>	<b>2010 Forecast</b>	<b>2011 Forecast</b>	<b>2012 Forecast</b>	<b>2013 Forecast</b>	<b>2014 Forecast</b>	<b>Change in staff numbers 2009-2014</b>
Patient numbers	146,020	153,321	160,987	169,036	177,488	186,363	
<b>Staffing requirements</b>							
	<b>FTEs</b>	<b>FTEs</b>	<b>FTEs</b>	<b>FTEs</b>	<b>FTEs</b>	<b>FTEs</b>	<b>FTEs</b>
Junior doctors	27	31.3	35.8	40.5	45.5	50.7	23.7
Middle grade doctors	8	8.4	8.8	9.3	9.7	10.2	2.2
Consultants	14	14.7	15.4	16.2	17.0	17.9	3.9
Emergency Nurse Practitioners	11	11.6	12.1	12.7	13.4	14.0	3
Nurses	110	115.5	121.3	127.3	133.7	140.4	30.4
Emergency Department Assistants	54	56.7	59.5	62.5	65.6	68.9	14.9
Radiographers	30	31.5	33.1	34.7	36.5	38.3	8.3

**Table 2**  
**Potential increase in staff costs over next five years**  
**(based on 2008/09 pay and price levels)**

	<b>2009 Actual</b>	<b>2010 Forecast</b>	<b>2011 Forecast</b>	<b>2012 Forecast</b>	<b>2013 Forecast</b>	<b>2014 Forecast</b>
Patient numbers	146,020	153,321	160,987	169,036	177,488	186,363

### Clinical staffing costs

#### Average salary

<b>2008/09</b>		<b>€m</b>	<b>€m</b>	<b>€m</b>	<b>€m</b>	<b>€m</b>	<b>€m</b>
€59,500	Junior doctors	1.6	1.9	2.1	2.4	2.7	3.0
€86,000	Middle grade doctors	0.7	0.7	0.8	0.8	0.8	0.9
€114,500	Consultants	1.6	1.7	1.8	1.9	1.9	2.0
€40,000	ENP	0.4	0.5	0.5	0.5	0.5	0.6
€32,500	Nurses	3.6	3.8	3.9	4.1	4.3	4.6
€20,000	EDA	1.1	1.1	1.2	1.3	1.4	1.4
€40,000	Radiographers	1.2	1.3	1.3	1.4	1.5	1.5
	<b>Total cost</b>	<b>10.2</b>	<b>10.9</b>	<b>11.6</b>	<b>12.4</b>	<b>13.2</b>	<b>14.0</b>
	Forecast increase on 2009 cost		0.7	1.4	2.2	3.0	3.8

## One of the key problems facing the emergency department is managing demand

NUH ED experienced growth in patient numbers of over 6% from 2008 to 2009 and, over the next five years, based on current forecasts, patient numbers are expected to rise a further 5% per annum.

This anticipated growth in demand is in line with that facing health systems around the world and the reasons for this have been well documented: higher patient expectations, growth in chronic disease, ageing populations, the introduction of new diagnostic technologies etc. NUH is affected by each of these but, in addition, two other changes have put a further strain on resources: first the relocation of a nearby emergency unit which effectively increased the Trust's patient catchment area; and, second, changes in General Practitioner (GP) operating procedures which have made it quicker for patients to access treatment from the hospital than from their family doctor. Government access targets require that all patients visiting the emergency department of their local hospital are seen within four hours and that those patients visiting their GP are seen within 48 hours. The result is that some patients circumvent the system by going directly to the emergency department for treatment even if they are suffering only a minor ailment.

The challenge the emergency department faced was how to manage this additional demand when it was already operating at near maximum capacity. If the forecast growth in patient numbers was not addressed then, over the next five years, the department would need to recruit an additional 29.8 doctors, 33.4 nurses, 14.9 Emergency Department Assistants and 8.3 radiographers which, based on 2008/09 pay scales, would increase staff costs by over €3.8m. (Tables 1 and 2)

Unrestrained growth such as this is clearly unsustainable in the current economic climate; it is also unfeasible. The department already has trouble recruiting sufficient numbers of suitably qualified staff and is heavily reliant on costly agency staff and locums. In 2009 for example, the department spent over €0.6m on temporary nursing staff and over €1m on interim medical staff. The growing demand for services had to be addressed urgently. The department had to take action; do nothing was not an option.

A team of management consultants from KM&T<sup>4</sup>, a worldwide business improvement consultancy specialising in innovative business and operational performance improvement solutions, were brought in for nine months, firstly to help ED staff identify more productive working practices and then to support and advise them through the change management process.

KM&T spent the first 10 weeks on diagnostics; including supporting staff to track the pathway of nearly 400 patients through ED, speaking to key stakeholders and running workshops for each of the different staff groups. Each member of staff who works in the ED was given the opportunity to contribute in some way to the change management process; some staff were seconded to the transformation team, some joined working groups and everyone was invited to attend structured workshops to discuss and share ideas that would transform service delivery. This staff involvement was critical to the success of the project and resulted in over 400 improvement ideas being identified.

Once the current operational state on ED had been fully documented and the service improvement ideas noted, the transformation team asked the NUH IT team to become involved in the project and to help identify the technological solutions that, with new improved working processes, would make the vision become a reality.

These were then prioritised by ED staff and are now being implemented by the department's nursing and medical teams.

Clinical involvement will have been a key factor in the success of this project, which has been designed, managed and led by frontline staff. KM&T have lent their business management expertise and the NUH IT team have provided advice and the necessary enabling technological tools but ownership of the project rests solely with the ED staff. As a result, the transformation programme has fostered a strong collaborative working environment across all areas of ED; each member of the department has contributed to its design and each member of the department has a role to play in ensuring its success.

'The time was right to link together the opportunities presented through the infrastructure investment and the aims and goals of the Emergency Department in its future state.'

*Ian Smith, Deputy Director of ICT Services, NUH*

## The technological solution

A number of different areas were identified where it was agreed that technology would bring significant benefit to operations within ED. This report focuses on just one of these: improving the communication links within the department.

Communication was identified as a problem due to the sheer size of the emergency department. With six separate treatment areas as well as a stores section and numerous offices it can be very difficult to locate other members of staff, to manage patient throughput or to get up to date clinical information on a patient. As a result nursing staff were spending up to 19%<sup>5</sup> of their time searching for people or equipment, patients were kept waiting longer than necessary for treatment, staff were under increasing pressure to meet the government target of seeing and treating all patients in less than four hours and the overall capacity of the department was severely reduced.

The solution proposed and developed by NUH staff working with Cisco and its partners utilised IP telephony services provided by both fixed and portable handsets. The portable phones operate from the wireless network so that, unlike mobile phones, they can be used to make internal calls throughout the hospital - even in those parts of the hospital outside the range of the standard phone networks - at no operational cost.

In addition the phones feature:

- a phone directory
- a staff locator
- push to talk functionality
- group messaging system
- automatic updates from clinical systems.

The new technology plugs the gaps in communication. At the touch of a button staff are able to instantly locate or speak to any other member of the on-duty ED team to ask for assistance, to obtain a second opinion or to view clinical results.

ED staff received training on the new system in early October 2009 and it became operational from mid October. Network coverage was initially restricted to within ED but the range is now being extended so that by the end of 2010 staff will be able to use the portable handsets throughout the hospital.

There were a few teething problems: staff failing to switch phones off when they were busy or not remembering to turn them on after breaks; staff forgetting how to use various functions on the phone; and patients concerned that staff were engaged on personal business rather than working. These were all minor issues, however, which were quickly and easily resolved. Staff worked as a team to get the very best from the system with the more technologically confident coaching the more challenged users and the department organised a communication campaign to help patients understand the real purpose of the phones.

Overall the new system has been a great success. Indeed it has been such a success that, just six weeks after roll-out during a planned four hour system outage, staff complained that without the phones, despite the established fall back procedures, they could not do their jobs properly.

*'The new phones enable staff to find who they want, when they want them. Once you have it, you can't imagine how you got by without it.'*  
*Sam Clunie, Nurse in Charge, Emergency Department, NUH*

5. [www.nuh.nhs.uk/about/annualreports/annualreport2009.aspx](http://www.nuh.nhs.uk/about/annualreports/annualreport2009.aspx)

## HOW THE COLLABORATION TECHNOLOGY HAS IMPROVED COMMUNICATION IN THE EMERGENCY DEPARTMENT

Over 250 staff work on ED, including 54 Emergency Department Assistants (EDAs), 121 nurses (including 11 Emergency Nurse Practitioners), 30 radiographers, 35 trainee doctors (junior and middle grades) and 14 consultants (senior doctors). All of these staff have benefited in some way from the improved communication links delivered by the new technology.

### Emergency Department Assistants

Emergency Department Assistants (EDAs) provide general support to patients and staff. They undertake a vast range of duties including:

- assisting staff with the basic clinical care of patients
- undertaking clerical work (including staffing the ED reception desk)
- portering duties including escorting patients to other areas of the hospital, replenishing the oxygen cylinder supply and collecting drugs from the hospital pharmacy.

There are usually six EDAs on each 12 hour shift: two staffing the reception desk, one on paediatrics with the remainder working as and where required.

Before the new technology was installed, if clinical staff needed the support of an EDA they made a public address announcement requesting the presence of an EDA in a particular area of ED.

This system of communication was often ineffective, however, as sometimes three EDAs responded and sometimes none. It also made it very difficult to manage and prioritise the EDAs' workload; clinical staff were generally unaware of how many EDAs, if any, were available to assist at any one time and they didn't know whether the EDAs were needed for more urgent tasks elsewhere in the department.

A data collection exercise, undertaken between 14 July 2009 and 23 July 2009, demonstrated the severity of the problem. Data was collected on each nursing shift and across all of the main areas in ED. The exercise showed that, during this period, only 30% of calls for assistance were answered within four minutes and that, on average, over 40% of calls received no response. In those cases where no EDAs responded to a call for assistance then either the patient had to wait longer for treatment or clinical staff had to perform non-clinical duties.

The reason for the poor response rates is that the public address system is only audible in certain areas of ED; for technical reasons it could not be extended outside this range. However, those EDAs not staffing the reception desk spend a large proportion of their time outside the department, collecting oxygen cylinders from the outdoor store, picking up drugs, helping patients to or from their cars, transferring patients to one of the wards or taking them for scans or x-rays. This meant that they never heard the calls for assistance. The problem was exacerbated by the sheer size of the hospital. For example, transporting a patient on a trolley bed from ED to ward D57, the long stay acute medical unit, takes 25 minutes and at night, for security reasons, hospital rules require two staff to accompany each patient.

'It is a tool that has been configured to suit the needs of the department.'

*Richard Tucker,  
Superintendent Radiographer,  
Emergency Department,  
NUH*

A further problem was that, while staff had become immune to the public address system (for them it had just become more background noise), patients - particularly the elderly and those with dementia – often found the constant calls extremely disturbing. The public address system sounded in every patient cubicle and, in busy periods with up to 10 calls to EDAs going out in a five-minute period, the noise could become most unsettling for patients.

The obvious solution to the problem would have been to give all EDAs a mobile phone so that they could be contacted at all times whenever they were on duty. However, the Emergency Department is located on the lower ground floor of the hospital where there is, at best, very poor network coverage.

The solution proposed and developed by the ED change management team working with the NUH IT team was for each EDA to be issued with a portable handset, operating from the new local wireless network. This would enable clinical staff to make immediate contact with the EDAs wherever they were located in the hospital.

With the new technology installed each EDA now collects a portable handset from the EDA manager at the start of their shift and clips it securely to their uniform. They leave the phones switched on when available for work then switch them to 'do not disturb' when engaged in clinical duties.

The nurse-in-charge for each area now has a desk phone which, through the local wireless network, can be used to instantly locate and call an available EDA. The nurse uses the locator button on the phones to find the nearest available EDAs then uses either the push to talk function (which is similar to a two way radio) or the phone function to call for assistance.

The handsets are very similar to mobile phones, so staff have had no trouble learning how to use them or adapting to the new working procedures.

*As a result of the new technology:*

- there has been a measurable improvement in EDA response times. Data extracted from the call logs shows that on average, the time taken for an EDA to respond has reduced to just over eight seconds and that 79% of calls for assistance are now answered at the first request for help. (In the remaining 21% of cases a second or third call has to be made to identify an available EDA.)
- the EDAs' workloads are now better managed as all calls for assistance are channelled through the nurse in charge or nurse co-ordinator, enabling prioritisation
- clinical staff no longer have to search on foot for an EDA
- patient waiting times are reduced as they no longer have to wait until an EDA can be found to escort them to another area
- noise levels have noticeably reduced throughout the department, making the environment more peaceful and far less disturbing to patients.

'We no longer spend long periods of the day searching for staff; using the new handsets we can find who we want when we want them.'  
*Sam Clunie, Junior Sister,  
Emergency Department,  
NUH*

## Emergency Nurse Practitioners

Emergency Nurse Practitioners (ENPs) are registered nurses who have undertaken additional relevant training so that they may 'receive patients with undifferentiated and undiagnosed problems and make an assessment of their health care needs, based on highly developed nursing knowledge and skills, including skills not usually exercised by nurses, such as physical examination'.<sup>6</sup>

ENPs see all ED patients who present with minor injuries. They have their own waiting areas and treatment rooms which are located some distance from the main ED areas.

Before the new technology was installed, if the ENPs were uncertain about a particular patient's injury, wanted advice on treatment or just needed a second opinion then they had to find a doctor. This usually meant phoning round the department or, more often, going to search for one on foot. It was an inefficient way of working which often resulted in doctors being interrupted whilst treating another patient.

The solution proposed and developed by the ED change management team working with the NUH IT team was for each ENP and each doctor to be issued with a portable handset, operating from the new local wireless network. This would enable ENP staff to instantly locate and speak to an available doctor. With the new technology installed each ENP has been issued with a portable handset which operates in the same way as those used by the EDAs.

*As a result of the new technology:*

- ENPs can now obtain instant advice or support from a doctor whenever they need it
- doctors are not disturbed when they are already engaged in clinical duties. If they are busy then they just switch their handsets to 'do not disturb'
- patients' waiting times are reduced as ENPs no longer have to search for an available doctor.

## Emergency Department Consultants

Another staff group that ED staff often need to contact but who can be difficult to locate are the Emergency Department Consultants (senior doctors).

Before the new technology was installed in the emergency department, if a patient needed to be seen by a consultant, ED staff would consult a paper-based rota, identify the doctor on call and then page them. They would then wait by the phone until the doctor called them back. However, the system was both inefficient and ineffective as:

- the rota was rarely updated when doctors swapped duties so ED staff didn't know whom to call
- rota did not include details of doctors' rest breaks
- the hospital phones were frequently used by patients or their relatives so staff had trouble finding a phone that was not in use to page the doctors
- two or three different doctors would sometimes be paged at the same time, from the same phone, so that when the doctors tried to respond only one could get through
- doctors were not aware of how urgent a call was
- doctors did not answer page calls if they were engaged in clinical duties elsewhere.

The solution proposed and developed by the ED change management team working with the NUH IT team was similar to that for EDAs and ENPs. Each consultant would be issued with a personal portable handset so that they could be quickly and easily contacted whenever they were on call.

*'As a consultant, people were always looking for me 10, 12, 15 times an hour – wandering around the department, paging me / waiting by a phone.'* Demas Esberger, Head of Service, ED Consultant, NUH

6. [www.rcn.org.uk/\\_data/assets/pdf\\_file/0003/146478/003207.pdf](http://www.rcn.org.uk/_data/assets/pdf_file/0003/146478/003207.pdf)

With the new technology installed each Emergency Department consultant now has a personal handset which they switch on and carry with them whenever they are on duty. Using the technology provided by the new phones, trainee doctors or the nurse in charge can now instantly see which consultants are on duty, can locate them and then either phone for advice or ask for their assistance.

*As a result of the new technology:*

- nurses and junior doctors no longer waste valuable time searching the department or phoning around to locate a consultant
- consultants no longer waste time searching for a hospital phone to respond to a page call
- trainee doctors and the nurse in charge no longer have to wait by the phone for a doctor to respond to a pager
- patient waiting times have reduced.

### **Radiographers**

Although the ED has a dedicated x-ray department it is some distance from the main patient treatment areas. If a patient requires an x-ray the examining doctor completes an electronic x-ray request and an EDA is called to escort the patient to the x-ray department. The radiographer takes the x-ray and sends it electronically back to the doctor. The patient waits in a corridor outside the x-ray department until someone comes to collect them and return them to the main area of ED. Finally, when the doctor has received the x-ray and the patient is back in ED a diagnosis is made.

Before the new technology was installed this could be a slow process that was fraught with difficulties:

- it was difficult to find an EDA to take the patient to x-ray
- radiographers had no way of querying requests or discussing results with doctors which meant that patients could be returned to ED without having had all the requisite x-rays
- doctors did not know when the x-rays had been taken so had to keep checking their computers
- patients were left waiting in a corridor outside x-ray, in an area with no refreshment or toilet facilities, for periods of up to an hour until an EDA could be found to take them back to ED
- despite pressurised workloads, radiographers would sometimes have to escort patients back to ED if no EDAs could be found.

The process was inefficient, significantly extended patient waiting times, was often distressing for patients, and staff worried about the poor level of service being provided to patients.

The solution proposed and developed by the ED change management team working with the NUH IT team was enabled using a combination of telephony services and an interface to the Trust's Emergency Department system.

With the new technology installed the radiographers have a desk phone located in a central area next to their computers which they can use to instantly locate clinicians whenever they have a query or want to discuss a particular case. Once the x-rays are completed, the referring clinician and the EDAs now receive a simple text message confirming that the x-ray is ready for review and that the patient is ready for return to the main department.

*'Surprisingly, the installation of the new technology has actually increased human interaction.'*

*'The new system still has the human factor – you ring and can talk to someone at the other end which radiographers like. This human element mixed with technology supports a more collaborative working environment.'*

*Richard Tucker,  
Superintendent Radiographer,  
Emergency Department, NUH*

*As a result of the new technology:*

- patients are no longer returned to ED without having all the necessary x-rays. If the radiographer considers that additional x-rays are required he consults the referring doctor while the patient is still in the x-ray department
- staff are notified immediately x-rays are ready so doctors no longer have to keep checking their computers for results
- radiographers can speak directly to EDAs and arrange for patients to be collected so they no longer have to leave the department to return patients to the main department themselves.

### **Stores Manager**

Before the new technology was installed, if clinical staff ran out of stock or needed a particular item of equipment not held in a central area, they either had to go to stores and look for it themselves or find the ED Stores Manager. However, as the clinical staff struggled to find their way round the stores department and the Stores Manager could be difficult to locate, this was an unsatisfactory arrangement.

Staff tended to work round the problem by over-stocking certain areas of the department. This led to low stock levels in the stores area and so had the detrimental effect of encouraging over-procurement.

The solution proposed and developed by the ED change management team working with the NUH IT team was to provide the Stores Manager with a handset so that clinical staff could instantly locate the Stores Manager and get immediate access to supplies.

*As a result of the new technology:*

- nurses no longer waste valuable time searching for the Stores Manager or for supplies
- patients do not have to wait while supplies are found so waiting times are reduced
- more stock can be held centrally, supporting better management of stock levels.

### **Example of a typical patient journey before and after the introduction of the new technology**

An example of the typical pathway of a patient with a broken leg – before and after the introduction of the new technology – is set out on the facing page.

On arrival the patient is taken to Area 3, and after a 24 minute wait, is examined by a doctor. The doctor orders an x-ray and an EDA is called to take the patient to the x-ray waiting room. Before the new technology was introduced, it would take about 14 minutes to locate an EDA. With the new technology an EDA is called within one minute.

The patient waits in x-ray for 14 minutes before being called by the radiographer. The radiographer has a query about the x-ray request or results but cannot locate the referring doctor so the patient is transferred back to Area 3 where they wait 12 minutes to be seen by the doctor before being returned to x-ray for another wait of five minutes and then further x-rays.

With the new technology in place, however, the radiographer can instantly locate and speak to the referring doctor and clarify any queries whilst the patient is still in the x-ray department. The patient is then returned to Area 3 is seen by the doctor and discharged from ED.

As a result of the new technology the patient journey time is reduced from 113 minutes to just 76 minutes.

*'The department is working much more efficiently as the Stores Manager now delivers stock immediately it is requested.'*

*Kathryn Cox, Sister,  
Emergency Department,  
NUH*

	<b>Before</b>	<b>After</b>
Arrive	11.40	11.40
Area 3	11.40	11.40
Seen by doctor	12.04	12.04
EDA called	12.15	12.15
Transfer patient to x-ray	12.29	12.16
X-ray waiting area	12.30	12.17
X-ray	12.44	12.31
X-ray query Radiographer phones Dr		12.38
X-ray query Patient returned to Area 3	12.51	
Dr reviews x-ray	13.03	
Patient returned to x-ray	13.07	
X-ray waiting area	13.08	
X-ray	13.13	
Transfer back to Area 3	13.19	12.42
Dr reviews x-ray	13.29	12.48
Discharge	13.33	12.56
<b>Patient waiting time</b>	<b>69 minutes</b>	<b>39 minutes</b>
<b>Patient journey time</b>	<b>113 minutes</b>	<b>76 minutes</b>
<b>Reduction in patient waiting time</b>		<b>30 minutes</b>

'Long wait on trolley. Too much moving around.'  
*Comment from patient in 2008 survey*

## HOW THE COLLABORATION TECHNOLOGY WILL HELP THE EMERGENCY DEPARTMENT MANAGE DEMAND

As mentioned previously, one of the key problems facing the emergency department is managing demand. Patient numbers are forecast to increase by 5% per annum over the next five years but, with the department already operating at near maximum capacity, this extra patient activity cannot be absorbed. It was vital, therefore, that the new technology helped address this issue.

In July 2009, as part of the change management programme, KM&T suggested that NUH staff tracked the movement of nearly 400 patients presenting in ED with a minor injury or illness (patients categorised as 4, 5, 6 and 7). They recorded the time each patient arrived in the department and the time taken for each stage of the patients' journeys through ED.

The study showed that, on average, about 75% of the time adult patients were in ED was spent waiting and about 71% for paediatric patients. Patients waited to be streamed, waited for a wheelchair, waited for an EDA, waited for medication, waited for a specialist doctor, waited to get a blood test, waited to be taken to the x-ray department, waited to be collected from x-ray, waited for the doctor to receive and then review results, waited to be admitted to a ward or waited to be discharged home.

NUH staff repeated the data collection exercise in November 2009, after the new technology was fully operational in ED but before any processing changes had been implemented. The data showed that, on average, waiting times were now significantly shorter. For adults the waiting time for each patient had decreased by 21 minutes (28%) and for children by 29 minutes (40%). (Tables 3 and 4)

Prior to the introduction of the new technology patients spent nearly three quarters of their time in ED waiting. The average value added time, therefore, where the patient was being examined, receiving tests or treatment of some sort, was just 25% for adults and just 29% for children. After the introduction of the new technology, as a result of the reduction in waiting times, there was a significant improvement: for adults the average value added time increased by 5% to 30%, and for children by 7% to 36%. (Table 5)

NUH staff undertook both the July and November data collection exercises before the rollout of any of the service redesign initiatives, which suggests that the reduction in waiting times and increase in value added time can be attributed solely to the improvements in intradepartmental communication made possible by the new technology. At the touch of a button staff can now instantly locate any other member of the on-duty ED team to seek assistance, ask advice or to view clinical results and, as a result, patients' waiting times have significantly decreased.

Since the introduction of the new technology, the total time each category 4, 5, 6 or 7 patient spends in the department has reduced by an average of 23% (23 minutes) for each adult and 33% (34 minutes) for each child. The reduction in total length of each patient journey is important, not just for the patient, but also for capacity management.

'The new phones have made a significant improvement to the department. A huge time saving. Sometimes had to wait 5-10 minutes by a phone, a very inefficient way of working.' *Demas Esberger, Head of Service, ED Consultant, NUH*

**Table 3**  
**Adults - average length of time each category 4, 5, 6 or 7 patient spends in NUH ED**

	Waiting	Receiving treatment	Total
Before new system	74 minutes	25 minutes	99 minutes
After new system	53 minutes	23 minutes	76 minutes
Time saved per patient	21 minutes	2 minutes	23 minutes

**Table 4**  
**Paediatrics - average length of time each category 4, 5, 6 or 7 patient spends in NUH ED**

	Waiting	Receiving treatment	Total
Before	73 minutes	30 minutes	103 minutes
After	44 minutes	25 minutes	69 minutes
Time saved per patient	29 minutes	5 minutes	34 minutes

**Table 5**  
**Average value added time**

	Adults	Children
Before	25%	29%
After	30%	36%
Improvement	5%	7%

The data collected by NUH staff showed that on average, since the introduction of the new technology, clinicians now spend two minutes less time with each adult and five minutes less with each child. ED staff attribute this time saving to the improved communication made possible by the new technology. Using their portable handsets staff can now instantly call for advice, a second opinion or to check on results. There is no waiting time – for either the clinician or the patient.

As, on average, the emergency department currently treats approximately 400 patients each day of which around 151 (37.7%) are classed as category 4, 5, 6 or 7 then this equates to a total time saving for clinicians of nearly seven hours per day, or one full time doctor per year – a total annual cost saving of €86,000. This will help staff cope with the increasing demands on the department enabling it to contain part of the cost of the additional staff required to treat the forecast growth in patient numbers.

However, the full benefits of the new technology are still to be realised; additional functionalities are being added in the coming months and these will give further potential for savings.

‘Patients want to get in and out as quickly as possible; our phones improve patient throughput so patients will benefit.’

*Navin Bedi, Senior Doctor, ED Consultant, NUH*

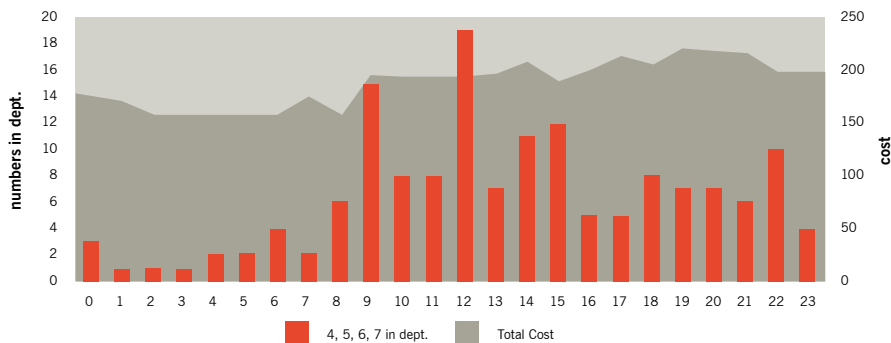
## Matching staffing to demand

In addition to helping the emergency department manage the growth in demand the new technology will also assist staff rostering. At present, although the number of doctors on duty is aligned to the number of patients in the department, the number of nursing staff and EDAs on duty is not. For historical reasons nursing staff and EDAs follow a standard 12 hour shift pattern which means that, at any particular time, there is little correlation between the number of patients in the department and the number of EDAs or nursing staff on duty.

Figure 1 compares the number of patients presenting in ED with a minor injury or illness (category 4, 5, 6 and 7 patients) on 28 September 2009 with the total cost of the staff who treated these patients. Whereas the number of patients can be seen to vary throughout the day, the total staffing cost remains fairly constant throughout.

Figure 1

**Category 4, 5, 6, 7 patients in department by hour and total staffing cost (Monday 28 September 2009)**



The new technology will help change this by giving managers the tools needed to gain a better understanding of the fluctuating demands on the department. In future they will be able to use real-time call records, extracted from the new phones, to analyse workflow patterns, to undertake trend analysis and to support more effective staff planning. If the data shows that a number of calls and messages were unanswered over a particular period of time, for example, then this would suggest that the department was understaffed. Over time, the call logs will help ED managers gain a better understanding of the pattern of workflow in the department so that they can better match capacity to demand. This will help decrease patient waiting times, ease the pressure on staff at peak periods and help reduce the department's dependence on agency staff.

'Anything that makes the patient journey better has to be a winner.'

*Sam Clunie, Nurse in Charge, Emergency Department, NUH*

## HOW THE COLLABORATION TECHNOLOGY WILL IMPROVE SERVICES FOR PATIENTS

When NUH ED has sought feedback from patients on the services provided, the two issues that they always raise relate to waiting times and communication. A survey of 441 NUH ED patients in July 2009<sup>7</sup>, for example, found that nearly three quarters (71%) of patients complained that they were not kept informed on waiting times.

To improve services from the patients' perspective, therefore, the solution proposed and developed by the ED change management team working with the NUH IT team had to address both patient waiting times and communication issues.

As mentioned previously, patient waiting times have measurably improved. For adults the waiting time has reduced by 28% and for children by 40%. (Table 8) This is a direct result of the improved staff communication links within ED; patients are no longer left waiting for an EDA to take them to or collect them from x-ray, for an ENP to get a second opinion from a doctor or for their results to be reviewed.

**Table 8**  
Average patient waiting times, category 4, 5, 6 and 7 patients before and after introduction of new technology

	Before	After	Improvement
Adults	74	53	28%
Children	73	44	40%

**Table 9**  
Extracted from the NUH emergency department patient satisfaction survey

	July 2009	January 2010	Improvement
The staff were friendly, caring and courteous towards me.	63%	70%	7%
A member of staff told me which side effects to look out for.	51%	57%	6%
The medicines I was given were clearly explained to me.	65%	72%	7%
My personal needs and requirements were taken into account in a respectful way.	61%	70%	9%
I was given enough privacy when discussing my condition.	63%	69%	6%
I was given enough privacy when being treated.	67%	73%	6%
I was given enough privacy when being examined.	68%	74%	6%
I was kept updated on waiting times.	29%	33%	4%
The information I was given about my care and treatment was understandable.	61%	67%	6%
I felt I could ask for anything from any member of staff.	49%	55%	6%
I was involved in decisions about my care and treatment.	49%	55%	6%
I was given enough information about my treatment/condition.	56%	67%	11%

The ease with which staff can now communicate with colleagues throughout the department has reduced the pressure on staff and this is perhaps the reason that the latest patient survey shows an overall improvement in communication. (Table 9)

These figures, particularly those related to communication, are expected to improve even further following the introduction of digital signage to the main waiting areas of the department. These screens will keep patients informed of waiting times, display information, present news channels and will provide entertainment in the children's areas.

In addition to shorter waiting times and improved communication, the new technology has brought noticeable improvements to patient comfort levels. As previously highlighted in the report: patients are no longer disturbed by the constant call of the public address system; and patients are no longer left waiting to be collected from outside the x-ray department for long periods of time.

## **RETURN ON INVESTMENT**

Nottingham University Hospitals NHS Trust invested a total of €4.8m on the new technology, around 2% or €96,000 can be attributed to ED.

Clinicians in charge estimate that the time savings achieved to date can be equated to the cost of one doctor or €86,000 per year therefore, based on current operation; the cost of the technology will be fully recovered in under 14 months. However, the technology is just a platform and it has the potential to deliver a huge range of additional functionalities including locating objects, optimisation of laboratory result data flows and better space and bed management. This additional functionality will deliver further savings and, if these are taken into account, then the full cost of the ED technology is expected to be fully recovered much sooner than in 14 months.

## Conclusion

Working in conjunction with the hospital IT team, the change management team from NUH ED have designed and put in place an information system that has successfully bridged the communication problems that were hampering service delivery in the department. Utilising telephony services provided by fixed and portable handsets, the new system enables staff to instantly contact any other member of the ED team – wherever they are located within the department.

Although it is very early days, the new technology has already delivered significant improvements to service delivery:

- patients have benefited from the streamlining of operations which has significantly reduced patient journey times by 23% for adults and 33% for children and patient waiting times by 28% for adults and 40% for children. Staff now have more time to spend on direct patient care and with the demise of the public address system the environment has become far more peaceful. As a result there has been a measurable improvement in overall patient satisfaction
- clinical and nursing staff have benefited from improved intradepartmental communication. At the touch of a button they can now locate or speak to any other member of the on-duty ED team to ask for assistance, to obtain a second opinion or to view results. These changes have fostered a more collaborative working environment with all staff working together to ensure the new system's success
- productivity has measurably increased. Improvements in communication have reduced the time doctors need to spend with category 4, 5, 6 and 7 patients and this has resulted in a total time saving of over seven hours a day or one full-time doctor per year – a total annual cost saving of €86,000. This cost saving will cover the cost of the department's initial investment in the new technology allowing a full return on investment to be realised in just over a year.

The new technology is currently only in the initial stages of roll-out. Over the next 12 months further functionality will be added to the system and the technology will be rolled out across both sites of the hospital to deliver:

*clinical benefits of:*

- secure access to up to date information at point of care
- enabling access to allow remote clinical decision making (e.g. from home), removing the need for on-call doctors to be based at the Trust and enabling quicker consultation of senior clinical staff
- real time bed state reporting and management, enabling quicker patient throughput.

*patient benefits of:*

- secure, but monitored, patient (and other third party) access to the internet using the WiFi network
- enabling remote viewing of images from outreach clinics so patients don't need to travel to hospital
- shorter waiting times and improved safety from reductions in need for duplicate data entry.

These functions will provide further support towards the drive for system improvement in the years ahead as the department faces the pressures of managing increasing demand, rising costs and ever shrinking budgets. A more detailed analysis will be required in the months ahead to fully assess the benefits of these additional features.

In summary the NUH IT team and ED change management team have produced a reliable, efficient, flexible ICT solution that is fully aligned to business needs and will provide the support that ED staff require as they face the challenges of the future. It is already delivering significant benefits; it will be interesting to see how much more it delivers in the year ahead.

'The new technology supports information driven decision making.'  
*Amber Bristow, Emergency Department Project Lead, Emergency Department, NUH*

## BACKGROUND – THE ENGLISH HEALTHCARE SYSTEM

The infrastructure of the English healthcare system is based around a primary and secondary care service model with general practitioners (GPs) acting as the gatekeepers to secondary care services. The system is publicly funded through taxation and, with the exception of some dental, optical and dispensing services, offers free care at the point of delivery.

The English healthcare system in brief:

- National Health Service (NHS) covers all 51.2m citizens
- With over 1.3m employees, the NHS is one of the largest employers in the world
- NHS expenditure was €109bn in 2008/09
- There are 34,010 GPs (66.6 per 100,000 population)
- The NHS treats 1m patients every 36 hours
- The NHS national telephone helpline (NHS Direct) receives half a million phone queries each month.

*Department of Health: Departmental Report 2009 (page 218)*

The administration of the NHS varies in each part of the UK, but in England it currently operates at four different levels:

- Department of Health
- Strategic Health Authorities
- Primary Care Trusts
- NHS Trusts.

### Department of Health

The Department of Health defines and oversees the overall direction of the NHS and sets the standards for service delivery. It is accountable to both the government and the public.

The Department has three strategic objectives<sup>9</sup>:

- better health and well-being for all: helping people stay healthy and well; empowering people to live independently; and tackling health inequalities
- better care for all: the best possible health and social care that offers safe and effective care, when and where people need it; and empowering people in their choices
- better value for all: delivering affordable, efficient and sustainable services; contributing to the wider economy and the nation.

### Strategic Health Authorities

For the purposes of the delivery of healthcare, England is sub-divided into 10 distinct regions. Responsibility for overseeing the delivery of healthcare in each region lies with a Strategic Health Authority (SHA). SHAs monitor the performance of NHS Trusts and PCTs within their region and ensure residents have equitable access to quality health care.

### Primary Care Trusts (PCTs)

Primary Care Trusts (PCTs) are the organisations responsible for commissioning hospital, community and primary care services. There are currently 152 PCTs in England and, between them, they control over 80% of the overall NHS budget.

Primary care is the first port of call for most people when they develop a health problem, usually via a visit to their GP or family doctor. There are over 34,000 GPs in England, the vast majority of whom operate as independent contractors to the NHS.

### NHS Trusts / NHS Foundation Trusts

The provision of hospital care, mental health services and ambulances is undertaken by NHS Trusts. These organisations receive most of their income through providing services to PCTs. There are currently 253 NHS Trusts: 73 of these provide mental health services and 12 provide ambulance services.

NHS Trusts which have passed a rigorous assessment process are granted Foundation Trust status. Unlike other NHS Trusts, these organisations are performance managed by Monitor, an organisation that reports directly to the Secretary of State.

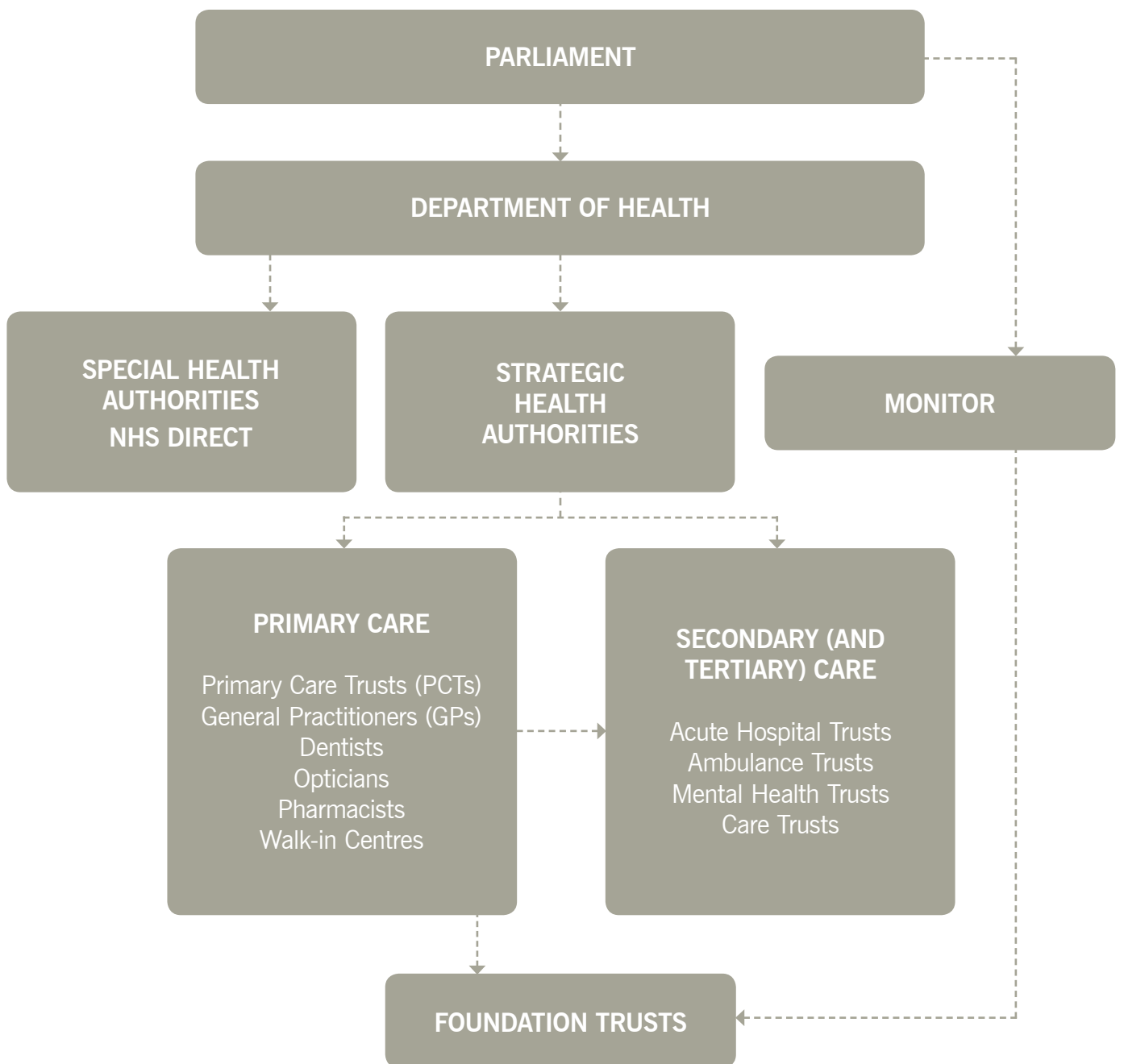
### Foundation Trusts:

- have greater operational freedom
- can retain their surpluses and borrow to invest in new and improved services for patients
- are accountable to their local communities, to their commissioners and to Parliament.

There are currently 122 FTs of which 36 are mental health trusts.

In addition to the organisations listed above England has 10 Special Health Authorities which provide specialised health services such as blood supplies and transplant services across the whole country, and NHS Direct, which provides 24 hours a day, 365 days a year health information and advice through both its on-line service and a telephone helpline.

9. [www.dh.gov.uk/en/Aboutus/HowDHworks/DH\\_4105906](http://www.dh.gov.uk/en/Aboutus/HowDHworks/DH_4105906)



## Appendix B

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### Nottingham University Hospitals NHS Trust's Medical Grade Network

In 2006, NUH and Cisco undertook a wide-reaching study of business processes at the Trust, and concluded that 'connecting' healthcare would enhance patient safety, improve clinical outcomes, reduce the length of hospital stay, minimise administrative costs and increase revenues. Such benefits would be achieved by considering organisation, process and technology together, across functional and geographic boundaries, to develop efficient 'care pathways' - and to deliver information to the point of care at the time of need.

To help the reader of this report, we have prepared a brief overview of the benefits of the Medical Grade Network (MGN) as deployed in Nottingham.

Although, at component level, the deployment is highly complex, the benefits are described in terms of eight attributes; (1) converged IP networks, (2) communications, collaboration and messaging, (3) the application environment, (4) video, (5) mobility solutions, (6) intelligent building technology, (7) data centre and (8) information and service assurance.

In order to ensure that technology can effectively address the requirements of delivering modern healthcare, Cisco recommends the adoption of an architectural approach to IT system design and operation. There are a number of such architectures in use across the EU and beyond, each designed to ensure the strategic linkage of business to technology. Cisco has published a number of detailed documents describing the approach. For the healthcare sector, the current documentation can be found at

[www.cisco.com/en/US/docs/solutions/Verticals/Healthcare/MGN\\_wireless\\_adg.html](http://www.cisco.com/en/US/docs/solutions/Verticals/Healthcare/MGN_wireless_adg.html)

[www.cisco-nab.com/](http://www.cisco-nab.com/)

The rationale for a network-centric architecture is clear: the network delivers applications to the user, and is the prerequisite for any data-exchange. It provides collaboration, virtualisation and personalisation, ensuring the use of reliable, accurate, current and consistent patient and business information. This is the foundation for a connected health ecosystem. Cisco terms this fundamental tenet 'The Network as the Platform'.

### Converged IP Networks

The internet is the largest IP network.

Every day, users exploit the internet to access websites, video information for business, research or entertainment, to interact with friends, family and colleagues using messaging, or audio and video telephony. New applications and providers emerge constantly.

The internet acts as a conduit for business and consumer services into homes, businesses and public sector bodies.

NUH now considers its network in that same way, as the single conduit for all business and clinical services; its IP network is critical infrastructure, essential for service delivery. As a consequence, the leadership team for ICT at NUH embarked upon a two-pronged strategy: to transform its own approach to service provision, and to shift how IT was perceived and managed by the Trust as a whole. The first change was operational, requiring total adherence to the IT Infrastructure Library (ITIL) model across the team, and for all processes. The second was cultural; the requirement was to have IT seen to serve the Trust, enabling rather than attempting to impose change. The solution was to make the hospital-wide Service Improvement Board responsible for managing and prioritising the whole IT programme of work. This has ensured congruence of purpose between business priorities and IT service delivery.

### Communications, Collaboration and Messaging

Rich-media communications, collaboration and messaging tools are the main element of the applications whose benefits are examined in this study and which complement the mobile and video environments described below.

One of the first communication systems to benefit from convergence onto the IP network was telephony (Unified Communications). The last 10 years have seen wholesale transformation of telephony services from TDM (Time Division Multiplex) to IP. Unified Communications offers huge advantage over old world systems, with orders of magnitude more intelligence and integration being offered. Simply put, Unified Communications offers a wide range of communication options, enabling more communication more simply and more successfully than before.

These solutions allow staff to work from any location without downgrading levels of contact with colleagues. Key tools within this category include instant messaging, voicemail, video and web conferencing. These tools are well established within the private sector and have been instrumental in allowing mobile network environments to deliver transformational changes in working practice.

Telepresence and healthpresence allow very high quality video conferencing – HD video, directional CD quality sound, and no perceptible delay – to support executive and clinical contact. These tools – particularly when combined with effective collaboration tools – are the key to providing a 'face to face' equivalent experience.

### The Application Environment

Applications currently used by NUH can be virtual (cloud based), national, regional or local in nature, and can be accessed from a clinical modality, PACS viewing station, desktop PC, laptop, tablet, or smart phone, with processing done locally (fat client) or virtualised (thin client). Local ICT considerations include how the applications perform, are prioritised, and are secured; the protection of Person Identifiable Data is paramount. The medical grade network provides an environment which is available (no single point of failure), scalable and secure, allowing interactions between all users and systems to occur seamlessly.

## Video

Video is a key asset in NUH where 'showing rather than telling' is so powerful – for CT scans, for a patient's clinical symptoms, for training, for remote observation of patient behaviour and for richer information sharing between different clinical disciplines.

As seen on the internet, video is now easily supported on correctly-designed IP networks. Video offers great potential for transforming and improving clinical and operational efficacy:

- it can deliver live or stored e-learning material
- it can deliver messages and other information to staff and patients within Trust buildings using digital media/signage
- it can allow traditional audio-only telephony to be superseded by much richer video telephony
- it can enable video and rich-media conferencing between clinical teams
- it can help reduce travel providing benefits in terms of cost, time and environmental impact.

## Mobility Solutions

Mobile working is increasingly important in NUH.

Mobility solutions provide a key to improved productivity and effectiveness for hospital and community-based staff. They also enable solutions that help identification and utilisation of key resources. Mobility solutions are very widely deployed and early concerns around safety and security have been addressed – in some part by regulatory compliance. Today wireless is robust, fast and is secured to transport patient-identifiable data. It also provides the base for bedside or mobile computing in hospitals so that patient information can be available directly at the point of need.

Wireless networking allows for location-independent working, for example within hospitals where it can be a key enabler for initiatives such as the productive ward. RFID based asset tracking offers very strong business and economic benefits. Wireless tags allow key assets to be located and tracked for security, for routine maintenance and for improved utilisation of those assets.

Remote access and teleworker solutions allow staff to work from home or when out in the community. This ability offers considerable benefits both to employers in terms of increased staff efficiency and effectiveness, and to staff who can potentially achieve a better work / life balance. While working from home is a benefit for many it can be essential for those who are carers, who are long term sick, or have child care responsibilities. Provision of mobility solutions should be seen by an employer as a means of fostering staff inclusion, and of retaining key staff members who might otherwise not be able to continue in work.

### Intelligent Building Technology

Connected Real Estate is the industry term for utilising the IP network to improve the function and efficiency of buildings and their environs.

Connected Real Estate calls for all essential building services – building and energy management, heating and ventilation, security and access control – to be run on the network. Once again, the

network becomes a key business asset, but importantly adds reliability and reduces complexity, duplication and cost.

## Data Centre

The increased reliance on ICT by healthcare providers focuses attention on the environment – the data centre - where applications, information and services are located.

In the past data centres were simply a repository for servers and storage, but today data centres are built to exacting standards of dependable power, advanced cooling and high security. They also employ virtualisation and dynamic provisioning to provide the ability to make operational changes to applications and services in a timely manner, with no impact on users.

### These new technologies include:

- Virtualisation – so that all data centre infrastructure need not be dedicated to particular applications, and can be made available on demand to meet new needs. This can also reduce the ICT estate, hence having a positive impact on power usage and carbon impact.
- Dynamic Provisioning – so that software tools can allow virtual infrastructure, servers and storage to be dynamically provisioned on demand to meet changing business requirements.

## Information and Service Assurance

As previously discussed, NUH ICT services are now treated in the same way as 'Critical National Infrastructure'.

That is, infrastructure and services are designed and deployed so that they can offer the highest levels of reliability and availability, and provide assurance for sensitive patient information. In the past ICT services in healthcare were not designed with end to end security in mind. ICT security provision was usually limited to perimeter protection via firewall devices or similar. NUH has implemented a 'self-defending network' with pro-active security provision along the end to end path between user and data centre. Some of the principal concerns addressed are:

- Governance – particularly in respect of handling patient information in the new, collaborative environment.
- Person Identifiable Data – ensuring the integrity of such data particularly in those applications without inherent encryption capability.
- Data Loss Prevention – due to accidental loss/theft of assets, the misuse of removable storage devices, malicious hacking of systems, and human error.

Key areas for security provision are at the client device, at the network edge, in the core of the network and within the data centre. In each of these areas there have been major technological advances – such as non-signature based threat detection at the desktop, admission control at the network edge and virtualised services offering very fine granular control within the data centre.

The MGN deployment considered all of these areas to maximise the ability of technology to deliver on assurance policies.

## Appendix C

### Nottingham University Hospitals NHS Trust's Emergency Department Patient Satisfaction Survey

	July 2009	January 2010	Improvement
I would recommend this hospital to a friend or relative.	55%	62%	8%
I would choose to come to this hospital again for my care.	59%	62%	4%
The staff were friendly, caring and courteous towards me.	63%	70%	7%
The nurses on duty provided me with the care I needed.	60%	62%	2%
I felt the staff did as much as they could to control my pain.	54%	58%	4%
I was asked if I was in pain during my time in the Emergency Department.	60%	60%	0%
Hand gel was available in the area I was treated in.	74%	77%	3%
Staff washed their hands or used hand gel before and after caring for me.	56%	60%	4%
The food and drink provided was appropriate for my needs and my diet.	44%	48%	4%
I felt able to ask for food or a drink.	44%	47%	3%
A member of staff told me which side effects to look out for.	51%	57%	6%
The medicines I was given were clearly explained to me.	65%	72%	7%
It was easy to find my way around the department.	57%	60%	3%
The toilets and basins were clean and sufficiently stocked.	66%	67%	1%
The department was clean and tidy.	70%	74%	4%
My personal needs and requirements were taken into account in a respectful way.	61%	70%	9%
I was given enough privacy when discussing my condition.	63%	69%	6%
I was given enough privacy when being treated.	67%	73%	6%
I was given enough privacy when being examined.	68%	74%	6%
I was kept updated on waiting times.	29%	33%	4%
The information I was given about my care and treatment was understandable.	61%	67%	6%
I felt I could ask for anything from any member of staff.	49%	55%	6%
I was involved in decisions about my care and treatment.	49%	55%	6%
I was given enough information about my treatment/condition.	56%	67%	11%

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The staff from the Emergency Department at Nottingham University Hospital

The staff from the ICT department, NUH

Staff from NextiraOne

## About the organisations

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### ACCA

ACCA (the Association of Chartered Certified Accountants) is the global body for professional accountants. We aim to offer business-relevant, first-choice qualifications to people of application, ability and ambition around the world who seek a rewarding career in accountancy, finance and management.

We support our 131,500 members and 362,000 students throughout their careers, providing services through a network of 80 offices and centres. Our global infrastructure means that exams and support are delivered – and reputation and influence developed – at a local level, directly benefiting stakeholders wherever they are based, or plan to move to, in pursuit of new career opportunities.

We use our expertise and experience to work with governments, donor agencies and professional bodies to develop the global accountancy profession and to advance the public interest. Our reputation is grounded in over 100 years of providing world-class accounting and finance qualifications. We champion opportunity, diversity and integrity, and our long traditions are complemented by modern thinking, backed by a diverse, global membership. By promoting our global standards, and supporting our members wherever they work, we aim to meet the current and future needs of international business.

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### CISCO

#### Corporate Overview

Cisco Systems, Inc. is the worldwide leader in networking for the internet. Today, networks are an essential part of business, education, government and home communications, and Cisco Internet Protocol-based (IP) networking solutions are the foundation of these networks.

Cisco hardware, software, and service offerings are used to create internet solutions that allow individuals, companies, and countries to increase productivity, improve customer satisfaction and strengthen competitive advantage. The Cisco name has become synonymous with the internet, as well as with the productivity improvements that Internet business solutions provide. At Cisco, our vision is to change the way people work, live, play and learn.

Cisco has over 300 offices in 140 countries, and employs 65000 people. Cisco is committed to innovation and research and development is a core component of our corporate culture. Cisco spends nearly \$5.2bn a year in R&D, making us one of the top R&D spenders in the world.

Cisco (NASDAQ: CSCO) this year celebrates 25 years of technology innovation, operational excellence and corporate social responsibility. Information on Cisco can be found at [www.cisco.com](http://www.cisco.com). For ongoing news, please go to <http://newsroom.cisco.com>.

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