

Lessons from England about GP computing

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Executive Summary

There are 29,000 GPs in England who work in 8,810 practices; about ¼ of whom still work alone. Over 97% of GPs have a clinical computer system and almost all use their systems for acute prescribing and for repeat prescribing. Many practices are using electronic appointment systems and an increasing number of practices scan all hospital letters, reports etc which are then attached to the individual patient record. There are estimates of up to 30% of practices running ‘paper-lite’ systems today. In those practices which are paper-lite, a full time GP will spend 24-27 hours using their computer while in direct contact with their patients.

Today, the NHS has two national networks – N3 (the New National Network) and NHSnet. N3 and NHSnet are connected and route traffic between them. N3 will eventually replace NHSnet. NHSnet has about 10,000 connections. At present N3 provides approximately 5,500 connections; this is on target with the plan to connect all 18,000 NHS locations by March 2007. Today, 94% of GP practices in England receive their pathology results electronically and have their EMRs updated automatically.

General practice has been the cornerstone of the NHS since its inception in 1948. With approximately 300 million consultations every year (nearly 90% of the work of the NHS), primary care is predominantly provided by GPs who act as gatekeepers. Since 2000, GP practices and community health services have been formed into Primary Care Trusts (PCTs), with influence over the health care budgets for their enrolled populations. PCTs are managed by a board and a Professional Executive Committee which represents local GPs, nurses, social services, and the community.

Most GPs are technically self-employed independent contractors funded by a combination of methods: capitation, fee for service, and allowance. In June 2003, GPs accepted a new General Medical Services (GMS) contract, negotiated by the British Medical Association (representing the physicians) and the NHS Confederation (representing the employers). Currently 60% of GPs operate under the GMS contract. The contract is with the practice rather than the individual GP, thus allowing other health workers to be GMS contract holders provided there is at least one GP in the partnership. Patients are now registered to a practice rather than an individual GP.

Computers have been used in general practice in England since the 1970s. The real growth in general practice computing, however, did not occur until after 1987. This was primarily due to:

- The 1988 buy in of the College and the professional organization (BMA) to valuing IT and providing resources to support training of providers and their staff.
- The agreement by the Department of Health in 1990 to reimburse part of the cost of purchasing and maintaining computers in general practice.
- The introduction of the new GP Contract and the publication of the “Health of the Nation” in 1991 with its emphasis on information collection and analysis, particularly in relation to health promotion targets.

Yet another influencing factor was the introduction of Requirements for Accreditation (RFA) in 1993 to ensure GP computer systems provided agreed core functionality and conformed to national standards. It also determined whether remuneration of GP purchasing & support costs were allowable based on performance in a number of defined areas of functionality.

It is useful to note that computer usage has markedly increased since the advent of the new 2004 GMS contract containing the Quality and Outcomes Framework (QOF). The introduction of quality targets replaced the majority of Items of Service as a mechanism of funding. The QOF has both clinical and organisational targets giving a total of 1050 potential points. In 2005–06 these points will be worth £120 each for an average size practice, thus giving GPs an extra income over their base income.

In 2004, the national programme for IT (NPfIT) – now referred to as “NHS Connecting for Health”- introduced a central system to electronically collect the anonymised data from GP practices to indicate their monthly performance. The Quality Management and Analysis System is a new national system, which gives GP practices and PCTs objective evidence and feedback on the quality of care delivered to patients. The system shows how well each practice is doing, measured against national achievement targets detailed in the GMS contract, which sets out the way GPs work and the way they are financially rewarded.

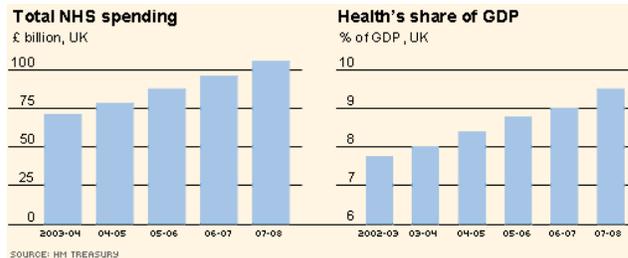
Introduction

The National Health Service (NHS) was set up in 1948 to provide healthcare for all citizens, based on need, not the ability to pay. The NHS is funded by the taxpayer and hence is accountable to Parliament. There is a devolved parliamentary government for Scotland and Wales who have their own Assemblies whilst the NHS in England is managed by the Department of Health - which is directly responsible to the secretary of state; Northern Ireland is managed by its own Department of Health, Social Services and Public Safety. The English department sets overall health policy, is the headquarters for the NHS and is responsible for putting policy into practice. It also sets targets for the NHS and monitors performance. The government controls the national supply of doctors, nurses, and other skill groups through the Workforce Development which fund training places.

Consistent with the general public sector trend to switch from "rowing" to "steering," the government of England has recently placed increased emphasis on holding Strategic Health Authorities, Primary Care Trusts, and NHS Trusts (hospitals) accountable for outcomes and outputs; they are charged with the implementation of these policies with the Department of Health setting targets and monitoring performance.

NHS funding covers preventive services, inpatient and outpatient hospital care, physician services, inpatient and outpatient drugs, dental care, mental health care, and rehabilitation for the citizens of the UK, of which 49 million live in England (59 million in the UK). There is little use of cost-sharing arrangements other than small charges for drugs and dentistry, but even in those cases there is free coverage for many patient categories. More than 80 percent of all drug prescriptions are transacted at no charge to the patient.

It costs more than £70 billion (\$154B) a year to run the English health care system. About 90 per cent of this comes from public funds. Over the past 40 years, total spending on health has increased by an average of 3.9 per cent a year in real terms. Currently, the UK spends about 8 percent of its GDP on health care; it is forecast to rise to over 9% by 2007.



Private insurance covers 11% of the population and accounts for only 4 percent of health expenditure. Both for-profit and not-for-profit insurers cover private medical care, which plays a complementary role to the NHS. After a rapid increase in membership in the 1980s, there has been almost no growth in private insurance coverage in the past ten years. In recent years, private spending has stabilised at around 16% of total health expenditure in the UK. This is low in comparison with both the EU average, which was 25% in 1998, and the OECD average of 26 % in the same year.

Over 1.2 million people work for the NHS in England making it the 3rd largest employer in the world. There are 500,000 nurses and 90,000 doctors, of which 29,000 are GPs who work in 8,800 practices. In 2004, there were approximately 2,800 single-handed practices; about one in four practices are GPs working alone and this is not expected to change in 2005. As of early 2005, there were 28 Strategic Health Authorities, 302 Primary Care Trusts (PCT), 273 acute hospitals and community/mental health hospitals, and 10,000 community pharmacies.

There are 36 walk-in centres in the NHS. These nurse-led centres aim to be convenient sources of treatment for minor ailments, of information about local health services, and of advice about self-care and healthy living. Walk-in centres are additional to GP services, not a replacement for them.

There are 14 million interactions each week between patients and the NHS. In a typical week:

- 1.4 million people receive help in their home from the NHS
- 800,000 people are treated in NHS hospital outpatient clinics
- NHS district nurses make more than 700,000 visits
- NHS ambulances make over 50,000 emergency journeys
- NHS Direct nurses receive around 25,000 calls from people seeking medical advice
- Pharmacists dispense approximately 8.5 million items on NHS prescriptions
- NHS surgeons perform around 1,200 hip operations and 3,000 heart operations

Administering the NHS

The NHS is administered by the Department of Health through the NHS executive and 28 Strategic Health Authorities (SHAs) created in 2002 to manage the local NHS on behalf of the Secretary of State. The SHAs have a strategic role including being responsible for developing plans for improving health services in their local area, and making sure national priorities are integrated into local health service plans .

Secondary and tertiary care is provided mainly through publicly owned semiautonomous, self-governing hospitals known as NHS Trusts, which contract with PCTs on a long-term basis. Medical and surgical physicians (consultants) are salaried but may supplement their earnings by applying a minor proportion of their time to treating private patients. There are few private hospitals and an even smaller number of private general practitioners. In contrast, the nursing and residential home-care sectors are dominated by private providers.

Primary care is predominantly provided by GPs who act as gatekeepers; the rest is provided in Accident and Emergency Units within acute hospitals. Since 2000, GP practices and community health services have been formed into Primary Care Trusts (PCTs), with influence over the health care budgets for their enrolled populations. PCTs have a wide range of sizes in terms of geographical area. Their role is to improve the health of the population and tackle inequalities within it and to commission a range of hospital and community services on behalf of the population. PCTs are managed by a board and a Professional Executive Committee which represents local GPs, nurses, social services, the strategic health authority and the community (through a 'lay member'). Groups of PCTs relate to a strategic health authority and are responsible for providing a range of community health services for their populations.

General practice has been the cornerstone of the NHS since its inception in 1948 and is crucial in providing patients with continuity of high quality, personalised healthcare. With approximately 300 million consultations every year (nearly 90% of the work of the NHS) UK general practice is

internationally renowned as the most cost effective form of healthcare delivery in the developed world. A number of countries with more expensive and fragmented health systems have begun to duplicate the UK system of general practice, with its emphasis on equity of access via registered patient lists with the GP providing the gateway to other parts of the health service. This ensures the coordination, continuity and comprehensiveness of healthcare, via a unique payment system linked to positive healthcare outcomes.

Most GPs are technically self-employed independent contractors funded by a combination of methods: capitation, fee for service, and allowance. The 1990 GP Contract affected all GPs in the UK and required that they be available for patients 26 hours/week over 5 days and to accept 24 hour responsibility for their patients. GPs were required to publish a directory of services and were expected to live reasonably near to their patients, even in inner city practices.

General practice fund holding introduced the internal market to the NHS in 1991 and introduced the purchaser and provider concept to the delivery of healthcare. The scheme was optional in England and was designed to enable fund holding GPs to manage their budget for practice staff, certain hospital referrals, drug costs, and community nursing services. Section 1 of the Health Act of 1999 ended the practice of GP fund holding in England by which time over 50% had entered the scheme.

Increased Payments for Results

In June 2003, GPs accepted a new General Medical Services (GMS) contract, negotiated by the British Medical Association (representing the physicians) and the NHS Confederation (representing the employers). Currently 60% of GPs operate under the GMS contract. This contract allowed GPs to opt out of 24 hours seven days a week responsibility which was transferred to the PCT. The contract is now with the practice rather than the individual GP, thus allowing other health workers to be GMS contract holders provided there is at least one GP in the partnership. Patients are now registered to a practice rather than an individual GP.

Personal Medical Services (PMS) pilots were first established in 1998 as an alternative to the single national contract for GPs. For the first time, the NHS was able to set up family practices with salaried GPs and find new ways of delivering primary care services. Eight of the first 'wave' of 83 PMS pilots included nurses who ran their own practices, sometimes employing a GP. Today, 40% of English GPs operate PMS practices.

A single NHS number for each patient

A unique NHS number for each patient was first introduced as a result of the 1948 National Health Service Act, under which general practitioners were paid per- capita for all persons registered with them. The original NHS number was based on the ID number used in the World War II food rationing system.

From 1950 until the issue of the new NHS Number in 1996, the NHS Number was used as a means of communication between NHS organisations to facilitate the timely and accurate transfer of primary care records. Other than this there has been minimal advantage taken of this population-wide registration number, Citizens were given a card with their NHS number on it from 1950, however most people lost it and were never asked for it by service providers. Such cards are still issued and may now be asked for when changing medical practices.

It has been reported that if the number had been used universally in the NHS then there would have been, for example, a reduction in the number of errors in transferring pathology results emanating from hospital generated numbers which are different to the NHS primary care number and do not appear as part of the patient record in GP system.

The development of computers in English General Practice

The history of GP computing (predominately in General Practice) in England began in the 1970s with:

- The Ottery St. Mary Project - a Department of Health sponsored project that produced the first "paper light" general practice system and resulted in the definition of the standard computer-generated prescription form.
- The Oxford Community Health Project - the linkage of about 100 GPs to a mainframe computer for the purpose of gathering epidemiological data.

In 1982, the government and the Royal College of General Practitioners sponsored a project which, for the first time, introduced microcomputers to a relatively large number of general practices across the UK (about 150). Interestingly it was the Department of Trade not the Department of Health that liased with the RCGP. In the same year, the first commercial suppliers (Abies and VAMP) of GP systems started up.

As a result of the demand for coded data in the GP systems in 1986, Dr. James Read developed the Read Codes Version 1 (a 4-character version) to cover requirements of general practice, and first introduced them on the Abies platform. In 1987, a company (VAMP/AAH Meditel), based on two existing commercial suppliers and supported by the pharmaceutical industry, began to offer GPs "free" systems in return for reliable data provision on prescribing habits and patterns.

In 1991, the Read Codes Version 2 was declared a NHS Standard and became Crown Copyright. The new 5-character version mapped to Read 1, ICD-9, OPCS4, CPT-4 and the British National Formulary. The coding scheme was a comprehensive, hierarchically arranged, thesaurus of healthcare terms for use in computers and cross-referenced to national and international classifications covering over 100,000 preferred terms and a synonym list of 150,000 terms. In the same year, the Oxford GP links project connected about 30 practices to the John Radcliffe Hospital for the purpose of receiving Pathology Reports using the ASTM 1238 standard message.

In 1992, the first NHS Information Management and Technology (IM&T) Strategy was published; a strategy which was influenced by the Korner Committees on Information of the 1980s. It recognised the need for information to be captured once only where possible, for that information to come from systems used by health care professionals, for systems to interact, and that the general practitioner's medical record held primacy as the definitive account of a patient's history. In the same year, the UN/EDIFACT was adopted as the standard messaging protocol for NHS communication and the first Windows/LAN-based systems was introduced.

Between 1990 and 1993 the Department of Health undertook three surveys of the growth of computers in general practice in England and Wales. These showed that in 1987 approximately 10% of practices were computerised and that this figure had risen to 79% by 1993. The surveys also showed that the more partners there were in a practice, the more likely it was that the practice would be computerised. In 1993, approximately 66% of single-handed practices were computerised as compared to 99% of practices with 6 or more partners. Of the computerised practices, the majority used their systems for the "three Rs"; registration (98%), repeat

prescribing (94%) and simple recall (84%). The computer was used for recording full clinical records in only 29% of practices; a quarter of the practices were deemed “paperless” at that time.

In 1994, the NHS Centre for Coding and Classification developed Read Codes Version 3, a new multi-axial coding scheme based on core terms and qualifiers covering nearly all the requirements of medicine. It was produced as a result of extensive work by a number of different specialty working groups. Version 3 was mapped to all previous versions of Read and ICD-10. It encompassed all of the clinical specialties as well as general practice; as a result, some hospitals began to use it.

A 1996 study of computerisation in GP practices found that 91% of GPs used the clinical system for their clinical records. In addition, 81% used the clinical system during the consultation to record clinical data; 48% for some consultations and 33% for all consultations. The breakdown of use was as follows:

- Using the system for a partial record: 50%
- Currently partial, but eventually plan to record a full record: 19%
- Full EMR, but retaining manual (handwritten) records: 16%
- Full EMR, replacing manual (handwritten) records: 6%

In 2000, the Department of Health entered into collaboration with the American College of Pathologists to merge the Read codes with SNOMED RT. In 2003, a new SNOMED CT was released and was declared the standard to be used in all clinical information systems in England by 2008.

In 2003, as part of the previously mentioned GMS contract, PCTs became responsible for the total cost of IT systems and ownership of newly purchased hardware and software, thus the ownership of GP systems is slowly moving from the GP practices to the PCT.

In 2004, the national programme for IT (NPfIT) – now referred to as “NHS Connecting for Health”- introduced a central system to collect electronically the anonymised data from practices to indicate their monthly performance. The Quality Management and Analysis System (QMAS), is a new single, national IT system, which gives GP practices and PCTs objective evidence and feedback on the quality of care delivered to patients. The system shows how well each practice is doing, measured against national achievement targets detailed in the GMS contract, which sets out the way GPs work and the way they are financially rewarded.

There are currently 8,810 GP practices in England of which 8,511 have a GP clinical computer system. All practices with a system use their systems for NHS acute prescribing (once only) and for repeat prescribing. Exceptions to this rule are those prescriptions generated during home visits or when prescribing controlled drugs which at present by law these must be hand written. This may change in the near future to electronic prescribing due to the findings of the Shipman inquiry.

Many practices are using electronic appointment systems and an increasing number of practices scan all hospital letters, reports etc which are then attached to the individual patient record. There are estimates of up to 30% of practices running ‘paper-lite’ systems today. In those practices which are paper-lite, a full time GP will spend 24-27 hours using their computer while in direct contact with their patients. Those with document management and pathology reporting this will require an additional 4-8 hours of computer time; the need for continuous access by clinicians is significant and a utilization rates are growing. GPs use their computers 16 hours/week on average; practice managers use it 13 hours/week.

The majority of the data in GP electronic medical records is structured and coded using READ codes; most systems used version 3 though a significant number are still using version 2. No system has yet to begin using SNOMED-CT.

Over 80% of GPs find their systems easy to use. The majority of the data in a patient's electronic medical record has historically been entered directly by the GP. However, increasingly a great deal of clinical data is entered into patient records by practice nurses, health care assistants, notes summarisers and administrative staff now as well as by GP's. It is expected that this will expand enormously in the future.

As part of the national accreditation process known as the Requirements for Accreditation (RFA), all clinical systems have a decision support capability (e.g. drug-drug interactions) though this needs to be switched on by the supplier by setting up configuration parameters. As it is not always switched on at configuration there is a low uptake. Many doctors believe it will slow down their system or lengthen the time of each consultation. Nonetheless, the reduction in prescribing errors has been profound in primary care in the UK since its introduction.

In the December 2003, the National Patient Safety Agency released a report entitled "Realising the Potential of GP Computer Systems to Improve Patient Safety". Since over 95% of GP practices in England are automated and the most commonly used clinical application are medication prescriptions which are printed and carried to the pharmacy by the patient, there was a commonly held belief that medication errors were not a significant issue in primary care in England.

To the surprise of many, the assessment of GP computer systems revealed:

- lack of alerts in relation to contraindications – for example, there was no warning of the risk of Reyes' syndrome when prescribing aspirin to an eight-year old child
- spurious alerts – for example a serious alert warning was given for a commonly used and relatively safe drug-drug combination
- failures of drug allergy warnings – depending on how the allergy history had been recorded, warnings might or might not be displayed
- risks of prescribing drugs with similar names – particularly with penicillin (frequently used) and penicillamine (rarely used and likely to do harm to some patients)
- lack of warning for inappropriate dosages – for example, trying to prescribe methotrexate daily instead of weekly

Perhaps the most concerning finding was that English GPs have come to rely on their computers to provide alerts. More than 90% of GPs regarded computerised alerts (including contraindication alerts) and systems for recall for patient monitoring to be important. The vast majority also agreed with the idea of making it more difficult to override critical alerts. The survey revealed that some GPs are not fully aware of the safety features on their computer systems and only a minority has had training on the use of these safety features.

In the UK there has been a separation of referral and subsequent booking appointments. This has been reflected in the IT systems. Referral systems have long been accepted by GPs because they aid the process and reduce work in that the clinical system can be linked to send information without the need for re-keying. The new national Choose and Book initiative which began in 2004 takes the process that one step on and will permit GPs to book appointments to specialists (consultants) and clinics on-line. Progress to date has been slower than expected; 205,000

electronic bookings via the NPfIT were due to have been completed by December 2004 but just 63 had been done.

In April 2005, the National Programme for IT began pilots of GP-to-GP record transfer between practices running EMIS and InPractice Systems. GP-to-GP record transfer, when fully operational, will for the first time enable patient records to be seamlessly electronically transferred from one practice to another when a patient moves practices. The process of transferring patient records between practices is still paper-based and can currently take weeks.

GP-to-GP record transfer represents one of the most challenging aspects of the NPfIT, as it entails transferring a complete and accurate lifelong patient electronic record between very different GP systems that can be variously configured. With a wide range of different GP systems in use, and many different configurations of each of the major systems, ensuring patient records can be accurately transferred is a huge challenge. In order to overcome these problems, GP-to-GP record transfers will work by translating all records taken from existing systems into the HL7 v3a electronic health messaging standard language.

Currently, there are 10 different physician office systems in England. The EMIS system accounts for 57% of the market, while the InPractice (InPS) system has 22% and iSoft/Torex has 14%.

EMIS is the UK's leading IT supplier in primary healthcare, hosting over 33 million electronic medical records (EMRs) within its systems. The EMIS Primary Care System (PCS) Practice edition has been designed to meet general practice needs as closely as possible, uniting functionality with ease of use. Accredited to RFA'99 v1.2, the PCS Practice edition is also fully accredited to RFA Scotland v1.0. It enables GPs to meet the requirements of the new GMS Contract. Population Manager contains a set of approximately 160 searches that extract the information required for the new Contract and present it in an easy to understand format. The software also contains a set of specifically designed Contract templates to aid speedy and standardised data entry. Over 250 EMIS practices (4,000 users) use a centrally hosted version of the system (PCS enterprise) using a remotely hosted server operating under Microsoft n-tier technology with Windows smart clients.

InPS with Vision, its flagship product, remains one of the market leading solutions for practices that wish a Windows based clinical system. Improvements in the bandwidth availability and stability of wide area networks, such as NHSnet, have allowed the development of clustered solutions where a number of practice datasets can be maintained from a central location. The InPS solution employs 'thin-client technology' removing the need for practice based file servers and encouraging the centralisation of tasks such as system back-ups, configuration of new users and system housekeeping. InPS have significant experience of deploying central server GP solutions with over 1,000 users using Vision on central server solutions.

IT systems in General Practice usually consist of:

- Clinical system and clinical server
- Appointment system
- QOF software
- QMAS software
- Clinical Audit software
- Clinical Management Software
- Microsoft Office for Clinical letters
- PDA or laptop version of clinical information system (often 3rd party)
- Document Management Software
- Anti viral and adware software
- Firewalls
- Finance package
- Banking package
- Payroll software
- HR package
- Intranet and Domain server
- Exchange Messaging server
- Dispensing and Stock control systems
- Decision support (EMIS uses Mentor & BNF, InPS uses First Databank)

Approximately 150 practices undertake electronic prescribing and medication request services to remote pharmacies while over 200 practices provide Internet patient access appointment booking facilities. Approximately 600 practices contribute pseudo-anonymised patient level data daily to 2 large databases, a) QRESEARCH based at Nottingham University and 9 million patient records, and b) General Practice Research Database (GPRD) with 1 million patient records; both are used for research purposes.

The majority of suppliers provide support for their software but not all do; many practices have multiple support suppliers or non at all. Most suppliers also provide hardware maintenance, LAN network support and provide IT managed services under contracts with PCTs. Where PCTs have taken over support it has been in the non-clinical system area focusing on hardware failure or Microsoft support. In the new GMS contract guidance, it calls on PCTs to be sensible about supporting clinical features such as document management. Some PCTs can only afford to provide basic recovery & helpdesk support; few provide preventative maintenance or whole systems support. There is no national or even regional 24/7 help desk as there is in other countries such as Denmark and New Zealand.

The more advanced PCTs are attempting to eliminate the feeling that GPs feel like they are “on their own” when it comes to their computer system. The Royal College of General Practitioners, along with the BMA, act advocates on behalf of the GPs. There are some informatics courses available to GPs provided by the software supplier for continuing education purposes however these are only competency or skills based; they tend to only address the effective operation of their vendor’s functionality, not information handling in general. There are a smaller number of informatics courses managed by the department of health (e.g. Primis) that focus on data entry quality and audit in a system independent manner.

Characteristics about the NHS data network

NHSnet is a secure, virtual private network established in 1995 with the aim of providing a technically advanced communications system available and dedicated to all of the organisations that make up the National Health Service in England and Wales. It was introduced on the basis of delivering business benefits to the NHS as a whole.

NHSnet was also made accessible to certain organisations closely related to health such as information system suppliers; services suppliers; government and administrative bodies, and so on. Access to NHSnet for these organisations, however, was subject to stringent audit and security requirements and in some circumstances was limited to certain restricted facilities.

The communications links and circuits that constituted most of the technical element of NHSnet actually formed only a part of the overall services supplied and supported by the

network. These services included, amongst others, facilities such as the central Message Handling System; the Secure Internet Gateway; the Secure Messaging Gateway, managed router services and so on.

Connections onto NHSnet were provided by the two largest telecommunications supplier companies in the UK – British Telecom (BT) and Cable and Wireless (CWC). The network itself was managed by the suppliers, which means that there was ready access to the vital technical and engineering resource required to maintain and support the network.

By 2001, 97% of all GP practices had an NHSnet line installed, 98% had an Acceptable Use Policy signed, which represents practices committed to the NHSnet security policy and therefore committed to joining the network and 92% with an e-mail system installed.

In 2002, a centrally managed web-based e-mail service which entails supporting a single e-mail address for all NHS employees working life, together with a shared on-line calendar throughout whole NHS was launched in. It was hoped that there would be 1.2 million users registered by 2004 but that did not happen and the contract has been moved to a revamped service which went online in early 2005.

In February 2004, the Health Minister announced that BT has been awarded a contract to provide and manage a broadband network to link all NHS organisations in England. The New National Network (NNN), also known as N3, provides a fast, reliable network on which to run the new IT systems being delivered by the National Programme for IT. The NHS was the first major user of significant broadband capacity in the public sector in England. The network enables much faster electronic transmission of visual data, such as video and x-rays.

Today, the NHS has two national networks – N3 (the New National Network) and NHSnet. NHSnet has 10,000 connections. N3 will replace NHSnet and will extend the network to 18,000 locations. N3 and NHSnet are connected and route traffic between them. The only reason to view them separately is because they are provided through two separate contracts (N3 with BT and NHSnet with Cable & Wireless) and operate to different service levels.

At present N3 provides approximately 5,500 connections. This is on target with its plan to connect all 18,000 locations by March 2007 (6,000 connections per year over 3 years). This is the date by which N3 will connect all clinical systems in England. It is forecast is that by 2010, 5 Billion+ transactions per annum with 1,000 messages/second will be going through the network with a guaranteed response rate of 0.2 seconds and 99.9% availability.

The networks together carry both the older EDI (or EDIFACT) messages and the newer HL-7 messages. EDIFACT will continue for as long as its client systems exist. These clients will be replaced by the new clinical systems that NPfIT suppliers are rolling out. The server end of the message may be phased out sooner because it is possible to convert the message form in the message handling system and there are fewer servers than clients.

The most clinically significant type of messages being transmitted is pathology results reporting by Electronic Data Interchange (EDI) under the Pathology Messaging Implementation Project (PMIP) specifications. The PMIP standards were prepared by General Practitioners on behalf of the Joint Computing Group of the Royal College of General Practitioners. Today, 94% of GP practices in England receive pathology results electronically and have their EMRs updated automatically.

Very recently, concern has been expressed that the pathology links system is delivering inappropriately coded results in England which make it clinically unsafe because the codes used do not detail the result of the tests performed. When results are sent back to practices via the pathology links system the software looks for Read codes in the data and offers it up to

GP clinical systems. However there is only one slot for Read coded data in the pathology links message which tells practices that, for instance, a cytology test has been done. There is no code to tell practices whether it was normal, inadequate, found early cancer or advanced cancer.

The Joint GP IT Committee is working to support NPfIT's new pathology and radiology messaging project to ensure the delivery of a robust clinical message for test requests and reports. The original message was not designed to carry cytology results. However, work is currently well advanced within the National Programme to develop a full pathology diagnostic services requesting and reporting design. This will take into account all major disciplines used by general practice including cervical smear requests and results reports. In the new Pathology National Programme report message, provision will be made for carrying cytology data using SNOMED CT as appropriate.

Both N3 and NHSnet are governed and overseen by staff within the National Program for Information Technology (NPfIT). BT has a £530 million contract (for seven years) to provide and manage the new N3 network. They also provide support to all organizations connecting to the network and certify and monitor system compliance.

How did English GP computing get to where it is today?

Computers have been used in general practice in England since the 1970s. The real growth in general practice computing, however, did not occur until after 1987. This was due to:

- The rapid decrease in the cost of computer hardware and software, and the significant increase in the power of such systems.
- The introduction of the government “no cost” computer schemes in 1987. Interestingly it was the Department of Trade, not Department of Health that liaised with the Royal College of General Practitioners.
- The 1988 buy in of the provider academics (College) and professional organizations (BMA) to valuing IT and providing resources to support training of providers and their staff.
- The agreement by the Department of Health in 1990 to reimburse part of the cost of purchasing and maintaining computers in general practice.
- The introduction of the new GP Contract and the publication of the “Health of the Nation” in 1991 with its emphasis on information collection and analysis, particularly in relation to health promotion targets.

The pharmaceutical industry has always played some role in assisting GPs with the cost of their computers in exchange for drug information. As an example, over the last few years a number of companies have been giving points (for prizes or cash) in return for the ability to collect anonymised data. The members of the Doctors Independent Network (DIN) are encouraged to provide data to DIN which through the data is made available to the pharmaceutical industry for pharmaco-epidemiology research. All profit gained from the sale of data supplied by members must, by the Constitution of DIN, be returned to the membership, usually in the form of goods and services. Profits from data sales will be used to support development of specialised software for users, postgraduate education and clinical audit. These are expected to provide the means by which practising doctors will be encouraged to improve their recording of clinical data. It is known that some practices obtained their appointments software in return for the DIN extraction.

Yet another influencing factor was the Requirements for Accreditation (RFA) which was first introduced in April 1993 to ensure GP computer systems provided agreed core functionality and conformed to national standards. It also determined whether remuneration of GP

purchasing/support costs were allowable based on performance in a number of defined areas of functionality. At the same time the GP/Health Authority links project saw the commencement of linkage of general practices to their local authorities for the purpose of registration/de-registration of patients using EDIFACT messages. This later led to the replacement of the paper-based process for registration and Items of Service transactions with an EDI system a two way exchange of data. The major resulting benefits was the reconciliation of patient databases between a GP practice and its Health Authority - the first important step to using EDI to exchange clinical messages between GPs and hospitals (e.g. referral letters, discharge summaries, pathology results, waiting list data, etc.).

A revised set of RFA requirements were introduced in April 1995. The main impact of these requirements besides raising the standard of GP systems was to reduce the overall number of suppliers in the market. A government directive issued in 1997, strongly recommended that health authorities should only reimburse GP expenditure in respect of new systems, changes of supplier or major upgrades to existing systems if the expenditure related to a system accredited to RFA.

In 1998, RFA99 was agreed by the Primary Care - Requirements for Accreditation Steering Group and endorsed by the NHS Executive. As a consequence, RFA99 provided a firm basis on which future requirements for GP systems could be built. There were a small number of important new additions, including requirements that all systems make use of MIQUEST (Morbidity Information QUery Export SynTax) and PRODIGY. For the first time, RFA99 included requirements for training. PRODIGY guidance offers advice on the management of conditions and symptoms that are commonly seen in primary care. The guidance is advisory and has been developed to assist healthcare professionals, together with patients, make decisions about the management of the patient's health.

In September 2003, Royal College of General Practitioners and the Department of Health issued the "Good practice guidelines for general practice electronic patient records (version 3)" which had been prepared by The Joint Computing Group of the General Practitioners Committee and sponsored by The Department of Health. The guidelines were written by national experts who are also users of clinical systems in their own practices. They are intended to support and encourage practices as they move towards becoming "paperless".

It is useful to note that computer usage has markedly increased since the advent of the new 2003 GMS contract containing the Quality and Outcomes Framework (QOF). The most significant change in the GMS contract was the introduction of quality targets in place of the majority of Items of Service as a mechanism of funding. The QOF has both clinical and organisational targets giving a total of 1050 potential points. In 2005-06 these points will be worth £120 each for an average size practice, thus giving GPs an extra income over the base income (based on list size) based on achieving quality targets. The QOF framework is also being used by the PMS practice who also receive additional income from this mechanism. It is thought that as the two contract types become more alike and share similar outcomes then there will likely emerge a single contract in the not too distant future.

Currently 8,500 GP practices are submitting clinical data to QMAS. By implication, as the QOF covers eleven disease areas and practices are to be financially rewarded for having objective evidence of the quality of care they provide data entry using GP clinical systems is taking precedence over handwritten records in these areas.

QMAS will ensure that GP practices are rewarded financially according to the quality of care they provide and that the payment rules that underpin the GMS Contract are implemented consistently across all systems and all practices in England. QMAS provides a positive incentive for GPs to treat patients in the community rather than referring them to hospital for

treatment such as diagnosis or minor operations. GP systems therefore need to record the activities (using Read codes) for this framework and transfer these data to a national database. The indicators cover all the [GMS] chronic disease management targets.

What does a typical physician office system cost?

Although many computers were leased in the early days, in 1991, approximately 56% of computerised practices owned their computer, but by 1993 this had risen to 86%.

As might be expected, the purchase and maintenance costs increase with the size of the practice. Although the average purchase cost in 1993 was £14,700, this varied between £7,600 for a single-handed practice and just under £22,800 for a partnership of six general practitioners.

Under the computer reimbursement scheme, once a system has been agreed by the PCT, general practitioners can claim from 50% to 66% of the price of any IT equipment. In April 2004 under the new GMS contract reimbursement is at 100% but ownership has moved for that equipment from the practice to the PCT. These reimbursements however, are subject to the availability of funds, less any income from the sale of anonymised data.

The initial investment for a system to support three GPs, two assistants and three administrators (8 workstations):

Hardware (workstations, server and communications server, printers, slot/card reader, back up, UPS, installation)	£25,000
Software including training from the supplier	£20,000
Conversion costs (£2,000 to £5,000)	£5,000
Network installation and cabling (less if wireless)	£2,000
Total	£52,000

The annual running costs are typically:

Upgrades & support	£5,000
Communications network (e.g. mailbox location #)	£0
Messaging costs free	£0
Preventative maintenance	£5,000
Total	£10,000

An increasing number of PCTs are choosing central server solutions to meet the clinical system requirements of GPs in their area. One example is the Vision Enterprise Edition which uses 'thin-client' technology to provide full functionality across a wide area network, with all data processed on central server. System administration is managed by the central team. The practice is no longer responsible for the administration of their local area network, system housekeeping or system backups.

There are a number of examples of ASP solutions (server and software at the supplier site and terminals at the physician office running on ADSL lines using a VPN network) in England. The Phoenix Partnership product runs on a central server and has 228 practices connected. Their SystmOne product is an RFA99v1.2 accredited suite of clinical systems, guaranteeing full compatibility with NHS data standards and offering complete and reliable functionality in areas such as electronic messaging, prescribing, reporting, encrypted pathology and PRODIGY. EMIS has a number of sites including a collaboration of 80 General Practices in London who have a central server run by shared services.

As part of the move to PCT ownership and the 100% reimbursement, there has been a large investment to upgrade legacy systems in General Practice so that practices can provide QOF data. As one example, in February 2004, the Bristol North PCT Board agreed to the upgrade all of its legacy GP systems to RFA99 compliant systems. £261K was approved by the Board to fund the systems upgrades and the related replacement hardware required. The PCT received £350K of capital funding from the £30m available nationally to fund RFA99 upgrades.

All messaging costs on NHSnet are covered by the Department of Health; neither the GP nor patients are expected to contribute to them.

As General Practices are small businesses, investments in technology are tax deductible, but they only now have to fund non-clinical technology use, for example accounting and payroll packages.

Clinical impact of computers in GP offices

The story of one practice may be a common view of many English GPs. That practice, situated in York in Northern England, covers the whole of the city and some of its environs. It has upwards of 22,000 patients and fourteen doctors, making it rather more than three times the size of the UK average. It has been a group practice since the inception of the NHS. It now operates out of five surgeries (offices) and one community base for district nurses and health visitors.

In 1997, the practice reported that during the period of 1987 – 1997, they invested considerable sums of money in its IT infrastructure. Taking hardware, software, telecommunications and support costs alone (without accounting for extra personnel costs: IT does not make for redundancies in general practice), the total figure was £450,000. Of that sum, slightly more than half was been recouped through government money of one sort or another.

“Has that investment been worthwhile? Even in retrospect it is impossible to produce a balance sheet which would clearly support a post hoc business case. On the other hand, it is obvious that a sizable proportion of practice income over the last six or seven years have been directly dependent on its computer systems. This has been particularly true since the new "GP Contract". In addition, the practice could not have become a fund holder or taken on board some of its other roles in the last five years without adequate IT systems in place. For us, there is no doubt but that the practice has, up to now, offered its patients a better service as a result of fund holding.

Most importantly, there are the more subtle changes that have occurred to the organisation as a result of IT support. The production of regular internal audit, the automation of patient contact systems, reliable access to well-structured and legible medical records, the involvement of the wider primary health care team, the automation of practice financial and accounting processes, and access to a common network of information have all produced changes, which, on the whole, have been beneficial. These changes are independent of fluctuating external political realities. They do not remove the gap between social expectation and deliverable health care product but they do lessen it to some extent. They also define it much more clearly than is possible by individual or collective anecdote. This latter fact may have much importance in the future.”

At the other end of the country, if we were to look at a typical patient visit today to the Hawthorn Medical Centre in Swindon in southern England, then we would find patients

arriving at the practice and booking themselves in for their appointment using a touch screen which interfaces with the front desk appointment and the clinical system. This saves them queuing to see a receptionist just to say that they have arrived and it only requires them to enter their date of birth which is then checked against the patient who have appointments. It confirms the appointment and instructs them to go to the waiting room and watch the electronic message display board.

When the clinician is ready to see the next patient they look at their appointment list, press a function key which opens the notes of the patient, logs the start of the consultation and puts out a message on the electronic call system display board. The display board tells the patient which consulting or treatment room to go to and reminds them who they are seeing.

The clinical system also integrates with the document management system and so the clinical staff can instantly view letters from the hospital or other health professionals, which have been scanned into the system and attached to the patient's clinical record.

Clinical information required to support Chronic Disease Management is collected via special templates which have been developed from the National Service Frameworks and Quality Outcome Frameworks to ensure that all the required information is collected during the clinic session, if possible. Whenever a patient subsequently visits the practice the system provides prompts for the clinician if any of this information is missing and reminds the clinician to record observations, undertake tests or take samples. This is particularly useful when seeing patients who are attending for reasons other than their chronic illness as opportunistic recording of clinical information can save later visits.

The clinical system is linked to the laboratory so that the latest test results can be shared with the patient during the clinic and discussion can be focused on the future management of the condition. There are built-in risk calculators for those with Chronic Heart Disease which analyse the various factors including pathology results. This enables the nurse specialist or doctor to help the patient plan their future care based on reducing the high risk factors as a priority. The scale (Framingham) instantly shows the patient the effect of any successful intervention on their degree of risk.

At the end of the consultation the clinician can agree a time period before the next review and put an electronic reminder in the clinical notes. This will be picked up by the administrator when he/she runs a report to book future clinics. The system then automatically produces mail-merge letters inviting the patient to the clinic. This proactive management of Chronic Diseases reduces the anxiety many patients have about future care and allows them to choose the level of professional care they need to support them. Experience to date shows higher compliance with treatments and lower DNA (Did Not Attend) rates in clinics.

Should the patient need to be referred to the hospital each clinician has an icon on their computer desktop which when clicked brings up the electronic referral system. This interfaces with the clinical system so that all the patient details including clinical summaries are pasted into the referral form. Each referral can be tracked onscreen to see the patient's progress through the secondary care system.

As part of the GMS contract in England, all practices must be able to produce registers for common disorders and a set of indicators which show the success level of treatment of a population, for example how many patients are being treated with statins. In addition there are indicators for measuring the effectiveness of treatments, for example reducing the level of hypertension in a population. The clinical system allows the Practice to review these results and plan the care of the population proactively and divert resources to those areas which require greater effort.

Conclusion

Clearly, the use of computer systems is an integral part of the day-to-day practice of English GPs. Equally clear, past and current governments have instituted policies which provide incentives to English GPs to avail themselves of modern tools to achieve the targets set by government and their own College. One such example is of course the new 2003 GMS contract containing the Quality and Outcomes Framework (QOF) with its new quality targets in place of the majority of Items of Service as a mechanism of funding.

Undoubtedly investigation of the use of computers by GPs over the past 5-10 years would reveal positive clinical outcomes – particularly in terms of chronic disease management as is the case in New Zealand. With the new incentives in place, one can only assume that the clinical impacts on patient care will be even more significant in the years ahead.

Acknowledgements

The authors wish to acknowledge the support of Canada Health Infoway and to thank Richard Fitton, Jean Roberts, Vic Peel, David Staples, and Malcolm Pearce for reviewing and editing drafts of this paper. Any errors or omissions are the sole responsibility of the authors.

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