Information in practice

Back to basics on NHS networking

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The success of the internet poses two challenges to thinking about electronic networking in health care. One is technological: if you do not want to use the internet you need to show that your chosen alternative is more appropriate and cost effective. The second challenge is more conceptual. The internet embodies a particular way of thinking about communications, emphasising open and sustainable solutions. Are these the key concepts that should drive our thinking in health care, or are others more appropriate?

At present the NHS has a dedicated private electronic network service called NHSnet, which has now been operational for four years. Throughout its history it has been dogged by negative publicity, stemming in part from unhappiness with the user charges levelled before 1999, a lack of useful resources to access, and detailed objections to policies for security and access to personal data.[1] However, the NHS Executive signalled changes in its policies for NHSnet in late 1999,[2] which might make it a more attractive option for clinicians. In addition, the NHSnet commercial contracts are due for renewal from 2002 to 2004, so there is merit in reviewing the current networking strategy to inform future decisions.

In this article we present data on NHSnet, and contrast it with the internet. These are by no means the only possible networking options available, but contrasting the two serves to highlight key evidence and arguments about NHS networking.

Summary points

Criteria for large scale communications networks for health care include the ability to support secure and reliable communications, open membership, use of sustainable technology, and cost effectiveness compared with alternatives

For NHSnet, the dedicated NHS network, security and reliability have been problematic, membership has until now been limited, it is not based on a sustainable technology, and it is relatively expensive

The internet is a more appropriate option judged against the above criteria

The NHS Executive has indicated changes in the management of NHSnet which may make it a more attractive option for clinicians

The contracts for NHSnet run out from late 2002 onwards, and there is an opportunity to think again about the type of network that is appropriate for the NHS.

NHSnet contracts through the private finance initiative

The central backbone of NHSnet is provided under contracts, through the private finance initiative, with BT, BT Syntegra, and Cable and Wireless. John Denham, minister for health, stated in the House of Commons in April 1999 that NHSnet is: "provided to National Health Service organisations as a service by commercial contractors who funded its development and meet its running costs and are, therefore, confidential to the contractors."[5]

The provision of the service is therefore notionally free, and the contractors gain their income from charges for use of the network. Until April 1999 individual NHS organisations and general practices had to meet the costs of connecting to NHSnet and were charged for each message sent. Now, connection and messaging costs are met centrally. Individuals and organisations are still required to meet the costs of providing computers that will link to NHSnet and associated costs such as staff training and system maintenance.

What is the evidence?

The information available on the costs and benefits of networking via NHSnet is limited. Full business cases for NHSnet were not prepared at the time of the two major NHS strategies, the 1992 Information Management and Technology Strategy[3] and *Information for Health* in 1998.[4] The main NHSnet contracts are provided through the private finance initiative (see box), and they have not been published.

Costs

The NHS Executive is currently paying £3.8m a year for hospital trust and health authority links to NHSnet centrally, which includes unlimited access to the internet (data provided by the NHS Information Authority in response to an "open access code" request). The figure shows that the costs of use of NHSnet have grown linearly over the past five years. The NHS Executive is also meeting centrally the costs of messaging, which are

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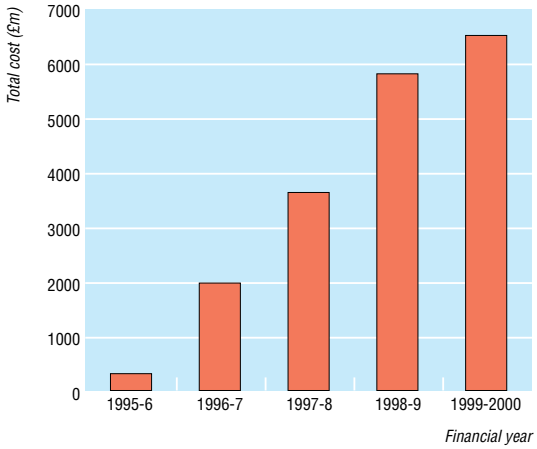

Total charges for use of NHSnet between 1995-6 and 1999-2000

estimated at £2.8m for 1999-2000. The crude mean cost to the NHS Executive of connection and messaging for 1999-2000 is therefore about £10 600 per organisation. The NHS Information Authority was unable to provide us with data on general practitioners' and other primary care use of NHSnet, but told us that about 70% of computerised practices were connected at the end of August 2000.

Evidence about the internet is also limited. The investment costs are not known, principally because of its long gestation and the large number of organisations involved in developing it. The costs of internet connection and messaging vary with the nature of the connection. As an example, the company Demon Internet offer a leased line for a 64 kb connection to the internet, comparable to NHSnet, for £4700 a year (see table). Once connected, the cost of 100 000 messages (which is the approximate number of messages per health authority or hospital trust a year) is zero for Demon Internet and about £24 000 for NHSnet. These figures can only be indicative, as the two networks offer different services to users—and in principle the NHS could even set up as an internet service provider in its own right—but they illustrate the order of costs associated with each strategy.

Criteria for healthcare networking: NHSnet and the internet*

Criteria	NHSnet	Internet
Costs:		
Start up	Not available	£588‡
Connection	£6090 a year†	£4700‡
Per message	23.7 pence†	Free‡
Per 100 000 messages	£30 000	£4700
Benefits	Not known	Experimental evidence lacking, but rapid growth suggests users perceive benefits
Security	High for external hacking, not known for internal misuse	Varies with use from low (such as unencrypted email) to high (such as for shopping with reputable firms)
Reliability	Network down for about 2.2% of time	Downtime for businesses about 1%. Reliability can be compromised by poor quality local connections
Open access	Used by health authorities and NHS trusts and some GPs. No patient access. No access from home for NHS staff. Cannot reliably send email attachments to or from internet	Ubiquitous. Anyone with web or email software at home, in a health centre, using a mobile device, etc
Sustainability	No. Technology no longer widely supported or sold	Yes

*Strictly, NHSnet and internet offer different functions to users, but figures are both based on unlimited access via 64 kb connections to a network.
†For health authorities and hospital trusts. Source: NHS Information Authority.
‡Source: Demon Internet (www.demon.net/).
GPs=general practices.

Benefits

For benefits, reliable figures are again elusive. The NHS Executive hopes that NHSnet will help save £100m a year in NHS running costs.[4 6] However, convincing evidence of cost savings is lacking,[7] as is evidence of clinical or management benefits attributable to NHSnet. More generally, there is scant evidence about the costs and benefits of the NHSnet networking technology in non-health settings.[8 9] Similarly, the benefits attributable to the internet have not been quantified, but observation of the rapid growth of internet connections[10] and the large volume of health related resources on the world wide web suggest that it is widely judged to be useful.

In the absence of direct evidence about benefits, one measure that sheds light on the relative values of the two strategies is the extent to which NHS organisations are actually using NHSnet and the internet. Some 200 000 X.400 messages (the main messaging protocol used for messaging within NHSnet) were sent each day over NHSnet in late 1999. In October 1999, a further 52 000 messages came into NHSnet from the internet, and 60 000 went out from NHSnet to the internet. Thus, 112 000 out of 312 000 messages, or about a third of all NHSnet messages, were moving between NHSnet and the internet. In March 2000 there were 4.221 million X.400 messages and 3.371 million SMTP messages (the latter are principally messages sent to or from the internet by means of one of the main internet protocols). This shows an increase to about 244 000 messages a day. Since almost all the SMTP messages would have been communications with the internet then about 44% of messages were sent to or from internet sites. These patterns of use, revealing users' actual preferences, suggest that access to the internet is valued by NHS users.

User requirements for networking

It is commonly assumed that large scale electronic networks are inevitable, so people do not stop to ask basic questions about their purpose and value. But what are networks actually for? One possibility is that they offer a means of communicating information that is more cost effective, secure, and reliable than paper based media (see table). Another possibility is that networks can be used to support wider policy developments, such as "joined up" government.[11] A networking policy that underpins cross boundary working will need to have open membership, in the sense that it should allow many different individual organisations to join the network without prejudging the technology they use and the information they need to communicate to one another. Technical solutions also need to be sustainable—that is, allow for likely changes over time in the technology itself and in patterns of use.

These five criteria—cost-effectiveness, security, reliability, open membership, and sustainability—can usefully be thought of as a general statement of user requirements for NHS networking. The 1992 and 1998 NHS information strategies focused on specifying

technologies, and there is no published user requirement for networking. We have already considered costs and benefits in this article and elsewhere,[12] and so we focus next on the other four criteria.

Security

Security has been one of the main sources of controversy about NHSnet.[1] Security threats can be external, from people attempting to hack into the network, or internal, with authorised staff misusing their access to sensitive data.[13 14] A study by the Audit Commission of fraud and abuse of information technologies indicated that a half of all public sector organisations are now affected.[15]

We gather that there have been attempts to hack into NHSnet from outside but that the electronic defences have withstood the attacks. The situation with regard to internal misuse is less clear. There has always been a code of conduct for connection to NHSnet. Initially it focused on screening potential users, through a complicated administrative process that users found difficult to understand and which required them to agree to abide by strict security rules. A new code of connection was published in 1999,[16] which seems to be much simpler to administer and includes policies on acceptable use and network security. We were told that the incidence of attempted misuse has been low to date.

On the internet, security is the responsibility of those who send and receive data. Large commercial firms are now confident about maintaining email and web links, and "e-commerce" is growing rapidly.[10] Indeed, companies can allow privileged users to gain access to and alter their own data. But, equally, there have been several accounts of major security breaches. The issue of security, by itself, does not help us to discriminate between NHSnet and the internet.

Reliability

Reliability is a key goal for both NHSnet and the internet. NHSnet adopted a closed network approach, broadly similar to that used by banks and other institutions that manage large volumes of transactions every day. In contrast, the internet uses protocols developed for ARPAnet, the original US military network that spawned the internet, with arbitrary routing over open networks to avoid problems such as broken links or nodes. Proper comparison of reliability is difficult, but NHSnet was "down" for about 2.2% of the time in late 1999 (although we were told that this has improved this year), and Demon Internet business services were down for around 1% of the time (see table). This criterion seems to favour the internet, though not decisively.

Membership

There are also differences between NHSnet and the internet on the issue of membership. NHSnet was conceived as a dedicated NHS network, and almost all health authorities and NHS trusts are now connected. This excluded patients, all health care provided outside the NHS, and many statutory organisations that need to communicate with the NHS (see box). In retrospect it seems that the NHS was viewed as a self contained organisation rather than one inextricably linked to the world around it. This position is changing, and there are now plans to link social services and other organisations to NHSnet. But the logical outcome must be a network with many non-NHS users, which tends to undermine the argument for sole reliance on a private network.

Membership of NHSnet

In principle, any organisation can join NHSnet if it has an NHS sponsor and agrees to abide by the code of connection.

Service provider organisations that are already members or will need to become members in the foreseeable future

- Pharmacists
- Opticians
- Dentists (NHS and private)
- Other private providers (such as nursing homes, private acute hospitals)
- Patient support groups
- Social services departments
- Police forces
- Civil servants in the Department of Health and NHS Executive

Organisations that may, in principle, become members

- Academic researchers
- UK security services
- Newspaper and television companies
- Employers (other than the NHS)
- Insurance companies
- Civil servants outside the Department of Health and NHS Executive

Those who will not have access

- Patients

The internet, in contrast, tends to encourage membership (though this is not the same as saying that it is an inclusive technology). Anyone with access to a personal computer and modem can use the internet at relatively low cost. Its resources are available to all—including clinicians, who already use it to search for evidence on good clinical practice and to exchange emails with one another and with patients.[17–19] The internet does not pose any technical barriers to people in different organisations communicating. This criterion tends to favour the internet, though it does not rule out a solution using a public and private network in tandem.

Sustainability

A sustainable networking strategy is one that allows individuals and organisations to change their own working practices, and the ways in which they use a network, and yet be able to continue to use the network without serious impediment. In effect this means that the economics of the solution, as well as the technology itself, must continue to make sense. In the case of information technologies, exposure to dynamic markets may lead to both cost reductions and innovations, which suggests that the NHS should use systems and software that are "open" and have many suppliers.

It is not widely appreciated that both NHSnet and the internet allow the use of two messaging standards, X.400 and SMTP: the difference, until now, has been that X.400 has been the standard for NHSnet, whereas SMTP has emerged as an internet standard. The difference may seem to be purely technical, but it has important implications for the evolution of networks. Support for niche standards such as X.400 leads users to become "locked in" to the few suppliers who offer it, and they risk having to pay monopoly prices and the standard not being supported in the longer term.

The decision to support SMTP as well as X.400 was taken by the NHS Executive in late 1999, though it was not widely publicised.[2] The decision is an economic as

well as a technical one. Hitherto, economic sustainability has been a crucial weakness in the argument for NHSnet, because a series of decisions about the design of the network led to the risk of "lock in" and obsolescence.

Conclusions

The elements of the user requirement outlined here are interlinked: the best technical solution, now and in the future, must make sense economically and provide the required security and reliability. The NHS Executive has recognised that NHSnet in its original form was neither "modern and dependable"[20] nor the most appropriate or cost effective solution available and now seems to be more open to discussion of the merits of alternative approaches. Perhaps we can now move to a more considered debate about future networking options.

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The NHS Information Authority's response to the authors' request about open access government can be found at www.kingsfund.org.uk/ehealthsystems/html

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NHSnet in Scottish primary care: lessons for the future

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Abstract

Objective To evaluate the primary care communications initiative, which introduced NHSnet to primary care in Scotland.
Design Semi-structured telephone interviews, postal questionnaire.
Setting All 15 Scottish health boards, random sample of 1 in 3 of all Scottish general practices.
Participants Information management and technology managers of health boards, 355 practice managers in the general practices.
Main outcome measures Variations between health boards in styles of project management, means of connection to NHSnet, costs to general practices, and training provided. Practices' levels of participation in initiative, initial use of NHSnet, and factors acting as incentives and disincentives to use of NHSnet.
Results 99% of Scottish general practices agreed to participate in initiative. Health boards varied significantly in project management styles (from minimal to total control), the nature of the networks they established (intranets or direct connections), costs to practices (from nothing to £125 per general practitioner per year), and training provided (from none to an extensive programme). In 56% of practices someone accessed NHSnet at least once a week. Practices varied considerably in amount of internet training received and staff groups targeted and in the intention to provide desktop access to NHSnet through a practice network.
Conclusion The initiative has successfully introduced a network that links Scottish general practices, health boards, and hospital trusts. However local variation in this "national" initiative may affect its use in primary care. Health authorities and general practices in England and Wales may wish to note these findings in order to avoid unhelpful variation.

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Introduction

NHSnet offers the prospect of an electronic network for primary care professionals across Britain. The new NHS Information Management and Technology Strategy, which is investing £1bn to improve patient care,[1] and the plans for an electronic telecommunications infrastructure linking all UK general practices[2 3] should make this prospect a reality. This will benefit patients by reducing paperwork and speeding up access to laboratory results, hospital appointments, and referral and discharge letters through use of email. Perhaps more importantly, it will redress the traditional problem of poor access to library resources in primary care[4] by providing access to up to date information through NHSnet web pages and the internet.[5 6] With the current emphasis on evidence based practice[7–10] and clinical governance,[11] and the increasing amount of information that doctors must sift through to keep up to date,[12–14] rectifying this problem has become a priority.[4 15]

However, since the plans for the electronic infrastructure were announced, Scotland has moved ahead of England and Wales on this issue. The English