Radiology services in the UK are in crisis. The ever-increasing role of imaging in modern clinical care has led to a relentless increase in demand, particularly for complex imaging including CT and MR scans which has far outstripped the ability of current services to cope. This is compounded by a failure to recruit to consultant radiologist vacancies in almost all parts of the UK. The results of this crisis are increasing delays in the reporting of imaging tests with delayed diagnosis of cancer and other serious conditions, and a damaging impairment of the central role played by clinical radiologists in supporting high quality patient care.

Why the crisis?
The UK has around 48 trained radiologists per million population, a figure which has remained almost static for the past five years. Figures from other comparable health economies include 78 in Germany, 107 in Sweden and 113 in France. During this time, the year-on-year average increase in activity in England has been 10.3% for CT and 12% for MRI. Despite this increase, imaging rates in the UK remain significantly below those found in other healthcare systems for most tests, suggesting that further growth is to be expected.

The current model
Traditionally each hospital has its own radiology service employing its own radiologists to support its own services and providing a variable level of local primary care imaging access. The increasing demands for complex imaging in the acute and planned care environment have resulted in the main focus being support of hospital services. This has led in some areas to dissatisfaction among primary care physicians and the resultant commissioning of less complex imaging services (mainly radiography and ultrasound) from alternative providers.

Are we using technology to its best effect?
The advent of digital imaging and image storage using Picture Archiving and Communications Systems (PACS) has allowed the separation of image acquisition from reporting. This has the potential to improve outcomes and efficiency as well as patient experience. Some of the benefits of PACS have been realised by the NHS. Images are instantly available for diagnosis and clinical management and can be transmitted to specialist centres when appropriate, but the full potential for improved efficiency and quality is far from being realised.

Is outsourcing the answer?
PACS has, however, facilitated the proliferation of providers offering remote reporting services (“teleradiology”), increasingly not just to overcome short term capacity gaps but also to replace parts of a local, patient-centred radiology service. The availability of these new services has helped to mask the growing gap between capacity and demand for image interpretation.

There are superficial attractions to the outsourcing model, particularly in areas where there are challenges with recruitment and retention of radiologists, but this model has a number of hidden costs and drawbacks which are increasingly apparent with greater use. These
mainly arise from fragmentation of the clinical pathway and the perception of radiological interpretation as a commodity rather than a clinical specialty. In such an increasingly fragmented service, clinicians frequently seek second opinions locally, resulting in duplication and further inefficiency. Radiologists working outside the main service, often without access to all relevant previous imaging and clinical information, are driven to practise in a more “defensive” fashion resulting in a greater frequency of repeat or additional tests. Other drawbacks include the loss of training opportunities and the temptation for individual trusts and health boards not to make necessary long-term investments in the radiological workforce and infrastructure when short term solutions are available.

Is skill mix the answer?
Reporting of some images by radiographers is already an established part of the service in most UK radiology departments. The current and anticipated increase in demand is for the more complex and time-consuming imaging examinations for which the expertise of a radiologist is required.

An alternative model – networks of expertise
What patients deserve is accurate and timely interpretation of their images, wherever those images are acquired. The priority for the NHS is to deliver this in the most efficient and effective way.

To achieve this, patients must have access to the expertise of a radiologist with appropriate skills and sub-specialisation where appropriate. As imaging has increased in its complexity, it is not feasible in most hospitals to deliver the range of specialist support in a timely fashion across all clinical presentations. This is most evident in relation to “out of hours” services when often only a single radiologist is available for consultation.

About a third of NHS trusts and health boards employ fewer than 10 radiologists. Smaller services are also challenged in responding rapidly to significant variation in demand and capacity.

Our proposal is that existing radiology services should collaborate to form networks of expertise serving a population of several million rather than a few hundred thousand as at present. A grouping of say 150-200 radiologists would have the capacity to provide continuous 24 hour cover across the range of required specialties. There are a few examples in practice, particularly in relation to neuroradiology, demonstrating that collaborative solutions can work. Annex A illustrates a possible model.

What are the obstacles?
The main obstacles to introducing such a model are technological, organisational and cultural.

Technological
Although the technology required for cross-enterprise data sharing has been in existence for some time, the NHS has been slow to realise its potential. Concerns about the resilience of the infrastructure as well as information governance have resulted in sub-optimal arrangements for data transfer even to support existing, established pathways of patient referral.

Organisational
Within the NHS in England in particular, the prevailing ethos of competition between providers must be overcome if a networked model of service is to be introduced.

There are many organisational structures that might be adopted - a “federation” of participating organisations would offer one possibility. This would be least challenging to trusts and health boards who wished to keep control of their own services and equipment but enjoy the benefits of scale including access to specialist expertise, smoothing of capacity
and potentially reducing outsourcing costs. If required, a teleradiology provider could be contracted to a federation offering better value to the multiple organisations involved.

To protect interests and provide sustainability, a federation would need to be underpinned by a suitable legal vehicle such as a joint venture.

*Cultural*

The emphasis on maintaining the viability of local services has led to a defensive culture in the NHS. Any new model would fail were it to rely on reversing such a culture. The model proposed is put forward as a true network and not “hub and spoke”. Willingness to collaborate may be the most important requirement. “Members” of the network could be either foundation trusts or non-foundation Trusts within English structures.

The hospitals would all maintain their own imaging services, including equipment base and staff. The only part of the service in which networking is proposed is in the reporting of acquired images.

*Conclusion*

The current workforce crisis is driving us towards the concentration of all specialist radiological expertise in a few centres of excellence. We do not believe that this is in the best interests of patients. Rather, our hope is that in the future most radiologists will work in a distributed network fulfilling a dual role as generalists to their local healthcare community and as an expert resource to a wider network in their specialist areas of practice.

There is a desperate need to recruit more radiologists to address current and future demands. We have too few radiologists to deliver the workload currently required, regardless of how they are deployed. Training the numbers needed will take several years but a new model of service along the lines we have suggested would make the most of the current limited capacity, would offer advantages to patients in terms of equitable access to expertise and would provide the best environment for the training of the radiologists we will require in the future.
A proposed networked model for imaging services

Introduction
The following is an illustration of how a network might be configured to show the potential benefits to the service overall while highlighting a number of the challenges to implement and maintain it.

The proposed example
The diagram below shows a network involving the imaging services of six hospitals - the number of hospitals is not critical but to achieve economies of scale we believe the minimum would be five. The PACS systems of the hospitals are connected by an IT Hub for ease of image transmission throughout the network. There is a facility for linking with a teleradiology resource for extra capacity of reporting.

The components
- **The hospitals**
The model illustrates a true network and not a hub and spoke model. It is envisaged that each "member" has equivalent status within the network. The hospitals may be from one geographic area but this is not essential and in fact there could be advantages in a geographic spread throughout the UK.

The hospitals will all maintain their own imaging service, including equipment base and staff. The only part of the service in which networking is proposed is in the reporting of acquired images.

- **The IT Hub**
The hospital PACS and RIS systems would link all the participating hospitals for ease of image transfer. In addition this hub would be "managed" by the introduction of a set of "rules" which would guide images to their correct location. These rules would be agreed by the network as a group and implemented on their behalf by the Hub manager. Rules would be divided into two categories -
• Generic
• Hospital specific

Rules could be open ended or time limited.

Examples of a generic rule could be –
All CT scans acquired after 10.00pm to be sent to the receiving imaging department in line with the agreed 24/7 rota

An example of a specific rule could be –
All Hospital A's hand and feet MRI scans to go to an appropriate MRI radiologist between 02/03/2015- 15/08/2015 (due to maternity leave)

Variations on this could include rules introduced by individual hospitals that set thresholds for when images would be transferred for reporting e.g.
All outpatient MRI scans waiting more than 48 hours for a report to be transferred for reporting. This might vary between different hospitals.

The “Hub manager” would then set up the appropriate protocols to ensure correct direction of images and would provide audit data on effective implementation of the rules.

• The teleradiology resource
To ensure that the network could deliver the reporting workload in a timely fashion it would need to ensure that it has the appropriate capacity and capability. Each network would have differing needs and priorities. Each hospital would need to identify its reporting needs and its current capacity.

The needs of some hospitals might be in specific expertise e.g paediatrics, head and neck etc. One advantage of the network is that by working together the need for individuals with such skills might be reduced. At times of leave etc, images could be transferred elsewhere within the network.

The other more generic need would be related to the current shortage of radiologists. Again it is possible that by combining into a larger workforce the network would be able to mitigate against the peaks and troughs in smaller services.

However, it is likely that the network would need to be able to flex capacity. This could be provided by a teleradiology resource, either by the use of an existing teleradiology provider as a partner in the venture or by management of the in-house radiologists utilising their non-contracted hours.