Evaluation of an independent, radiographer-led community diagnostic ultrasound service provided to general practitioners

Miranda Pallan, John Linnane and Sam Ramaiah

Abstract

Background Health care services traditionally offered in a secondary setting are increasingly being offered in a primary setting. There has been little assessment of quality and efficiency of diagnostic services such as ultrasound delivered in primary settings and no studies have looked at independently provided services.

Aims To assess the benefits and disadvantages of a radiographer delivered, primary care-based mobile diagnostic ultrasound service by comparing it to an NHS Trust diagnostic ultrasound service.

Design A retrospective, comparative study.

Setting A primary care area in the West Midlands.

Method Random samples of 200 and 193 adult patients who underwent diagnostic ultrasound in 2001/2002 with the community and NHS Trust services respectively, and all GP principals in the area were identified. Patient access (including wait for appointments), patient and GP satisfaction, clinical quality of services, and cost-effectiveness were assessed by postal questionnaires, interviews, review of stored ultrasound images, patient record review and collection of data on unit costs.

Results Mean wait for an appointment was 17.44 (15.85–19.02) and 44.53 days (38.83–50.23) for the community and NHS Trust services respectively. Response rates from the community and hospital patient groups were 52.9 per cent and 44.6 per cent, respectively. Demographic characteristics of the two groups of respondents did not differ significantly, therefore justifying comparison between the two groups of respondents. High proportions of patients from both services reported time and location of appointment as convenient. Access to secondary care following an abnormal ultrasound was not systematically different for the services. Patients were highly satisfied with both services. GPs were markedly less satisfied with the NHS Trust service compared to the community service. Quality of stored ultrasound images and reports were comparable for the services. Cost per abnormality detected was higher for the community service (£107.69 compared to £77.35 for the NHS Trust service, not statistically significant).

Conclusion The community diagnostic ultrasound service offers reduced waiting times compared to the NHS Trust service, and is of comparable quality. This benefit, together with high patient and GP satisfaction levels, may justify the possible reduced cost-effectiveness of the service compared to the NHS Trust service.

Keywords: community, diagnostic ultrasound, evaluation, primary care

Introduction

Over the last decade the NHS has become increasingly primary care led with an emphasis on comprehensive care being offered in a primary setting. Services including minor surgery, chronic disease management, and certain diagnostic procedures are now commonly provided in community-based settings. The development of the new General Medical Services (GMS2) contract will enable greater flexibility of provision of these services, as the contract will give Primary Care Organisations (PCOs) freedom to commission enhanced services from a range of providers. These may include GPs with special interests and independent providers, as well as NHS Trusts.

Diagnostic ultrasound scanning services have been increasingly offered in primary settings in recent years. Providers include freelance radiographers, and GPs who have undertaken training in ultrasound. With the GMS2 contract, commissioning of diagnostic ultrasound from providers other than NHS Trusts is likely to become more frequent. It is therefore important that these services are evaluated to ensure that they are of an adequate standard in terms of clinical quality and efficiency, and are acceptable and accessible to patients.

Studies evaluating community-based services that are traditionally secondary care-based have mainly concentrated on specialist outreach clinics. In general, specialist outreach...
clinics compare favourably to equivalent hospital based clinics in terms of patient accessibility and satisfaction, but have higher unit costs than the hospital based services. One study evaluated a GP provided primary care based diagnostic ultrasound service and found that patients valued having the service in a convenient location. However, unit costs for the primary care ultrasound service were higher than the equivalent hospital based service.9

This study aimed to evaluate a diagnostic ultrasound service provided to GPs by an independent radiographer, and compare the service to an equivalent open access NHS Trust provided service, so that the benefits and disadvantages of the service could be assessed. Results of an evaluation of an independently provided service such as this may be applied not only to diagnostic ultrasound services, but also to other independently provided services that may be commissioned under the new GMS contract.

Methods

We undertook a retrospective study of a community based, mobile diagnostic ultrasound service offered to GPs in a primary care area in the West Midlands and compared it to the diagnostic ultrasound service offered to GPs by the local NHS Trust. We identified all GP principals in the area. We also identified two populations of adult patients who had undergone diagnostic ultrasound following referral by their GP between April 2001 and March 2002 for the community and hospital services respectively (diagnostic scans included abdominal, pelvic, transvaginal, renal and prostate scans).

The primary outcome measure regarding accessibility of the services was mean time from referral by GP to ultrasound scan appointment. Using this outcome measure, we undertook a sample size calculation based on a 2-sample t-test, and determined that a sample size of 200 in each study arm would detect a difference in mean waiting time of 2.7 days between the two groups with 80 per cent power and 5 per cent significance. Using SPSS computer package we took simple random samples of 200 from the two patient populations.

We collected data on time between referral and appointment for the community service study sample from the GP referral forms, and for the NHS Trust service sample, we collected data on time from receipt of referral to appointment from the computerized patient management system (the dates of referral for the hospital service sample could not be determined). We calculated mean waiting times with 95 per cent confidence intervals for each group.

We developed, piloted and sent postal surveys to the two patient groups and to the GP principals. The surveys were designed to evaluate patient and GP access to the two services, patient and GP satisfaction with the services, and some aspects of service quality. We sent repeat questionnaires to non-responding patients, and called GPs who did not respond, asking them to complete the questionnaire on the telephone.

To assess patient access to secondary care services following an abnormal diagnostic ultrasound scan, we mapped pathways of a small number of patients referred to secondary care using their hospital medical records. Patients from each ultrasound service were matched according to the type of pathology identified on their initial ultrasound scan.

We assessed clinical quality of the two services by taking a random sample of 20 stored abdominal ultrasound scan images from the patient samples for each service (stratified into 10 normal, and 10 abnormal scans). These were reviewed by a consultant radiologist to assess quality of images and accuracy of corresponding reports.

We collected data on structure and organization of the two services by interviewing the NHS Trust Director of Imaging and the radiographer providing the community service.

We undertook cost-effectiveness analysis of the two services by obtaining unit costs for the services and identifying the proportion of ultrasound investigations that detected an abnormality, and calculating the average cost per abnormality detected with 95 per cent confidence intervals. Unit costs excluded overheads as these could not be estimated for the community service. We used detection of an abnormality as the outcome because ultrasound investigations are requested by doctors when there is clinical suspicion of pathology, therefore, one would expect a high proportion of ultrasound investigations to detect abnormalities if used appropriately.

We gained ethical approval for the study from the Local Research and Ethics Committee.

Results

We identified 783 and 353 patients that had undergone diagnostic ultrasound scans in the study period for the community and hospital services respectively. We identified random samples of 200 patients, but were unable to exclude under 18s from the hospital sampling frame. Therefore, for the hospital group, 7 patients under age 18 were excluded after taking the random sample, giving a study sample of 193. We identified 36 GP Principals in the area, who comprised the third study group.

The response rates for the surveys were 52.9 per cent for the community service patient survey (100/189, 11 patients had died or moved address), 44.6 per cent for the hospital service patient survey (82/184, nine patients had died or moved address), and 80.6 per cent for the GP survey (29/36). There was little variation between the two groups that responded to the patient surveys with regard to gender, age profile, or ethnicity. Of the 29 responding GPs, all used the hospital service, and 23 used the community service.

Access to ultrasound services

We obtained data on waiting time for ultrasound appointment for 88.5 per cent of the community service sample and 96.9 per cent of the hospital service sample (referral forms or computerized patient records were unavailable or incomplete for the remainder). Mean waiting time for an ultrasound scan appointment was 17.44 days (95 per cent confidence interval 15.86–19.02) for the community service and 44.53 days (95 per cent confidence interval 38.83–50.23) for the hospital service. Mean
waiting times by month are shown in Figure 1. Eighteen of the 23 GPs (78.3 per cent) who used both ultrasound services reported that waiting times for the services influenced their decision on which service to refer a patient to.

Location of ultrasound appointment was reported as convenient by 93 (93 per cent) of community service respondents and 78 (95.1 per cent) of hospital service respondents. Time of appointment was reported as convenient by 95 (95 per cent) and 76 (92.7 per cent) of community service and hospital service patients respectively. The time difference between allocated appointment time and actual appointment time was estimated as less than 10 minutes by 43 per cent of the community service respondents and 33 per cent of the hospital service respondents.

Pathways of three pairs of patients referred to secondary care following an abnormal scan were mapped. The greatest variation between the pathways was seen in the time interval between initial ultrasound investigation and referral to secondary care, which ranged from 1 to 168 days. Variations in other time intervals were less marked, and there were no systematic differences between the two services.

Satisfaction with ultrasound Services

We asked the patients groups to rate their satisfaction with their experience of having a diagnostic ultrasound scan on a scale of 1 to 5, 1 representing ‘very dissatisfied’ and 5 representing ‘very satisfied’. Eighty-six percent and 76 per cent rated their satisfaction as 4 or 5 for the community and hospital services respectively (Figure 2).

We also asked GPs to rate their overall satisfaction with the two services on a scale of 1 to 5. Satisfaction ratings reported by GPs differed greatly for the two services (Figure 3), notably, for the community service, 74 per cent (17) of the GPs who use the service rated their satisfaction as 5, whereas only one of 29 GPs who use the hospital service (3 per cent) gave a rating of 5. Seventeen GPs (59 per cent) gave a rating of 1 or 2 for the hospital service. Most of the comments associated with these low scores related to the length of time patients are required to wait for appointments.

We asked GPs if they had received any complaints regarding the ultrasound services. One GP had received a complaint about the community service compared to 14 GPs reporting complaints regarding the hospital service. Thirteen of these GPs reported complaints relating to appointment waiting times.
Ultrasound service quality

We assessed several quality indicators for the two services, which are classified into structure, process and outcome indicators in Table 1. Regarding most of these indicators, the community ultrasound service is comparable in quality to the hospital service.

Cost-effectiveness of the ultrasound services

Of the 200 patients in the community service sample, 198 ultrasound scan reports were available. Eighty of the 198 had undergone more than 1 type of scan in a single appointment. Of the 193 patients in the hospital ultrasound service sample, all reports were available, and 7 had undergone more than one type of scan at their appointment. The unit costs (excluding overheads), the number of abnormal scans and the estimated average cost per abnormality detected are shown in Table 2. The difference in the numbers of patients who underwent more than one scan at a single appointment between the two services may reflect that the hospital service has a system involving vetting of ultrasound requests by a radiologist whereas the community

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**Table 1** Comparison of quality of the community and hospital diagnostic ultrasound services

<table>
<thead>
<tr>
<th>Structures</th>
<th>Community ultrasound service</th>
<th>Hospital ultrasound service</th>
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<tbody>
<tr>
<td>Radiographer Continuing Professional Development (CPD)</td>
<td>No formal systems in place, but CPD activities undertaken informally</td>
<td>Formal systems in place</td>
</tr>
<tr>
<td>Equipment specification</td>
<td>Adequate for diagnostic ultrasound</td>
<td>Adequate for diagnostic ultrasound</td>
</tr>
<tr>
<td>Equipment maintenance</td>
<td>Complies with Royal College of Radiologists recommendations (^{10})</td>
<td>Complies with Royal College of Radiologists recommendations (^{10})</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th>Community ultrasound service</th>
<th>Hospital ultrasound service</th>
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<tr>
<td>Systems for prioritizing ultrasound requests</td>
<td>Prioritized by radiographer</td>
<td>Prioritized by radiologist</td>
</tr>
<tr>
<td>Written instructions issued prior to ultrasound understood by patient</td>
<td>98 per cent understood ((n = 100))</td>
<td>94 per cent understood ((n = 82))</td>
</tr>
<tr>
<td>Issue of report following ultrasound scan</td>
<td>Within 1 working day(^*)</td>
<td>Within 1 working day(^*)</td>
</tr>
<tr>
<td>Compliance of service with Data Protection Act (^{11})</td>
<td>Fully complies</td>
<td>Fully complies</td>
</tr>
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<tr>
<th>Outcomes (review of stored abdominal ultrasound images)</th>
<th>Community ultrasound service</th>
<th>Hospital ultrasound service</th>
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<tbody>
<tr>
<td>Quality of stored images</td>
<td>Good</td>
<td>Adequate</td>
</tr>
<tr>
<td>Demonstration of normal and abnormal anatomy</td>
<td>Adequate</td>
<td>Adequate</td>
</tr>
<tr>
<td>Quality of ultrasound reports</td>
<td>Adequate</td>
<td>Adequate</td>
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\(^*\) Reporting of ultrasound scans within 1 working day meets the Royal College of Radiologists’ reporting standard.\(^{12}\)

**Table 2** Costs and outcomes of the community diagnostic ultrasound service and the hospital diagnostic ultrasound service

<table>
<thead>
<tr>
<th></th>
<th>Community ultrasound service</th>
<th>Hospital ultrasound service</th>
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<tbody>
<tr>
<td>Cost per ultrasound Scan (excluding overheads)</td>
<td>£30.00 (all types of ultrasound scan including domiciliary)</td>
<td>£20.62 (abdomen)</td>
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<tr>
<td></td>
<td></td>
<td>£27.51 (lower abdomen)</td>
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<td></td>
<td></td>
<td>£25.89 (upper abdomen)</td>
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<tr>
<td></td>
<td></td>
<td>£22.18 (aorta)</td>
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<td></td>
<td></td>
<td>£27.51 (pelvis)</td>
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<tr>
<td></td>
<td></td>
<td>£23.67 (transvaginal)</td>
</tr>
<tr>
<td>Number of patients in sample</td>
<td>198</td>
<td>193</td>
</tr>
<tr>
<td>Total number of ultrasound scans performed on patients in the sample</td>
<td>280</td>
<td>200</td>
</tr>
<tr>
<td>Number (percentage) of abnormal ultrasound scans</td>
<td>78 (27.9 per cent)</td>
<td>61 (30.5 per cent)</td>
</tr>
<tr>
<td>Total cost of ultrasound scans</td>
<td>£8400.00</td>
<td>£4718.40</td>
</tr>
<tr>
<td>Average cost per abnormality detected (95 per cent confidence intervals)</td>
<td>£107.69 (£90.61–£132.71)</td>
<td>£77.35 (£63.76–£98.30)</td>
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service does not. This may influence the referring practices of GPs.

**Discussion**

**Summary of main findings**

In terms of access to the two diagnostic ultrasound services studied, we found that the community service offers greatly reduced waiting times. This finding closely relates to the satisfaction ratings of GPs. No such clear link is seen with patient satisfaction, as the majority of patients attending both services reported high satisfaction ratings. From the small number of patient pathways mapped, scans performed by the independent community service did not appear to delay referral to secondary care as a result of an abnormal scan.

Regarding service quality, within the limitations of the study methodology, the quality of the ultrasound images and corresponding reports for the two services were comparable. In other aspects of service quality, such as prompt reporting of scans and written communication with patients, the two services were comparable. The community service differed from the hospital service in that it had no formal structures for monitoring professional development activities, although these were being undertaken, and in dealing with GP requests for ultrasound as it had no radiologist prioritization system.

The unit costs of ultrasound investigations were higher for the community service as was the average cost per abnormality detected but this was not statistically significant. The economic implications of the services should be considered in relation to other findings of the study. The benefits afforded by greatly reduced waiting times and high levels of patient and GP satisfaction could justify the higher costs for the community service.

**Strengths and limitations**

There is a dearth of published literature on evaluation of community based diagnostic services, especially those that are provided by independent organizations. It is highly important with the advent of the GMS2 contract, and the opportunity this affords for provision of enhanced services in primary care, that these services are rigorously evaluated to ensure that patients are receiving a consistently high standard of health care. The introduction of patient choice also heightens the need for evaluation of health services offered by providers other than the NHS. In this study, we have attempted to comprehensively evaluate an independently provided community diagnostic ultrasound service by employing a range of methodologies and studying different groups of subjects.

Due to the retrospective design of the study, the patients were not randomly allocated to the two services, so it is possible that there were inherent differences in the two patient study groups. Also recall bias cannot be ruled out in this study.

Questionnaire response rates for the two patient groups were low (52.9 and 44.6 per cent). Walsall has a high proportion of ethnic minorities (14 per cent) and this is even higher in the South locality. This may have contributed to the low response rates, as it has been found that those from ethnic minorities are less likely to respond to postal questionnaires. Despite this, useful information can still be gained from comparison of responses from the two groups. Demographic characteristics of the two groups of respondents did not differ significantly, so comparisons of these groups are justified.

The method of reviewing stored ultrasound images to assess quality of the investigation is limited in that this only gives a snapshot view of the investigations. Added to this, there is a small possibility of observer bias as we were unable to blind the reviewer.

The outcome we chose for the economic evaluation was abnormality on ultrasound scan. However, patients are not always referred for ultrasound scans by GPs because they feel it is probable that the patient has a pathological abnormality. Negative ultrasound scan results may be useful to a GP for patient reassurance or ruling out a rare but serious condition.

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services studied, Mrs P Brainch, Dr C L Holland, Dr H Rai, and their staff. We also thank Rod Taylor, who advised on statistical aspects, and Tracy Roberts who advised on economic evaluative aspects of the study.

Competing interests
All authors have no competing interests to declare.

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References