

Evidence for models of diagnostic service provision in the community: literature mapping exercise and focused rapid reviews

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Scientific summary

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Background

Diagnostic tests and their results are fundamental to clinical decision-making. In the UK NHS, general practitioners (GPs) and other primary care professionals have traditionally had a limited ability to access many such tests directly. Instead, a common model is for GPs to refer patients for blood, tissue or imaging tests at the local hospital, sometimes resulting in waits for appointments and availability of test results. Offering more diagnostic tests in primary care and community settings such as GPs' surgeries and health centres could enable faster and earlier diagnosis of common conditions and avoid unnecessary referrals. Other potential benefits include greater convenience and lower costs for patients and possibly a reduction in numbers of missed appointments. The primary focus of this review is on services rather than individual tests.

Objectives

The review aimed to address the following questions:

- What models of community diagnostic services currently exist (in the UK and internationally)?
- What is the evidence for the quality, safety and clinical effectiveness of different models of diagnostic service provision outside hospital settings?
- Which tests are most commonly provided and is there any evidence for an effect on outcomes?
- Is there any evidence to support a broader range of diagnostic tests being provided in the community? This question was interpreted to refer to:
 - tests that are not currently offered in community settings but which could be appropriate for such use
 - organisational models such as larger diagnostic centres, compared with single-service models.

Methods

We performed an initial broad literature mapping exercise to assess the quantity and nature of the published research evidence. The results of this exercise were used to select three areas for investigation in more detail using focused rapid review methods. The focused reviews covered logistics of diagnostic modalities in primary care, diagnostic ultrasound services and diagnostic pathways for the assessment of breathlessness. Protocols were developed to guide the overall methods and conduct of the project and subsequently for each of the focused reviews.

Mapping exercise

A single database [Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R), searched 1946 to present] was searched for the mapping exercise. The search strategy combined terms around 'primary care' and 'diagnostics', and included both medical subject heading and free-text searches. Methodological search filters were applied to retrieve reviews and comparative studies. Results were limited by date to 2000 to current (December 2014).

Search results were stored in a reference management database (EndNote X7.5, Thomson Reuters, CA, USA) and exported to Microsoft Excel® 2010 (Microsoft Corporation, Redmond, WA, USA) for coding purposes. Records that appeared potentially relevant were coded as far as possible for condition/population studied, intervention/technology, country, setting, type of study (e.g. primary research, systematic review or narrative review) and focus of study (service delivery, test performance or both).

Studies were selected for coding that mentioned any kind of test (diagnostic or screening, including questionnaires or similar) where it appeared that a substantive component of the testing, diagnosis, analysis and interpretation took place in a primary care or similar setting. We tried to exclude studies from settings in which the findings would clearly not be relevant to service delivery in the UK NHS (e.g. tropical diseases in low-income countries). Coding was based on title and abstract (when available) only.

The findings were synthesised narratively by condition and technology. For studies judged to be most relevant to service delivery issues, key details were extracted and tabulated.

Logistics of diagnostic modalities in primary care

A framework entitled STEP-UP (Skills, Training, Equipment, Premises, User perspective and Primary–secondary interface) was developed and used to examine 13 primary care diagnostic topics [audiology, cardiac services, diabetic services, endoscopy, genetic testing, laboratory tests, magnetic resonance imaging, point-of-care (POC) testing, radiology/X-ray, respiratory tests and ultrasound]. We used a systematic mapping approach, standardised across all 13 topics, to identify, map and present findings from key items from the literature. Sensitive searches were conducted using PubMed Clinical Queries and Special Queries and The Cochrane Library. Additional sources, including The King's Fund Centre Library database, were searched for UK evidence. Dates covered were 2000 to September 2015. A process of examination of full text and follow-up of references was employed to populate the STEP-UP framework for each topic.

Diagnostic ultrasound services

The review aimed to address the following question: what is known about the implications of different ways of providing diagnostic ultrasound services in community or primary care settings? This was defined to include implications for both NHS organisations (e.g. related to provision of staff, premises, training and equipment, costs and cost-effectiveness) and patients (e.g. related to changes in management/pathways, acceptability to patients, accuracy of diagnosis and longer-term clinical outcomes).

We searched five bibliographic databases from 1995 to February 2015. Citation and grey literature searches were also conducted. Studies were included if they recruited people requiring diagnostic ultrasound for any condition and evaluated or described a service provided in a primary care or community setting by primary care/community staff. Open-access services provided to GPs by a hospital using its premises, equipment and staff were treated as a comparator intervention. 'Outreach' services using hospital-based staff to deliver services in community settings were also considered to be relevant comparators.

Selection of studies for inclusion (scanning of titles/abstracts and full-text publications) was initially carried out by one reviewer. Uncertainties were resolved by discussion and consensus among the review team. Included studies were classified on the basis of quality and relevance as level 1, level 2 or level 3; these classifications were used to guide data extraction and quality assessment.

Patient-related and service-related issues (as defined above) were used as a framework for a narrative synthesis. Evidence was grouped by type of service model and, when appropriate, by indications/patient groups covered.

Diagnostic pathways for the assessment of breathlessness

The study aimed to address the following research questions:

- What service models and pathways for breathlessness diagnostics delivered in primary care or community settings currently exist in the UK and internationally?
- What evidence is there for the quality, safety, feasibility, acceptability, clinical effectiveness and cost-effectiveness of such models and pathways?
- What are the barriers to and facilitators of developing and implementing such service models and pathways?

A comprehensive search of 10 key bibliographic databases was performed in July 2015. Results were limited by date to 2000 to current. Studies were included if they evaluated or described service models or pathways designed to be initiated in primary care or the community in order to make a differential diagnosis from a presenting symptom of breathlessness. This could include specific diagnostic technologies such as spirometry, although the effectiveness of such technologies was not assessed. Services delivered in secondary care settings were relevant comparators. Studies which evaluated the effectiveness of new services or changes to the referral pathway were given the coding 'intervention studies'. Papers that reported the views or perceptions of staff or patients were coded as 'views studies'. Intervention and views studies were assessed for quality using appropriate tools and synthesised separately using narrative synthesis methods. We used a conceptual modelling method to integrate findings from examination of the intervention and views literature. This was intended to provide an evidence-based overview of elements of the referral pathway that were reported in the identified literature.

Results

Mapping exercise

The searches identified 2644 records, of which 309 were identified by the review filter. Overall, we coded 302 records (11.4%) as meeting the inclusion criteria for the mapping exercise. Comparatively few studies (eight reviews and 20 comparative studies) focused on different models of providing diagnostic services. Most studies focused on test performance (e.g. diagnostic accuracy in a primary care population/setting). Examination of the identified papers supported the need for further focused reviews to synthesise the research evidence in more detail and identify any implications for practice and research.

We decided to examine a particular diagnostic technology in some depth. Ultrasound was chosen because of its wide clinical application, because there was no existing review covering this technology and because of the importance of recent developments in ultrasound equipment. The mapping exercise also gave an indication of the widely differing logistic and service delivery implications of introducing different diagnostic technologies in primary care/community settings and the review team proposed to explore the relevant evidence base using a structured framework. Finally, a major theme of the identified papers was to examine diagnostic tests in the context of patient management pathways and decision-making processes rather than in isolation. This finding led us to examine the evidence base around a selected primary care diagnostic pathway (symptom-based pathways for patients presenting with breathlessness) and its individual components.

It was already clear from this mapping exercise that the published evidence does not include an adequate description or evaluation of the wide range of service models currently being commissioned (or that might feasibly be commissioned) for diagnostic services in the NHS.

Logistics of diagnostic modalities in primary care

A total of 673 items were identified for inclusion across the 13 topics. *Table a* summarises the findings using the STEP-UP framework. For example, implementation of endoscopy services faces difficulties around human resources (skilled staff), premises, equipment and negative views from patients. By contrast, ultrasound appears relatively easy to implement, although the availability of skilled staff was, again, a potential barrier. Overall, information on logistic considerations was scattered, uneven and incomplete. There was more relevant evidence for newer technologies, and training and skills requirements were well specified for technologies supported by a specialist professional group (e.g. endoscopy). We found little direct evidence for equipment requirements, implementation issues and the impact on the primary–secondary care interface. The process of locating relevant information in lengthy documents was methodologically challenging.

Diagnostic ultrasound services

We included 37 studies, of which only three were classified as level 1 studies (comparative empirical studies or descriptions of UK-based service models). The best evidence from the UK was over 10 years old.

TABLE a Summary table for logistics of primary care/community diagnostics

Topic area	Human resources		Logistics		Communications and relationships		
	Skills	Training	Equipment	Premises	User perspective		Primary–secondary interface
					Clinician	Patient	
Audiology	○	○	○	○	⊕	⊕	○
Pneumatic otoscopy	○	⊕	⊕	∅	○	∅	∅
Tympanometry	⊕	⊕	⊕	∅	○	⊕	○
Cardiac services	○	⊕	⊕	∅	⊕	⊕	⊕
BNP	⊕	⊕	⊕	∅	⊕	⊕	○
ECG	⊕	⊕	⊕	∅	⊕	⊕	⊕
Echocardiography	○	○	⊕	⊕	⊕	⊕	○
Diabetic services	⊕	⊕	⊕	∅	⊕	⊕	⊕
Endoscopy	⊗	○	⊗	⊗	∅	⊗	○
Genetic testing	⊗	○	⊕	∅	○	⊕	○
Magnetic resonance imaging	○	○	⊗	⊗	∅	∅	○
POC testing	○	○	⊕	∅	○	⊕	○
C-reactive protein	⊕	⊕	⊕	∅	⊕	⊕	○
Radiology/X-ray	○	⊕	○	○	⊕	⊕	○
Respiratory tests	⊕	⊕	⊕	∅	⊕	⊕	○
Pulse oximetry	⊕	⊕	⊕	∅	⊕	⊕	○
Spirometry	○	⊕	⊕	⊕	⊕	○	⊕
Ultrasound	○	⊕	⊕	⊕	⊕	⊕	⊕

∅, insufficient evidence; ⊗, high degree of implementation difficulty; ○, moderate degree of implementation difficulty; ⊕, low degree of implementation difficulty; BNP, B-type natriuretic peptide; ECG, electrocardiogram.

The few studies that reported clinical effectiveness outcomes were mostly of poor methodological quality. Two studies indicated that community ultrasound can guide patient management and potentially reduce unnecessary referrals, at least for some indications/settings. One of these studies evaluated ultrasound scanning by GPs in a Scottish rural practice and the other evaluated a community open-access echocardiography service for diagnosing heart failure in the Netherlands. A further study from Australia highlighted problems with poor reliability and quality of scans performed in community settings. Major areas of uncertainty included the cost-effectiveness of community-based services, the training requirements for health professionals delivering such services, and whether or not perceptions of ultrasound scanning as a role for secondary care may represent a barrier to service development.

Diagnostic pathways for the assessment of breathlessness

Thirty-six studies were included in the review of interventions in the pathway for patients presenting with breathlessness. We found few studies using higher-quality comparative designs, although we identified evidence relating to a range of different interventions, and a body of work that was carried out in the UK. Eighteen papers were included in the review of views and perceptions of staff or patients.

Limited evidence from intervention studies, mainly using less robust study designs, indicates that the provision of services in the community (seven studies from the UK or Ireland), POC testing (three studies)

and open-access testing (seven studies) may have a positive impact on the diagnostic pathway for breathlessness in terms of appropriate referral to specialists and in terms of a reduction in misdiagnosis. Qualitative and cross-sectional studies highlight a complex interplay of patient, practitioner and organisational factors influencing the diagnostic pathway for breathlessness. Practitioners in primary care vary in their attitude towards the use of diagnostic technology based on accessibility, motivation, confidence, skills and knowledge. Although there is the suggestion that there should be improved access to diagnostic tools with regular training and financial incentives, the literature emphasises that use of technologies such as spirometry must be carried out to high standards, and that training may not necessarily lead to these standards being achieved.

Conclusions

The mapping exercise and focused reviews identified at least seven main models of service that are delivered in primary care/community settings and, in most cases, with the possible involvement of community/primary care staff. These models are:

1. community diagnostic centre (offering multiple diagnostic services or specialising in a single test); possibly non-NHS provider
2. community outreach from secondary care
3. GP with a special interest (offering test in addition to normal GP services)
4. specialist nurse or advanced nurse practitioner [dedicated to test (e.g. spirometry) or condition (e.g. diabetes)]
5. mobile service delivered at GP surgery or other community setting (possibly by non-NHS provider)
6. shared services within a primary care consortium (e.g. GP federation)
7. telediagnosis (interpretation/advice from secondary care).

Overall, the evidence base for community and primary care-based diagnostic services is limited, with very few controlled studies comparing different models of service. There is evidence from different settings that community-based services can reduce referrals to secondary care and allow more patients to be managed in primary care. Evidence on quality (including diagnostic accuracy and appropriateness of test ordering) and safety of such services is mixed.

Implications for health care

In the absence of clear evidence of superior clinical effectiveness and cost-effectiveness, the expansion of community-based services has been driven by other factors. These include government policies to encourage moving services out of hospitals; the promise of reduced waiting times for diagnosis and potentially treatment; the availability of a wider range of suitable tests and/or cheaper, more user-friendly equipment (e.g. handheld ultrasound scanners); and the ability of commercial providers to bid for NHS contracts, potentially offering new and more flexible models of service. However, service development also faces a number of barriers, including issues related to staffing, training, governance and quality control. Perceptions and attitudes of health professionals and patients are particularly influential in the absence of clear evidence-based conclusions. Drivers and barriers vary according to the diagnostic technology involved and other contextual factors.

Implications for research

There is a need for studies to compare the outcomes of different service models using robust study designs. Comparisons of 'true' community-based services (using community staff for test administration, interpretation and decisions about treatment/referral/further testing) with secondary care-based open-access services and rapid-access clinics would be particularly valuable. There are specific needs for economic evaluations and for studies that incorporate the effects of diagnostic decision-making in the community on the wider health system.

Research into logistic and practical factors that can affect decision-making around diagnostic service provision could be based around a specific technology or focus on the needs of a particular condition or management pathway. For example, specific recommendations on research around training for community ultrasound have recently been provided by the National Institute for Health Research Oxford Diagnostic Evidence Co-operative.

The STEP-UP framework presented here, or its extended version (STEPPED-UP, also incorporating Public perspectives, Economics and Drivers), could be used as a framework for planning programmes of research and evaluation that reflect the complex range of factors that may influence decision-making in this area.

The difficulty we encountered in identifying what services are being commissioned and keeping up with local evaluations suggests that there may be a need to improve the availability of information in this area to decision-makers, researchers and the public. Preliminary research could be undertaken to establish whether or not this is a true gap in the information resources available and whether or not NHS decision-makers would find such information helpful.

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