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NHS
National Institute for Health Research
Collaboration for Leadership in Applied Health Research and Care (CLAHRC) for Greater Manchester

GM-HFIT

(Greater Manchester Heart Failure Investigation Tool)

Primary Care Heart Failure Improvement Project
Evaluation Report
NHS Wigan Borough CCG

NIHR CLAHRC for Greater Manchester
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Executive summary

This report has been prepared by the NIHR Collaboration for Leadership in Applied Health Research and Care for Greater Manchester (CLAHRC GM). It provides the evaluation findings and result of the Greater Manchester Heart Failure Investigation Tool (GM-HFIT) primary care improvement project, a piece of work conducted by CLAHRC GM in collaboration with NHS Wigan Borough Clinical Commissioning Group (Wigan CCG).

The GM-HFIT project in Wigan CCG was established in August 2012 and involved 12 GP practices from the TABA locality within NHS Wigan CCG. Run over a 13-month period from October 2012, the project aimed to improve the quality of service and care for people with heart failure (HF) across the local area. The evaluation findings and results presented here were collected as part of a re-audit exercise conducted in November/December 2013.

The GM-HFIT Improvement Project

Heart failure is a complex and highly debilitating clinical syndrome that affects 530,000 people in England, equating to 1 to 2% of the adult population in England. Primary care teams in collaboration with specialist services, have an essential role to play in the on-going management of these patients. Yet, data available at the start of the project suggested that HF was often both under- and mis-diagnosed in primary care and that the clinical management of these patients was frequently sub-optimal. The GM-HFIT project was established in NHS Wigan Borough CCG to address these clear and important issues, building on a previous project of the programme undertaken in NHS Manchester, and a concurrent project in NHS Bury CCG that started in January 2012.

The GM-HFIT project comprised a series of key interlinked activities. These activities were:

- *Verification of existing HF registers*: examination of practice held HF registers by a HF specialist nurse to identify patients who did not have a confirmed diagnosis of HF and therefore needed further investigation or removal from the HF register. Recommendations for future management were also made, as required, for all patients on the register.
- *Audit of HF management*: assessment of the clinical management of all patients on the HF register against a set of evidence-based key performance indicators. This generated a 'traffic light score' for each practice that provided an arbitrary measure of the overall quality of HF management.
- *Case finding HF patients*: searching of practices' clinical records for patients with confirmed, or suspected, diagnoses of HF that were not already on the HF register.
- *Feedback session and implementation period*: feedback of the verification, audit and case finding results to practices by a HF specialist nurse. This was supplemented by the provision of facilitation support and education for practices as required/requested.
- *Re-audit and feedback*: repetition of the verification and audit processes to detect changes in HF register validity and the quality of clinical management.

Key findings and results

Heart failure prevalence and validity

- Between baseline and re-audit the total number of patients on the HF registers of participating practices increased from 364 (average, 30; range, 4 to 75) to 424 (average, 35; range, 2 to 69). This represents an increase in average HF prevalence from 0.77% (range, 0.25 to 1.3%) to 0.91% (range, 0.12 to 1.61%). A prevalence increase was observed at seven of the 12 participating GP practices.

- The case finding process identified a total of 152 patients across the practices with a confirmed HF diagnosis that required addition to the HF register. In addition, a further 15 patients were thought to require referral for echo, 24 required their echo report requesting and, on 120 occasions, practice GPs were asked to review individual patient cases.

- At the close of the project an improvement was observed in the validity of HF registers at all practices. At baseline, 76% (range, 67 to 86%) of patients were considered to be appropriately on the HF register, with 15.3% (range, 0 to 25%) considered to require further investigation and 9.7% (range, 0 to 25%) thought to be inappropriate and to warrant removal from the register. At re-audit the proportion of patients considered appropriate for the HF register had increased to 88.2% (range, 71 to 100%) and the proportion of patients considered to require further investigation or removal from the register had decreased to 7.1% (range, 0 to 25%) and to 5.4% (range, 0 to 11%) respectively.

- Improvements in HF register validity were primarily attributable to the addition to the HF register of patients with a confirmed HF diagnosis that had been identified through the case finding process. However, a number of practices also pro-actively removed from the register patients who had been identified, at baseline, as being inappropriately on the register. At re-audit, however, it was apparent that approximately a quarter of 'new' patients diagnosed with HF since the baseline audit (and not identified through the case finding process) had been added to the HF register in the absence of a confirmed diagnosis, indicating that further work will be required if the observed improvements in HF register validity are to be maintained.

Quality of heart failure management

- A 7.5 point improvement in traffic light score was observed, on average across the practices, between the initial baseline audit and re-audit. An increase was observed at nine of the 12 participating GP practices, with three observing minimal decreases. Increases in traffic light score were principally owing to improvements in the proportion of patients on the HF register with confirmed diagnoses and documented aetiology.

- With respect to clinical care, the principal improvement observed was in the proportion of patients on practice HF registers receiving, or documented as requiring, a primary care HF review either six monthly or annually. This increased from 10.2% at baseline to 45.8% at re-audit.

- The introduction of regular HF reviews supported small yet significant improvements, on average, in the proportion of HF patients having their pulse rate and rhythm, weight and oedema checked, their smoking status recorded and receiving, or documented as receiving, education in relation to nutritional intake. A small decline, however, was observed in the average proportion of patients on the HF register with a recorded NYHA classification and the proportion of patients screened for depression, both within the previous 12 months.

- Between baseline and re-audit, on average across the practices, a small reduction in the appropriate use of ACE-I/ARB and BB therapy for patients with confirmed LVSD was observed. The proportion of patients appropriately receiving an ACE-I/ARB, or for whom it was documented as contra-indicated, declined from 97.5 to 92.8%. BB use also declined in the same way from 82 to 78%, with a decrease in appropriate use being observed at approximately half of all practices.

In contrast to the observed reduction in appropriate ACE-I/ARB and BB use, increases were observed in the proportion of patients treated with optimal doses of these therapies. On average, the proportion of patients receiving maximum

tolerated dose of ACE-I/ARB, or being up-titrated, increased from 67 to 85.4%. A similar increase was seen in the proportion of patients receiving maximum tolerated dose of BB therapy, or being up-titrated, increasing from 71.4% to 95.7%.

1. Introduction

The Greater Manchester Heart Failure Investigation Tool (GM-HFIT) primary care improvement project was a piece of work established in partnership with the TABA locality in August 2012 to improve the quality of service and care for people with heart failure (HF).

Heart failure (HF) is a complex and highly debilitating clinical syndrome that affects over 530,000 people in England, equating to between 1% and 2% of the country's adult population (British Heart Foundation, 2010). Although the incidence and mortality rates associated with coronary heart disease (CHD), the main cause of HF, have declined over the past 20 years, the incidence and prevalence of HF continues to rise steadily, due, in part, to the ageing population and the increasing number of people surviving acute myocardial infarctions (National Institute for Cardiovascular Outcomes Research, 2012). The condition also poses a considerable economic burden, costing the NHS approximately £625 million per annum, and accounts for 2% of all NHS inpatient bed-days and 5% of all emergency medical admissions to hospital (Sutherland, 2010; National Institute for Health and Clinical Excellence, 2010).

Primary health care teams, in collaboration with specialist services, have an essential role to play in the on-going management and support of patients with HF. However, data suggested that HF was often both under-diagnosed and mis-diagnosed in primary care and that clinical management was frequently suboptimal (Department of Health, 2013).

In response to this clear and important issue, an improvement project led by the NIHR Collaboration for Leadership in Applied Health Research and Care (CLAHRC) for Greater Manchester was commenced in NHS Wigan Borough CCG within the TABA locality. Originally developed and implemented at ten practices across NHS Manchester, the GM-HFIT improvement project comprises of a series of key interlinked activities which collectively aim to improve the quality of service and care for people with HF in the local area. CLAHRC GM was a five year (2008-2013) programme of work which aimed to develop and implement innovations in care for people with long-term vascular conditions that promoted patient self-management, improved quality of care and made more efficient use of scare NHS resources.

This report presents the findings of the project evaluation. We begin by providing a summary of the background and design of the project, together with an overview of the associated aims and objectives and then reporting the project findings.

2. The GM-HFIT Improvement Project

2.1.1. Background to the project – national context

Cardiovascular disease (CVD) affects the lives of many millions of people worldwide and is one of the leading causes of morbidity and mortality in England. In 2011, CVD was documented as the primary cause of 29% of all deaths, of which just under half were due to coronary heart disease and almost a fifth due to stroke (South East Public Health Observatory, 2013). Over the last decade, significant improvements have been seen in the prevention, identification and treatment of CVD, with a 40% reduction in CVD mortality rates for persons under 75 years old between 2001 and 2010. During this same time period, the gap between CVD mortality rates in the most and least deprived areas of the country has also narrowed (Department of Health, 2013). However, there is still significant scope for improving the diagnosis and management of CVD nationwide to bring about further improvements in mortality rates and to improve quality of life of patients living with CVD (Murray *et al*., 2013).

As already described in the introduction to this report, chronic HF is a complex and common cardiovascular condition that is thought to affect between 1% and 2% of the adult population in England (British Heart Foundation, 2010). It is the leading cause of hospital re-admissions in the UK and has significant negative consequences for patients' quality of life, with over a third experiencing severe and prolonged episodes of depressive illness (Department of Health, 2013). Epidemiological studies also demonstrate that survival rates for HF are worse than those for patients with prostate and breast cancer, with 30-40% of patients with HF expected to die within one year of diagnosis (National Institute for Cardiovascular Outcomes Research, 2012).

There is strong evidence to indicate that optimal diagnosis and management of patients with HF can lead to significant improvements in prognosis, reduce hospital admissions and increase life expectancy for patients with this condition (National Institute for Cardiovascular Outcomes Research, 2012). A large number of clinical trials, for example, have demonstrated the considerable prognostic benefits of optimal angiotensin converting enzyme inhibitor (ACE-I), angiotensin receptor blocker (ARBs) and beta blocker (BB) therapy in this patient group. There are also a number of evidence-based clinical practice guidelines available to support the diagnosis and management of HF patients, such as those provided by the European Society of Cardiology (ESC) and the National Institute for Health and Clinical Excellence (NICE). Nationwide, however, there are recognised shortcomings in the quality of care provided for HF patients, particularly within the primary care setting (Department of Health, 2013).

Heart failure is recognised as being poorly identified and diagnosed in primary care, with its symptoms commonly being equated with respiratory conditions such as chronic obstructive pulmonary disease and asthma (Department of Health, 2013). While the British Heart Foundation indicates that HF prevalence in between 1% and 2% in the UK population, national prevalence at the end of March 2012 was 0.71% (Health and Social Care Information Centre, 2012). However, it should be noted that the quality of HF registers held in primary care is known to be highly variable (CLAHRC GM, 2011). Data also suggests that management in primary care is sub-optimal for this patient group. While often considered a disease of the elderly, improvements in the assessment, diagnosis and management would bring significant benefits, both for patients and the wider health system.

2.1.2. Background to the project – local context

The population estimate of Wigan in 2011 was 318,100 and is projected to increase to 336,200 in 2021, with the percentage of the population aged 40 or over in Wigan expected to increase slightly in that same time period (currently just over 25%). Levels of deprivation in the local population are higher than the national average, with 29.6% of the population in the most deprived national quintile. The proportion of the population in Wigan from black and minority ethnic groups is also significantly lower than average, estimated to be 2.7% (nationally 14.6%). Research suggests that rates of myocardial infarction are higher in South Asian men and that they are more likely to develop CHD at a younger age.

Life expectancy for both men and women in Wigan is lower than the national average. This, however, varies significantly across the local area with life expectancy being 11.1 years lower for men and 8.0 years lower for women in the most deprived areas of Wigan than in those areas that are least deprived. Early mortality rates from CVD have decreased nationally by 44.2% since 2004, and have been matched by similar decreases in Wigan. CVD mortality rates in Wigan, however, continue to be significantly higher than the national average, both for males and females (Figure 1).

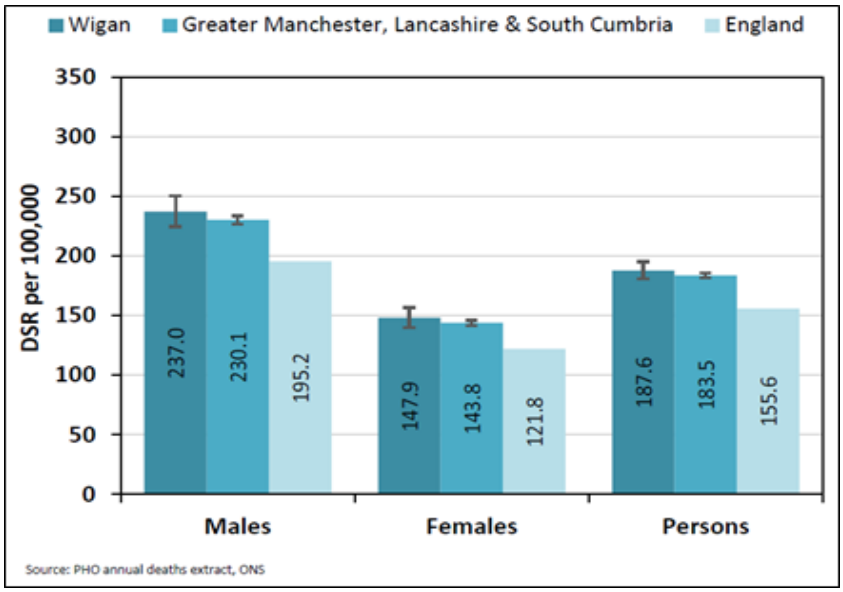

Figure 1: CVD mortality rates in Wigan by gender for all ages, 2009-11

HF is a leading cause of emergency admissions and re-admissions to hospital across the country. In 2011/12, the emergency admission rate in Wigan, for all persons, was 71.4 per 100,000 (341 admissions). This is higher than both the national average (60.7 per 100,000) and the admission rate observed across Greater Manchester, Lancashire and South Cumbria (67.4 per 100,000). Between 2004/05 and 2011/12, however, the emergency admission rate for HF in Wigan has decreased by 31.9%. This is considerably higher than the reductions in admission rates seen both nationally (18.0%) and regionally (20.4%) within the same time period.

The recorded prevalence of HF in Wigan was 0.86% in March 2012. This is higher than the national prevalence of 0.71% and considerably lower than the anticipated 1 to 2% prevalence described by the British Heart Foundation (2010). This has been attributed, by some, to the difficulties associated with distinguishing the symptoms of HF from those associated with respiratory disease such as chronic obstructive pulmonary disease (Department of Health, 2013). However, findings from an earlier phase of the GM-HFIT project suggested that practice-based errors in the clinical coding of HF may also account for a proportion of the gap between recorded and expected HF prevalence (CLAHRC GM, 2011). Data from the 2011/12 Quality and Outcomes Framework also demonstrated that the use of ACE-I/ARB (90.1%) and BB (88.7%) therapy for patients with left ventricular dysfunction in Wigan was marginally higher than the national average (89.3% and 83.9% respectively). While encouraging improvements in both cardiovascular outcomes and HF management have been observed in Wigan over the last decade, these figures still collectively serve to suggest that there remains significant scope for improvement in the diagnosis and management of people with HF across the local area.

2.2.1. Project aim and objectives

The GM-HFIT project was established in TABA in August 2012 with the overarching aim of improving the quality of service and care for people with HF across the local area. The associated objectives were:

- To ensure that 100% of patients on practice HF registers had a confirmed diagnosis.
- To ensure that 100% of practices correctly coded HF patients and implemented a standardised HF review template.
- To ensure that 80% of patients are on appropriate medical therapy and are titrated, or being titrated, to recommended dosages as tolerated (unless documented as contra-indicated).
- To provide HF education and a continuing rolling programme of education, with representation from 100% of the practices involved in the project.

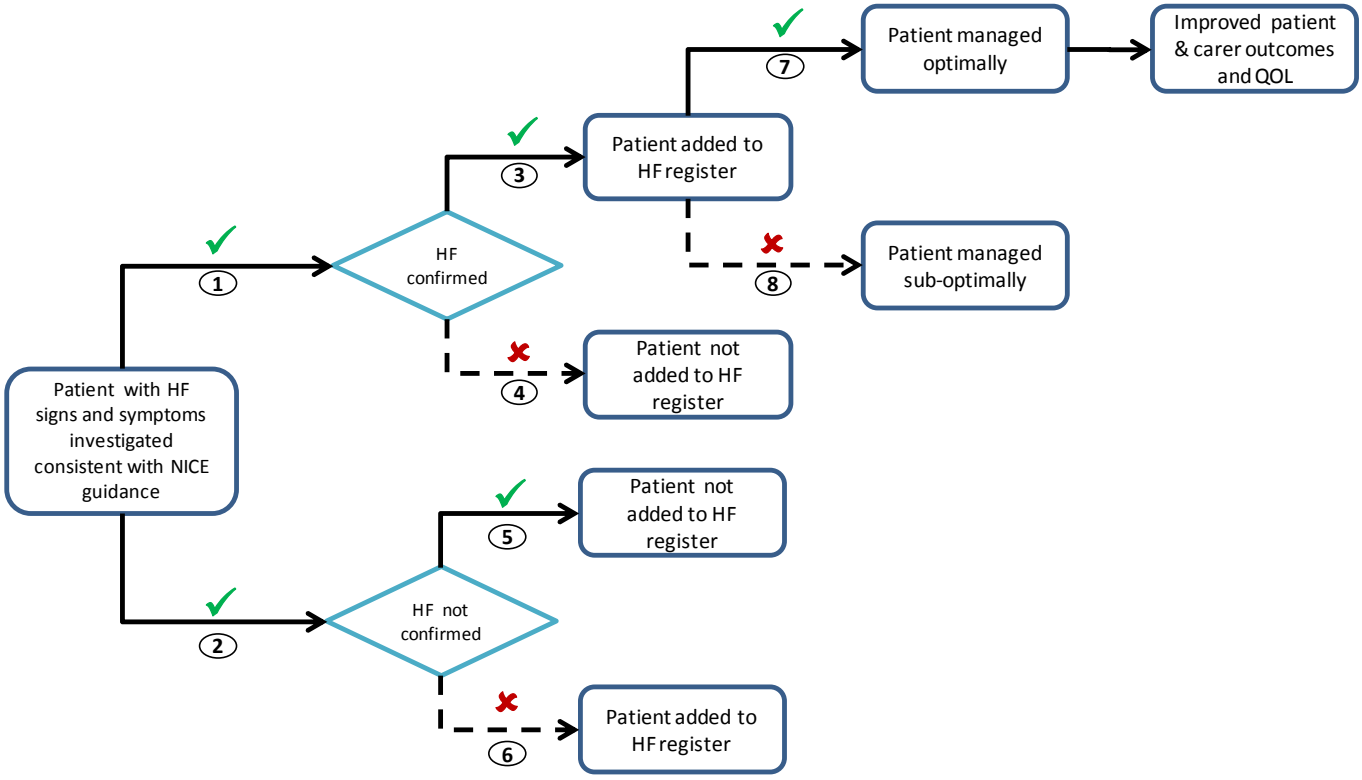

Figure 2: Project logic diagram

2.2.2. Project design

The GM-HFIT project in TABA followed a format that had been developed in two previous heart failure implementation projects delivered by CLAHRC GM. These projects had taken place in NHS Manchester (2009) and NHS Bury (2012, and on-going at the time of initiation in TABA). The key results of the project in NHS Manchester are described in section 2.4.1. of this report. The project consists of a series of key interlinked activities, including register verification and case finding, audit of HF management, feedback meetings, clinical education sessions, facilitation support and a final re-audit exercise. Figure 3 below offers an overview of the processes associated with the project. A detailed description of each element completed in each practice is then provided.

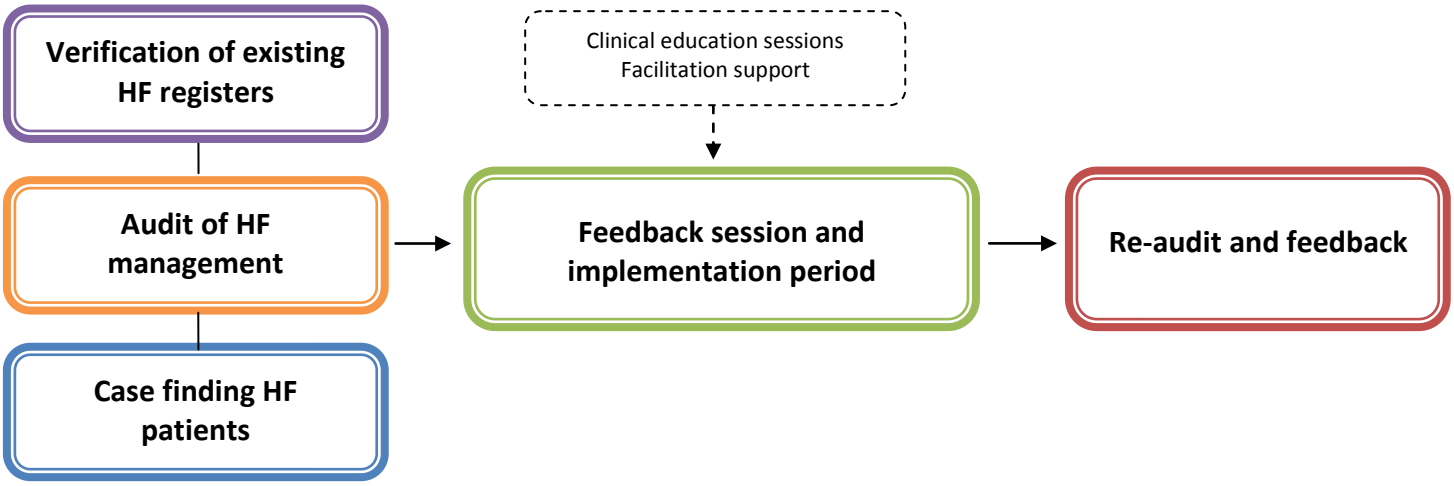

Figure 3: Design of the GM-HFIT Improvement Project

2.3.1. Verification of existing heart failure registers

The record of each patient on the HF register was manually audited by a heart failure specialist nurse (HFSN) to identify whether they had a confirmed diagnosis of HF. Based on this assessment, patients were then classed as appropriate or inappropriate for the HF register or as requiring further investigation. For each patient, a rationale for this classification was documented and recommendations made in relation to their future management. The nature of these recommendations was wide ranging, highlighting, for example:

- The need for further diagnostic investigations, either to verify a diagnosis of HF or to support on-going management.
- The need to remove patients from the HF register where there was evidence to refute a diagnosis of HF.
- Requirements to initiate and/or up-titrate patients' HF medication.
- The use of medication not licensed for or contra-indicated in HF
- Errors in Read coding. This included highlighting where Read codes needed to be added to patients' records and where existing Read codes required amendment, for example, where echocardiograms had been coded as electrocardiograms).
- Cases where it would be appropriate to consider making a referral to the HF specialist nurse for education, medication titration and on-going management.
- Incidences where appropriate immunisations (i.e. influenza and pneumococcal) had not been administered.

2.3.2. Audit of heart failure management

The management of each patient on the HF register was assessed against 22 key performance indicators derived from the NICE chronic HF guidelines. This included assessment of factors such as medication use, pulse checks, blood pressure management and the provision of self-management education. Collectively this information was then used to generate a traffic light score for the practice to allow for assessment of the overall quality of HF care provided. This assisted the HFSNs in identifying the areas that required improvement at the individual practice level and provided a benchmark against which any subsequent improvements in the standard of HF management could be assessed.

2.3.3. Case finding heart failure patients

A series of searches (see Appendix 1) were run on the practice system to provide a list of patients who may have a confirmed diagnosis of HF but were not on the HF register. The record of each of these patients was then manually checked by a HFSN to identify patients with a confirmed HF diagnosis and those requiring further investigation to

confirm or exclude a diagnosis of HF. The rationale for this decision was documented, together with recommendations for further management where required.

2.3.4. Feedback session and implementation period

The results of the verification, audit and case finding exercises were fed back to the practice by the HFSN who completed the audit. Each practice was provided with a folder containing their audit results, together with supporting resources and educational materials, and an action plan developed on the basis of the audit findings. Following each feedback session, support and further input from the HFSNs was available to each practice to assist them in implementing and acting upon the verification, management audit and case findings results.

During this implementation period, clinical staff were also invited to attend a half-day education session delivered by a local cardiologist and community heart failure nurse. These sessions were interactive and case-study based, covering topics pertinent to the management of HF in primary care, such as aetiology and diagnosis, pharmacological management and medication titration, patient monitoring and review, patient education and palliative care.

2.3.4. Re-audit and feedback

The verification and management audit processes described in sections 2.3.1. and 2.3.2. were repeated by a HFSN, this time in relation to each of the patients on the HF register at the end of the project. This allowed for changes in the validity of the HF register and the quality of the HF care provided by the practice that had occurred since the start of the project to be identified. New HF diagnoses (i.e. patients who had been added to the HF register since the baseline audit, but had not been identified through the case finding process) were of particular interest at this stage. The appropriateness of their addition to the register and the quality of their subsequent management provided an indication as to whether sustainable improvements in the diagnosis and management of patients with HF had been achieved.

A final feedback meeting was then held to provide the practice with an overview of the findings of this re-audit process and discuss any outstanding actions and further steps that may need to be taken by the practice to improve the quality of HF management they offer.

2.4. Results from the previous phase of the GM-HFIT project

As mentioned in section 2.2.2., the GM-HFIT project described in this reports builds on the results and learning generated in an earlier project conducted at ten practices in NHS Manchester, and ran simultaneously with a mirror HF improvement project in NHS Bury. To enable the results seen in the project in Wigan to be considered and assessed in the context of those that have been obtained elsewhere, a short overview of the key results from the Manchester project is provided below. The full evaluation report is available elsewhere (CLAHRC GM, 2011).

2.4.1. Changes in heart failure prevalence and register validity (NHS Manchester)

Across all practices (*n*=10), the percentage of patients on the HF register with a confirmed diagnosis increased from 59.7% to 79.0%, with improvements being observed across all practices.

- A total of 237 patients with a confirmed diagnosis of HF were identified through the case finding process.
- By the end of the project, average HF prevalence increased from 0.55% to 0.67%. The scale of the increase in prevalence was, however, highly variable across practices, with one practice seeing a reduction in prevalence and a further practice seeing no change.

2.4.2. Changes in the quality of heart failure management (NHS Manchester)

- The average traffic light score increased by 10 points, from 42 (amber- good HF care) to 52 (green- very high quality of HF care). Improvements in traffic light scores were observed across all practices, ranging from an increase of 3 to 27 points.
- On average, some improvements were seen in the proportion of patients with confirmed left ventricular systolic dysfunction appropriately prescribed ACE-I (88.5% to 90.3%) and beta-blocker therapy (71.6% to 82.6%) licensed for HF. More significant improvements, however, were observed in the proportion of patients receiving optimal doses of these therapies.
- Changes across other key performance indicators were highly variable.

3. Findings and Results

3.1. Participating GP practices

All 13 GP practices comprising the TABA locality were invited to take part in the project. 12 of the 13 GP practices elected to participate in the project.

3.2. Heart failure prevalence and register validity

3.2.1. Verification of existing heart failure registers

At the point of baseline audit, across all of the 12 GP practices participating in the project, there were a total of **364** patients on practice-held HF registers (average, 30; range, 4-75). The mean average HF prevalence was **0.77%** (range, 0.25-1.30%). Of these patients, across all practices audited, **76%** (range, 67-86%) were found to be appropriate for the heart failure register, **15.3%** (range, 0-25%) required further investigation and **9.7%** (range, 0-25%) were considered to be inappropriate and thus warranted removal from the register. This data is presented in Figure 4.

Patients were considered inappropriate for the heart failure register only where there was clear evidence in their records to indicate that they did not have heart failure. Frequently such patients were found to have been added to the register following documentation of a diagnosis of 'CCF' on a discharge summary, but had subsequently gone on to have outpatient echocardiograms demonstrating normal heart function. Patients were indicated as requiring further investigation where there was no diagnostic evidence of heart failure to unequivocally support either the presence or absence of heart failure.

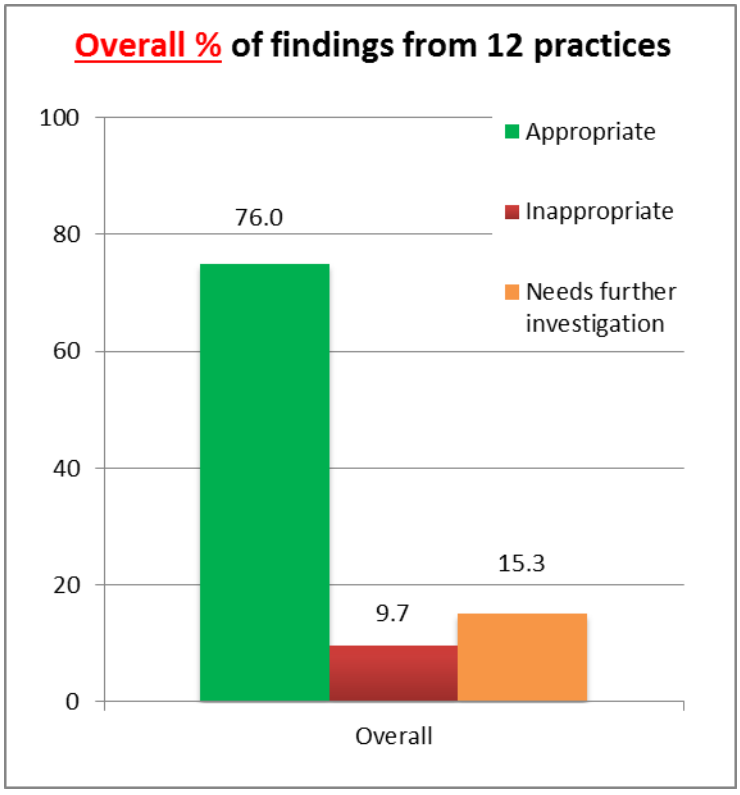

Figure 4: The percentage of patients at baseline on the QOF heart failure register who are appropriate, inappropriate or required further investigation to be on the register

3.2.2. Case finding heart failure patients

Action required	Number of patients (% of all records identified)
Addition to the register	152 (5.2%)
Referral for echocardiogram	15 (0.5%)
Echocardiogram report to be requested	24 (0.8%)
Referral for BNP	3 (0.1%)
GP to review case	120 (4.1%)

Table 1: Outcomes of the case finding process in all 12 practices

Across all 12 participating practices, a total of **2,903 patient records** were identified for investigation by the case finding searches. Each of these records was manually audited to identify patients who had a confirmed diagnosis of heart failure but were not on the register and patients who had signs and symptoms of heart failure or other indications that they required further investigation. The table below documents the results of the case finding process:

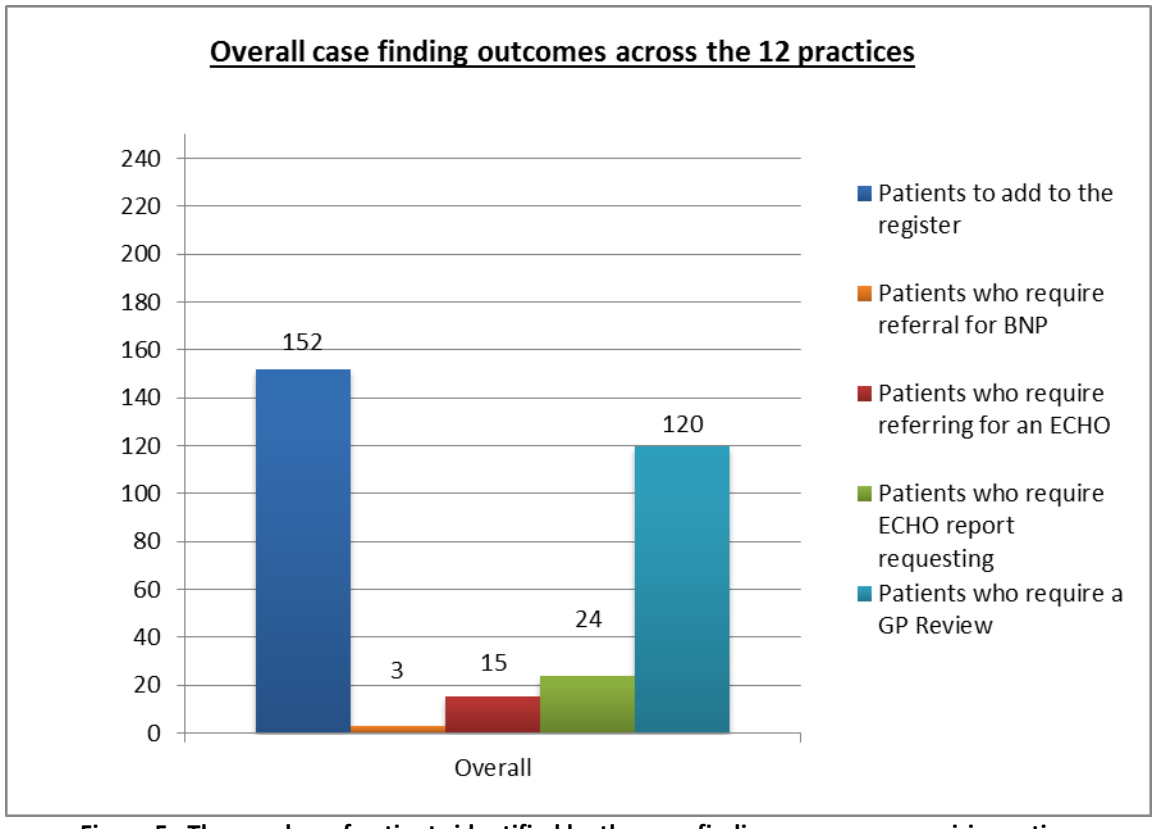

Figure 5: The number of patients identified by the case finding process as requiring action (e.g. addition to the heart failure register, or referral for an echo)

Using the results of the verification and case finding processes, 'new' minimum and maximum HF prevalences were calculated to offer an indication of the HF prevalence that would be achievable, and expected, should all practices implement recommended actions, such as adding and removing patients to the HF register. Based on the data from all practices completing the baseline audits, these calculations predicted the average minimum and maximum HF prevalence, at re-audit, of **0.93%**[*] (range, 0.40-1.40%) and **1.39%**[†] (range, 0.44-1.88%) respectively. Figure 6 details the predicted new minimum and maximum heart failure prevalence across TABA.

[*]Based on the number of patients identified through the case finding process as requiring addition to the heart failure register and the number of patients considered to be appropriately on the existing heart failure register.

[†]Based on the number of patients identified through the case finding process as requiring any action and the number of patients considered to be appropriately on the existing heart failure register or requiring further investigation.

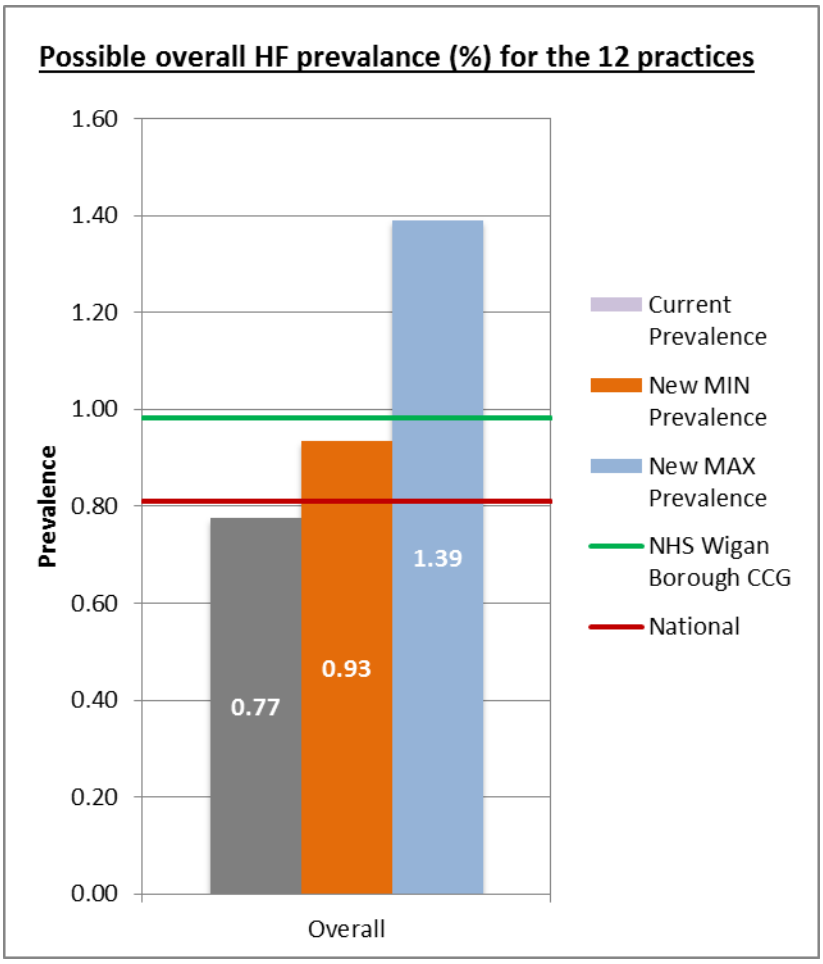

Figure 6: The predicted new maximum and minimum HF prevalence

3.2.3. Re-audit findings

At the point of re-audit there were a total of **424 patients** (mean, 35; range, 2-69) on practices' heart failure registers. Comparing this figure with the baseline HF register size for these practices, this represents a **17.1% increase** in the number of patients on the HF registers. The average prevalence across the practices increased from **0.77%** (range, 0.25-1.3%) to **0.91%** (range, 0.12-1.61%). Figure 7 presents the HF prevalence change for these practices, benchmarking them against the local and national prevalence figures provided by the QOF 2011/12 dataset.

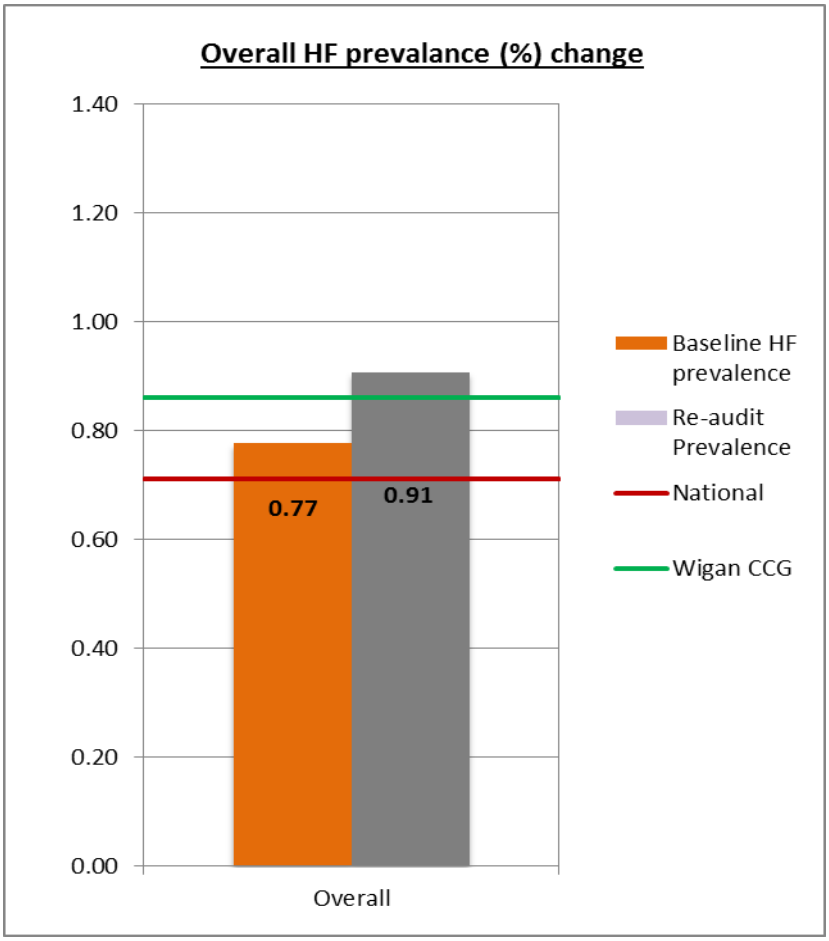

Figure 7: The average HF prevalence at baseline and re-audit

An increase in prevalence was observed at eight of the 12 GP practices at re-audit (ranging from increases of 0.03 to 0.61%). At four practices there was a decrease in prevalence (ranging from decreases of 0.02 to 0.16%).

At the point of re-audit, on average, **88.4%** (*n*=375) of the 424 patients on practice registers were considered appropriate for the HF register, **7.1%** (*n*=30) were thought to require further investigation to confirm a diagnosis and **4.5%** (*n*=19) were considered to have no diagnosis of HF and to therefore warrant removal from the register. The table below documents the percentage change, between the baseline and re-audit processes, in the proportion of patients considered appropriate, inappropriate and requiring further investigation.

Status	Baseline audit number of patients	Re-audit number of patients	% change
Appropriate	274	375	+ 12.2%
Further investigation	35	19	- 4.2%
Inappropriate	55	30	- 8.2%

Table 2: Comparison of findings between baseline audit and re-audit

Figure 8 presents the changes in the validity of the HF registers across the re-audited practices between the baseline audit and case finding processes and the re-audits. Of note, re-audited practices recorded an increased proportion of patients considered appropriate for the HF register of **12.2%**.

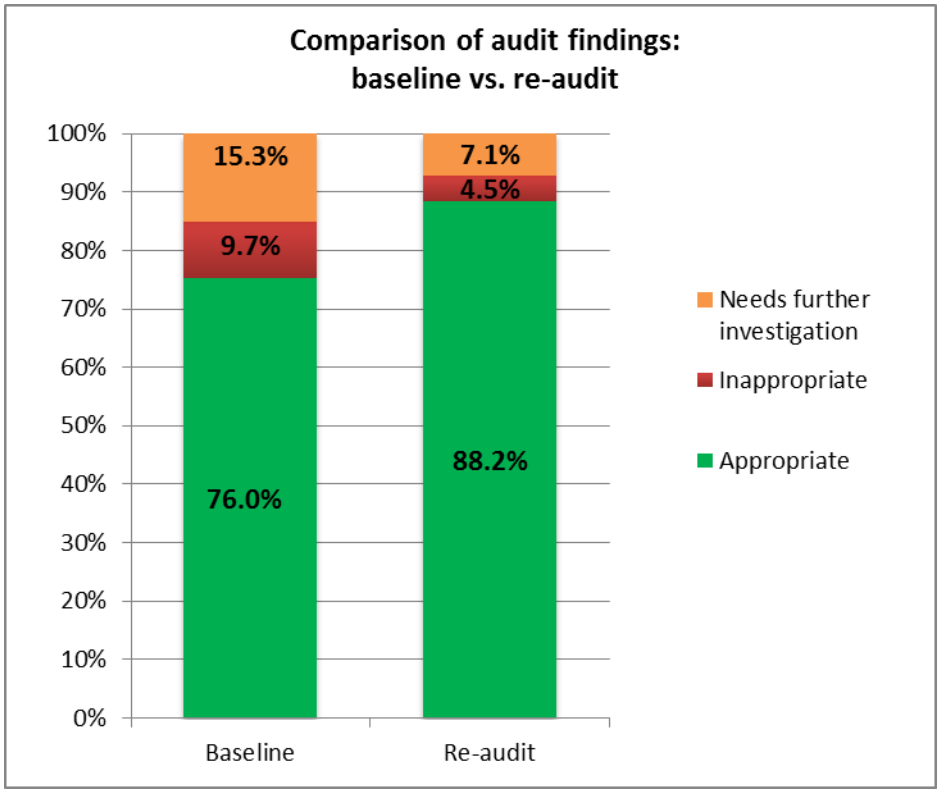

Figure 8: The percentage of patients at baseline and re-audit considered appropriate, inappropriate for the HF register or to require further investigation.

Figure 9 breaks these results down further, separately examining the validity of patients who were on the register at the time of the baseline audit, those identified through the case finding process and 'new' patients who had been who had been diagnosed with HF since the baseline audit.

At the point of re-audit, of those patients who were on HF registers at the time of the baseline audits **85%** were considered appropriate, **6%** required further investigation, and **6%** were deemed inappropriate for the register. Of those patients that had been identified by the case finding process as requiring an action (of any kind) and had subsequently been added to the register, **95%** were considered appropriate, **2%** to require further investigation and **1%** were considered as inappropriate additions. Finally, of the 'new' patients on the HF registers (patients identified since the baseline audit but not following any recommendations from CLAHRC), **86%**, **9%** and **5%** were considered appropriate, to require further investigation and inappropriate respectively. This indicates that practices were confident in following advice and instructions on correcting errors, but hadn't necessarily made adjustments to correct problems with the processes behind their diagnosis pathway – as errors seem to have been repeated in new diagnoses.

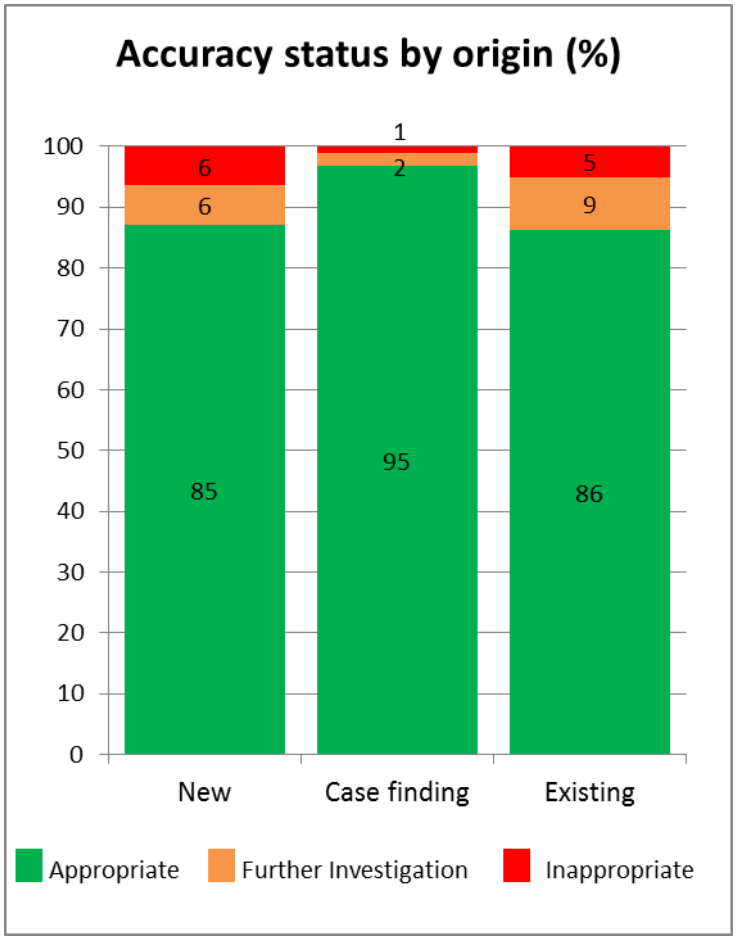

Figure 9: By origin, the percentage of patients on HF registers at the time of re-audit considered to be appropriate, inappropriate and requiring further investigation

3.2. Heart failure patient demographics

At the point of re-audit there were 424 patients on the HF registers. Of these, **63.4%** (*n*=269) were **male** and **36.5%** (*n*=155) were **female**. Table 3 details the age distribution of these patients.

Age bracket	Number of patients (%)
44yrs and under	11 (2.6%)
45-54yrs	24 (5.7%)
55-64yrs	63 (14.9%)
65-74yrs	120 (28.3%)
75yrs and over	207 (48.8%)

Table 3: Age distribution at re-audit

At the baseline audit, data was collected regarding the number and nature of co-morbid conditions with which patients on the HF register presented. This data is presented in Table 4 and Figure 10. The median number of co-morbidities was 3 (range, 0 to 7).

Number of co-morbidities	0	1	2	3	4	5	6	7
Number of patients (%)	17 (4.7%)	39 (10.7%)	81 (22.3%)	95 (26.1%)	86 (23.6%)	31 (8.5%)	11 (3.0%)	4 (1.1%)

Table 4: Number of co-morbidities recorded for HF patients

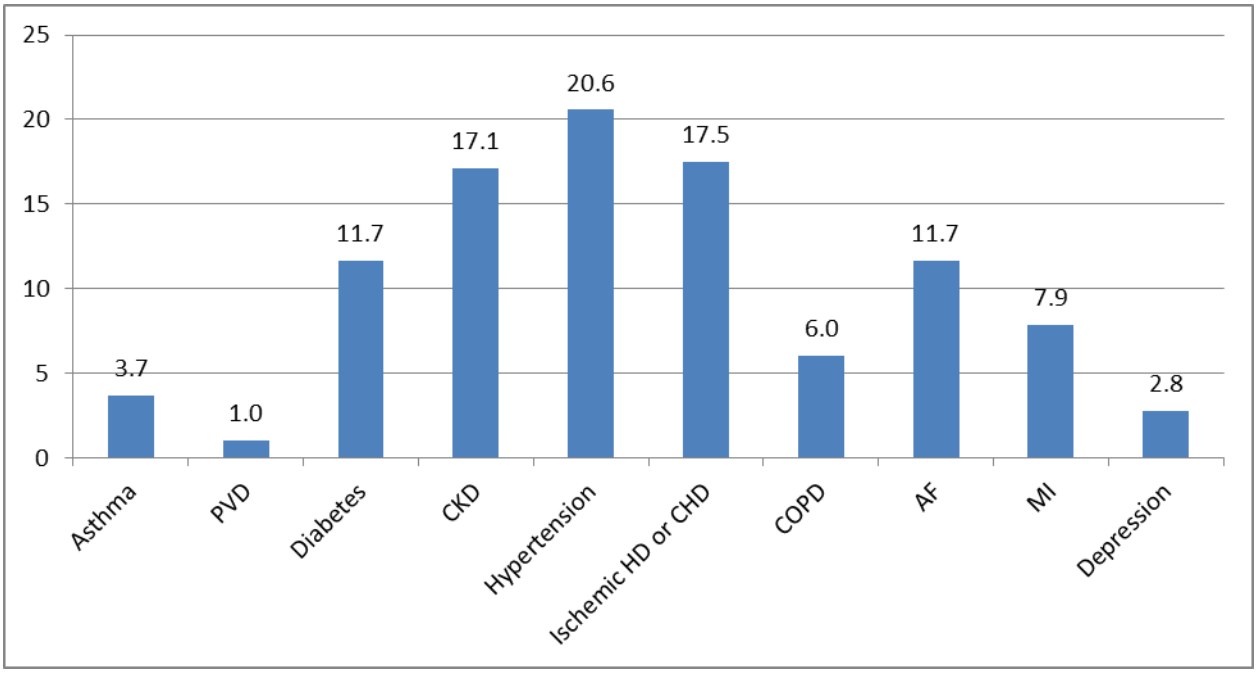

Figure 10: Prevalence of co-morbidities in patients on the heart failure register at baseline

Since 2006/07, the QOF dataset has calculated the proportion of patients on HF registers who were diagnosed with HF on, or after, 1st April 2006, the date the revised QOF contract came into operation. As detailed by Figure 11 below, at the time of baseline audit, across NHS Wigan Borough CCG, of those patients who were considered appropriate for the HF register and had a documented diagnosis date, 81.4% (n=215) had been diagnosed on or after 1st April 2006. At re-audit, however, this figure had increased to 89.0% (n=325).

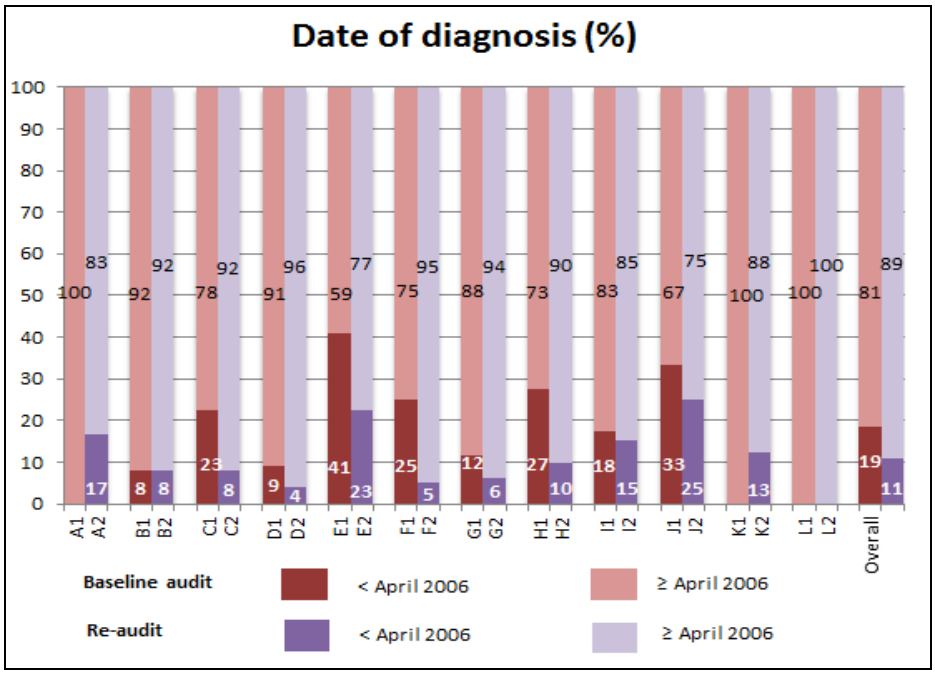

Figure 11: Percentage of 'appropriate' patients diagnosed with HF before and after initiation of QOF, measured during baseline audit and re-audit

The table below additionally details the proportion of 'appropriate' patients on the HF register, at baseline and re-audit, with different 'types' of HF (e.g. left ventricular systolic dysfunction (LVSD), diastolic dysfunction). As illustrated, while the proportion of patients on the HF register with LVSD remained relatively consistent, the largest proportional change was in the increase (4.2 to 6.6%) of patients documented as having diastolic dysfunction *(also known as HF with preserved ejection fraction)*.

'Type' of HF	Baseline audit number of patients (%)	Re-audit number of patients (%)
LVSD	240 (90.9%)	331 (90.2%)
Diastolic dysfunction	13 (4.9%)	24 (6.5%)
Right-sided	8 (3.0%)	6 (1.6%)
Other	3 (1.1%)	6 (1.6%)

Table 5: Typology of heart failure at baseline and re-audit

Of those patients on the HF register with documented LVSD, the table below also presents, where available, the proportion of patients across the CCG considered to have mild, moderate or severe functional impairment on echocardiogram.

Level of functional impairment	Baseline audit number of patients (%)	Re-audit number of patients (%)
Mild	63 (26.5%)	93 (28.7%)
Moderate	82 (34.5%)	118 (36.4%)
Severe	93 (39.1%)	113 (34.9%)

Table 6: Level of functional impairment for heart failure patients at baseline and re-audit

3.3. Quality of heart failure management

3.3.1. Traffic light score

The GM-HFIT audit tool generates, for each practice, a traffic light score based on their performance across 22 evidence-based key performance indicators (e.g. measurement of pulse rate/rhythm, provision of six-monthly HF reviews). The total traffic light score is out of 82, with scores greater than 76 being classified as gold (outstanding), 50-76 green (very high quality care), 25-49 amber (good) and less than 25 red (requires major improvement). At the feedback sessions following the baseline audit practices are talked through an Action Plan sheet that summarises their particular strengths and weaknesses in relation to heart failure as indicated by the traffic light score. By implementing the advice on the Action Plan practices can target specific areas of care to improve. Most commonly, this will feature advice around embedding a standardised six-month review proves for heart failure patients, which is uncommon in primary care, but forms one of the recommendations detailed by evidence-based guidelines. The re-audit provides insight into whether improvements in the diagnosis and management of HF have been made over the course of the project. At re-audit, on average across all 12 GP practices, a **7.5 point increase in traffic light score** was observed, from 51 to 58.5. Changes in the traffic light scores for each practice are presented in Figure 12.

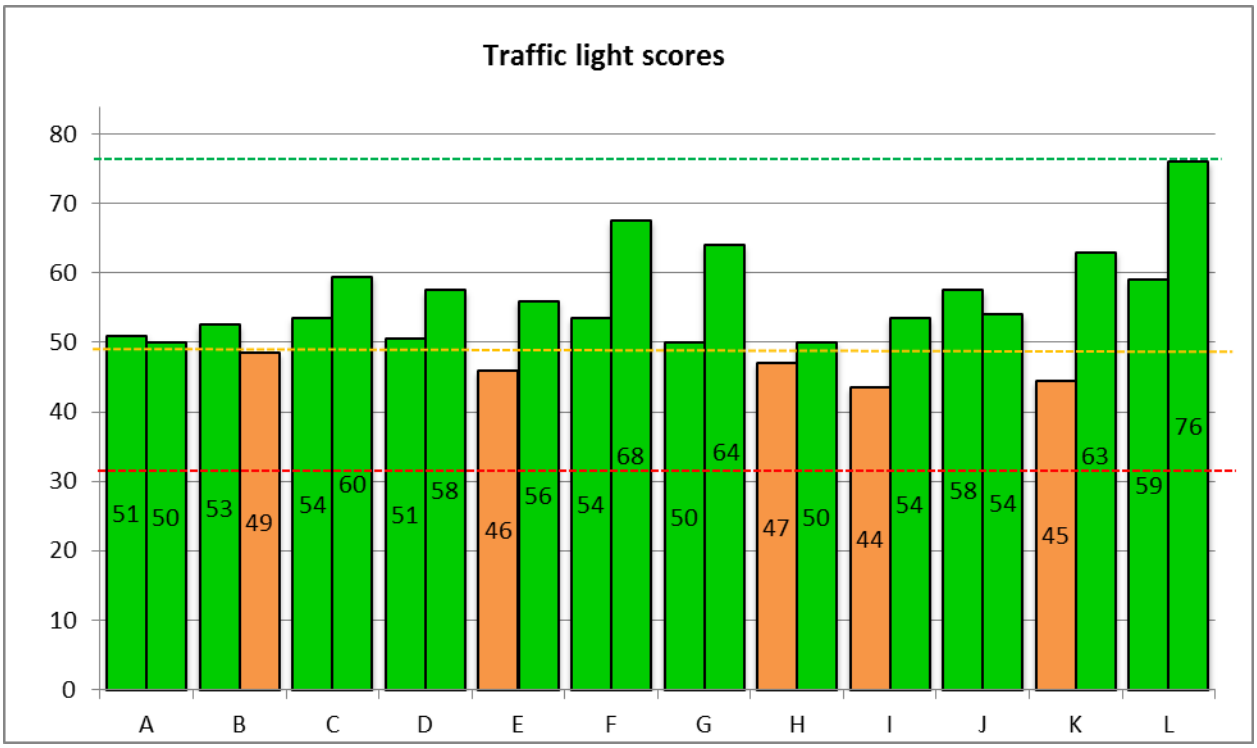

Figure 12: Change in traffic light score from baseline audit to re-audit

An increase in traffic light score was observed at 9 of the 12 practices (75%). The remaining three practices (25%) all registered a small decrease in score. Changes in traffic light score ranged from an increase of 18 points (from 45 to 63pts) and a decrease of 4 points (from 53 to 49pts and 58 to 54pts). Of note, at re-audit, there was only a minor difference of 2 points in the traffic light score for patients who had been newly identified after the baseline audit (either as a result of the case finding process or due to a 'new' HF diagnosis) when compared with those recorded at baseline.

At re-audit, across the 12 practices, there had been a small decrease in the proportion of the patients on the HF register **under the care of the HF specialist nurse**, either in secondary care or the community from **15.93%** to **15.33%**. However, as illustrated in Figure 13, this trend was not consistent across all of the practices.

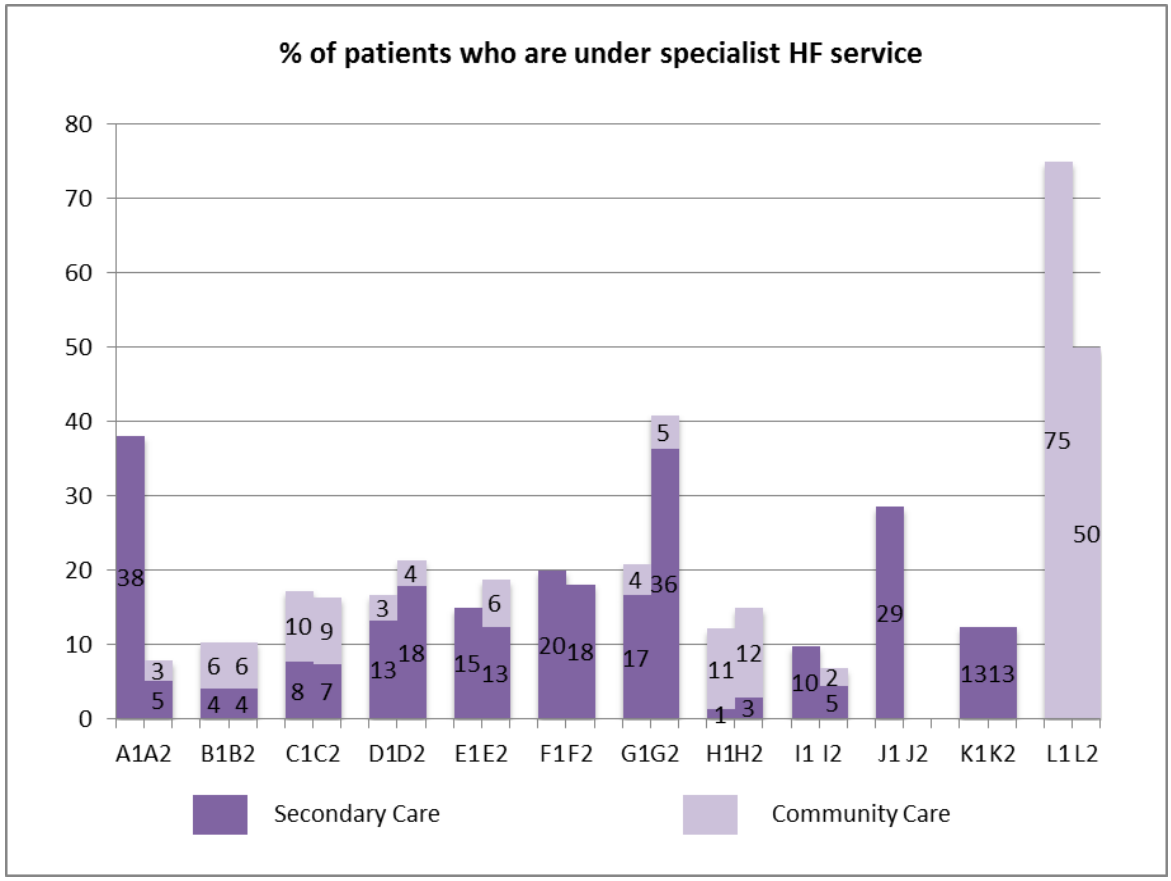

Figure 13: Percentage of recorded HF patients at baseline, and at re-audit, under community or secondary care for HF

3.3.2. Patients with a confirmed HF diagnosis

A key area of focus for the project was to ensure that HF patients have valid and complete information around their diagnoses. Recommendations were provided to practices after the baseline audit to encourage them to find related information to validate a diagnosis of HF if it was missing, such as repeating an echo, or requesting a missing report. Figure 14 demonstrates the change in the percentage of recorded HF patients with a confirmed diagnosis of HF at baseline audit and re-audit.

Across the 12 practices there was a mean increase of **11.58%** in patients with a confirmed diagnosis. Encouragingly, only one practice registered a decrease in this measure **(-7%)**. The smallest increase was **2%**; the largest increase was **25%**.

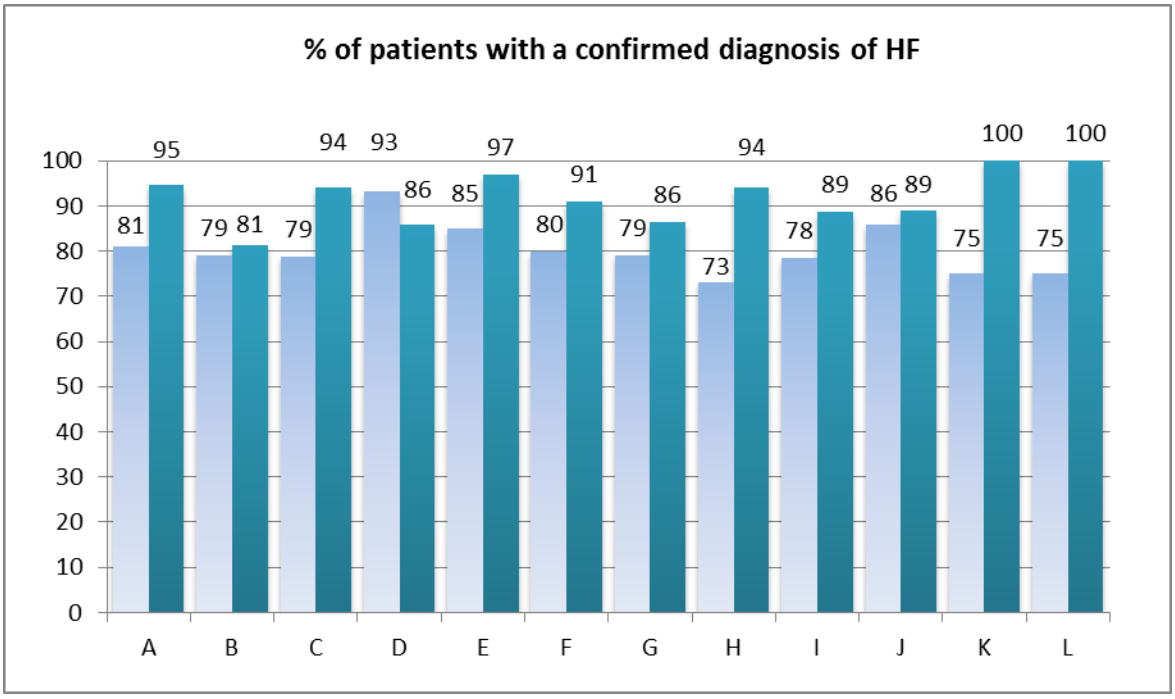

Figure 14: Change in the percentage of patients with a confirmed diagnosis of HF

3.3.3. Heart failure review

NICE recommends that all HF patients receive regular monitoring and reviews of their condition. The frequency of these reviews should be dependent on individual patients' clinical status and stability, but, at a minimum, should be six-monthly. In the GM-HFIT audit, this has consistently been raised as a weak area for any patients who are not under any kind of specialist review. The Action Plan that practices receive with the feedback details how these reviews can be implemented.

Between baseline and re-audit there was a significant increase in the proportion of HF patients that had received, or were documented as requiring, a **six-monthly or annual review** from **23.63%** to **54.25%** (six-monthly 14.01% to 25.0%; annual 9.62% to 29.25%) as detailed per practice in Figure 15. It is important to acknowledge, however, that, while not specifically documented as relating to HF, at both time points, a number of additional patients, particularly those with multi-morbidity, will have been having their condition monitored as part of a wider long-term conditions review.

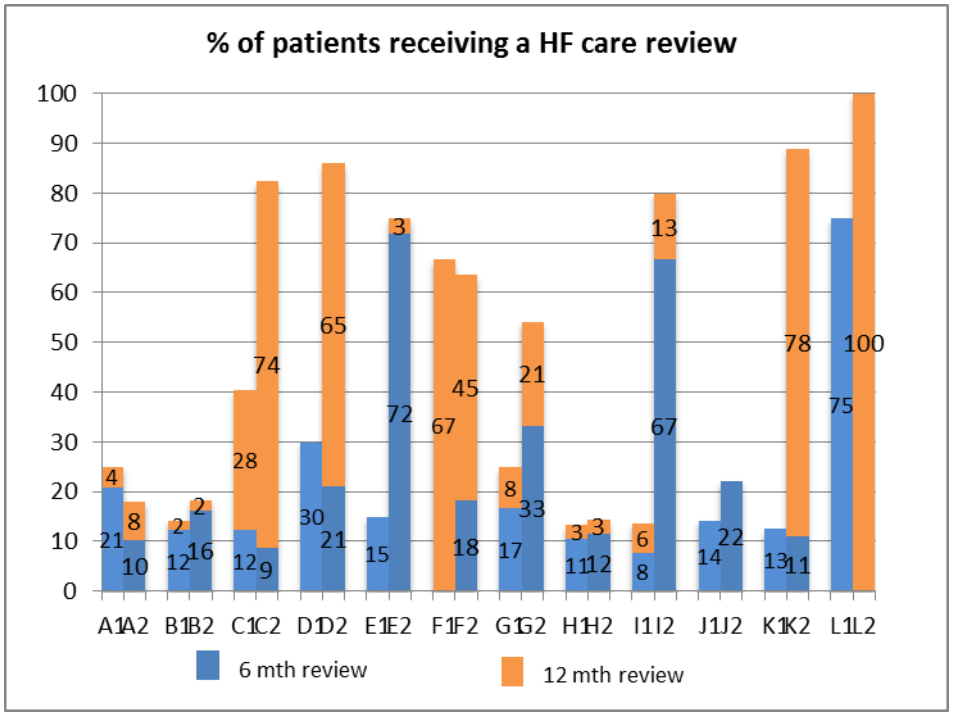

Figure 15: Percentage of patients receiving a HF review every 6 or 12 months, measured at baseline and re-audit (per practice)

3.3.4. Pharmacological treatment for heart failure

The 2010 NICE chronic HF clinical guidelines state that all patients with HF due to LVSD should be offered both ACE-I/ARBs and BBs licensed for HF unless contra-indicated. Due to the prognostic benefits offered by these therapies, this includes patients who are asymptomatic.

At re-audit, a small decrease in the **use of ACE-I/ARB therapy** for patients with confirmed LVSD was observed on average across all 12 practices (Figure 16). The proportion of patients with confirmed LVSD either on an ACE-I/ARB or for whom it was documented that this therapy was contra-indicated decreased from **97.5%** (90.8% on ACE-I/ARB; 6.7% contra-indicated) to **92.8%** (84.6% on ACE-I/ARB; 8.2% contra-indicated). This decrease was not consistent across all sectors or GP practices. A decrease in ACE-I/ARB use or documented contra-indication was observed in four of the 12 GP practices (33.3%). However, there was an increase at five practices (41.7%) and no apparent change at a further three (25%).

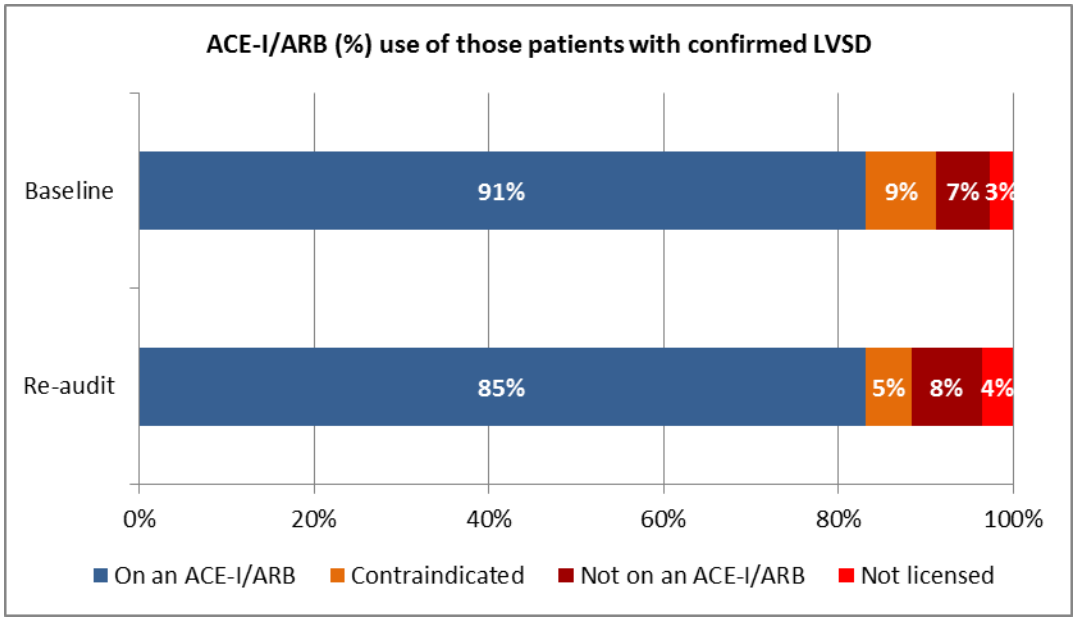

Figure 16: Change in the % of patients with confirmed LVSD on ACE-I/ARB therapy

A similar pattern was observed for the use of beta blocker (BB) therapy for patients with confirmed LVSD (Figure 17). The proportion of patients **in receipt of beta blocker therapy**, or for whom it was documented as contra-indicated, decreased from **92.9%** (81.7% on BB; 11.3% contra-indicated) to **87%** (77.9% on BB; 9.1% contra-indicated). Despite an overall decrease, a small majority of practices actually recorded an increase in this measure. Decreases were observed in four practices (33.3%), increases in a further seven (58.3%) and no change at a single GP practice (8.3%).

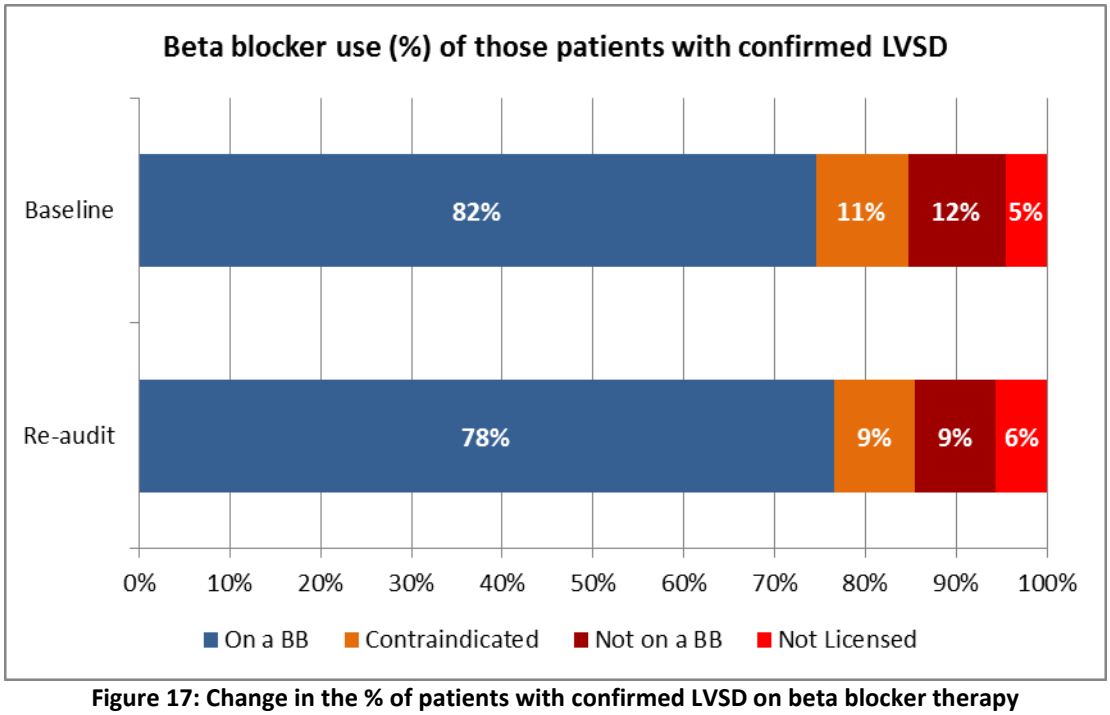

Figure 17: Change in the % of patients with confirmed LVSD on beta blocker therapy

There was, however, for both ACE-I/ARB and BB therapy, an increase in the proportion of patients receiving these therapies being treated to optimal tolerated dose. From baseline audit, the percentage of patients receiving a maximum tolerated **dose of ACE-I/ARB**, or being up-titrated (including evidence of an intention to up-titrate), increased across all practices from **67%** (59.2% optimised; 7.8% up-titrating) to **85.4%** (79.7% optimised; 5.7% up-titrating) (Figure 18). This

increase was consistent across all of the 12 GP practices (except for the one practice which was 100% at baseline and remained as such).

On average, the proportion of patients being treated to maximum tolerated **dose of BB**, or being up-titrated, also increased from **71.4%** (65.3% optimised; 6.1% up-titrating) to **95.7%** (81% optimised; 14.7% up-titrating) (Figure 19). This picture was not as consistent across all practices as ACE-I/ARB optimisation. An increase in BB optimisation or up-titration was observed in nine GP practices (75%), with a decrease evident in two practices (16.7%) and no change in the one remaining practice (8.3%).

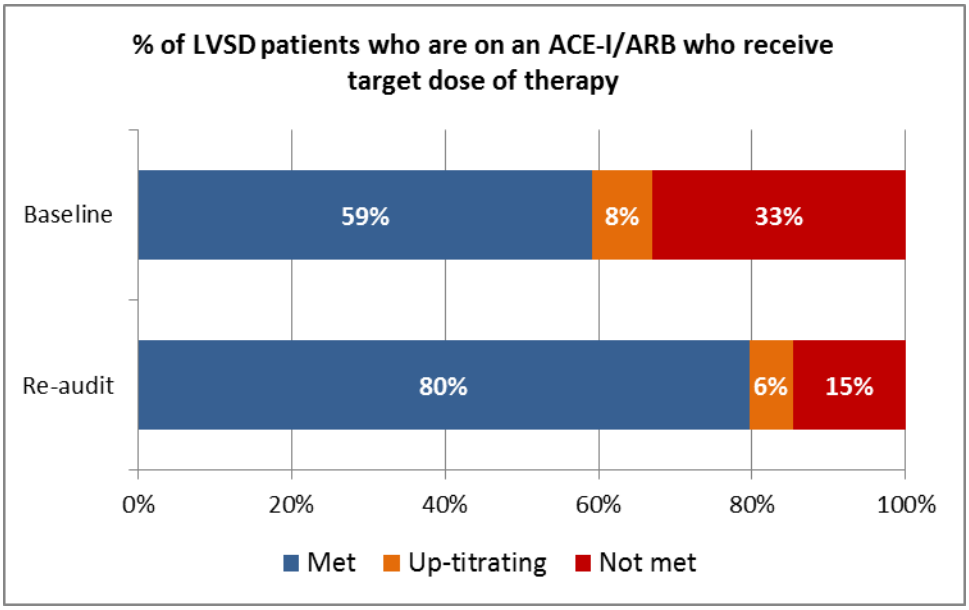

Figure 18: The overall percentage of patients receiving ACE-I/ARB therapy treated to optimal tolerated dose at baseline and re-audit

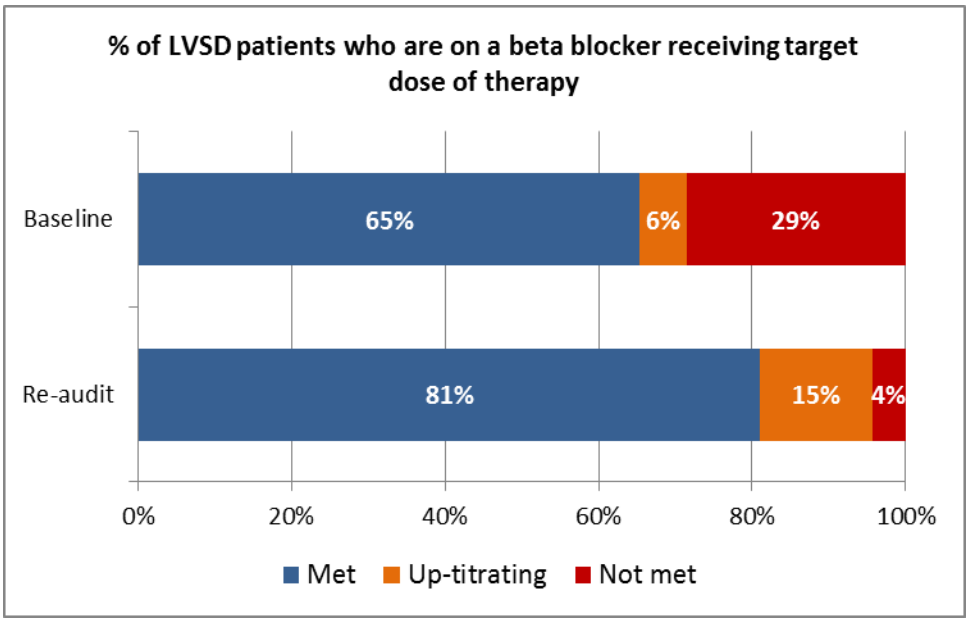

Figure 19: The overall percentage of patients receiving beta blocker therapy treated to optimal tolerated dose at baseline and re-audit

3.5.3. Clinical assessment

As previously described, all patients with chronic HF require routine clinical monitoring. This monitoring should include examination of cardiac rhythm. Over the course of the project an increase was seen in the proportion of HF patients documented as having had their **pulse rate (63.2 to 69.1%)** and/or **rhythm (48.9 to 51.4%)** checked in the previous 12 months. Increases were recorded at seven (58.3% - rate) and six (50% - rhythm) of the practices. In recent years, evidence has emerged indicating that controlling heart rate in patients with chronic HF to less than 70bpm reduces hospitalisations and offers mortality benefits. At re-audit, there was a small increase (from **25.5 to 34.4%**) in the percentage of patients with a pulse rate check in the previous 12 months whose documented rate was less than 70bpm.

Small overall increases were additionally observed in the proportion of patients on the HF registers who had a documented **oedema (from 26.9 to 28.8%)** and/or **weight check (from 14.3 to 20.8%)** in the previous 12 months. As Figures 20 and 21 below illustrate, this increase was consistent across all sectors for weight checks, but not for the monitoring of oedema. A negligible decrease was also observed in the proportion of HF patients with a documented blood pressure check in the previous 12 months (from **93.1 to 92.7%**).

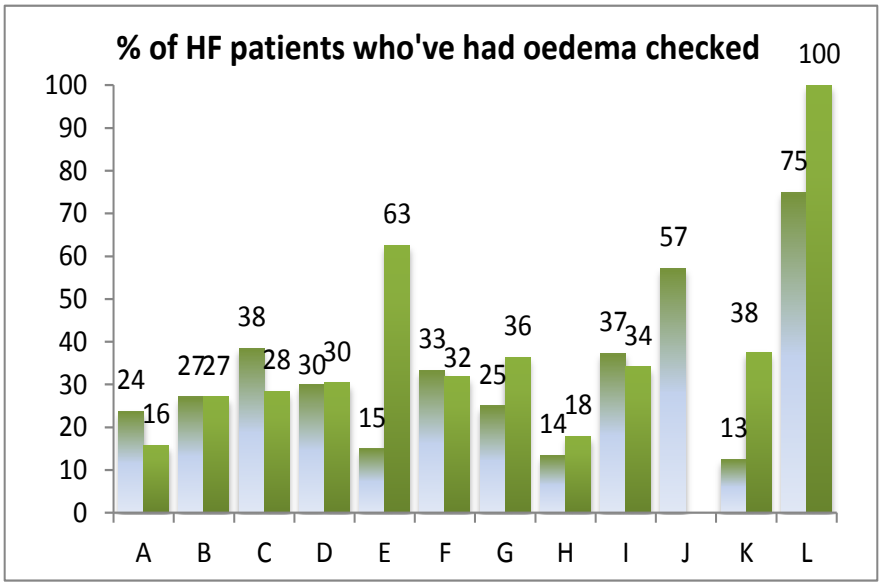

Figure 20: The proportion of HF patients per practice with an oedema check in the previous 12 months

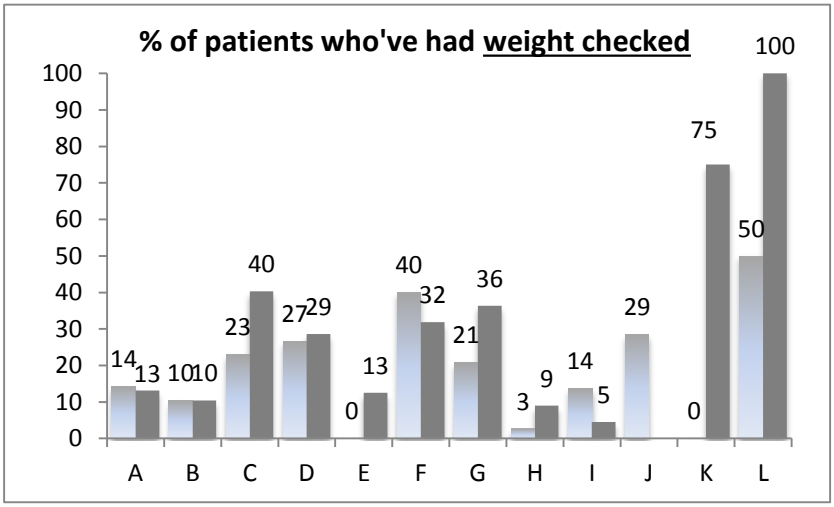

Figure 21: The proportion of HF patients per practice with a weight check in the previous 12 months

As part of their on-going monitoring, patients with chronic HF should have their functional capacity clinically assessed. This is commonly done using the New York Heart Association (NYHA) classification which places patients in one of four categories (NYHA I-IV) based on how symptomatic they are. Clinically, this information is of value to support the on-going management of patients, in particular to guide the appropriate selection and titration of pharmacological therapies. Over the course of the project there was a **small increase in the proportion of patients with a documented assessment of their functional capacity in the previous 12 months (from 9.3 to 11.4%)** (Figure 22). This, however, was not consistent across all practices, with a small increase in NYHA recording being observed in six (50%) of the GP practices.

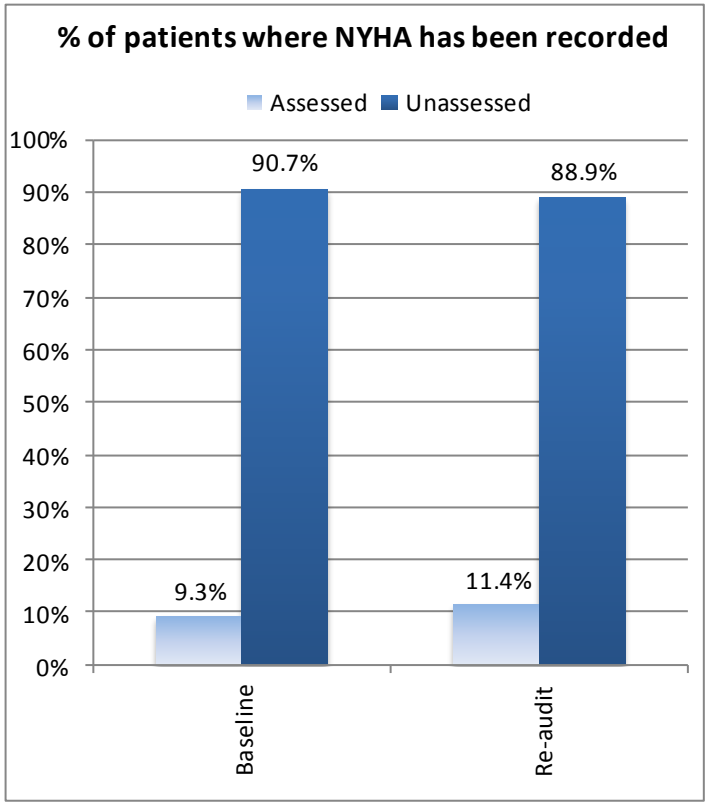

Figure 22: The overall, change in the percentage of HF patients whose functional capacity has been assessed and documented using the NYHA classification in the previous 12 months

3.5.3. Psychosocial monitoring

As a known risk factor for cardiovascular disease, patients with HF should be strongly advised not to smoke and their smoking status should, therefore, be routinely monitored. In addition, it is recommended that, particularly in view of its negative inotropic effects, patients should be advised to limit their alcohol intake. At re-audit, modest increases were observed across the 12 practices in the proportion of patients on the HF register with a smoking and/or alcohol status recorded in the previous 12 months. The proportion of patients whose **smoking status** had been checked **decreased from 84.6 to 82.5%** whilst the proportion having their **alcohol status** checked increased from **77.2 to 79.5%**. However, again, changes were not consistently observed across all practices. The recording of smoking and alcohol status increased at four (33.3%) practices for both measures.

The prevalence of clinically significant depression in HF patients is high at 20% and is associated with increased morbidity and mortality. The clinical monitoring of patients with HF should therefore include routine screening for depression. At re-audit the proportion of HF patients recorded as having been **screened for depression within the**

previous 12 months decreased from 66.8 to 64.4% (Figure 23). Again, four practices (33.3%) recorded an increase on this measure.

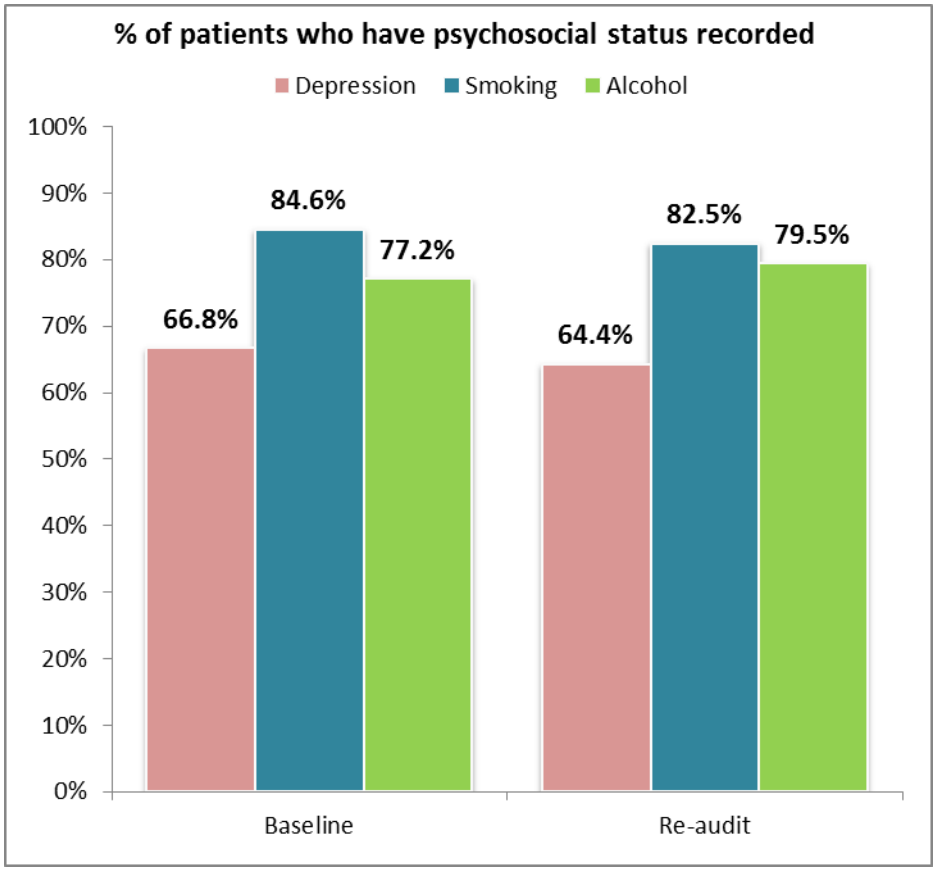

Figure 23: The overall percentage of patients screened for psychosocial risk factors in the preceding 12 months

3.5.3. Vaccination status

All patients with HF should be offered an annual vaccination against **influenza** and a **pneumococcal vaccination** on a single occasion. Marginal changes were observed over the course of the project in the proportion of HF patients documented as having received or declined these vaccinations (**influenza: 84.9 to 82.7%; pneumococcal: 79 to 79.3%**) (Figure 24). These changes, however, were not consistently observed across all practices.

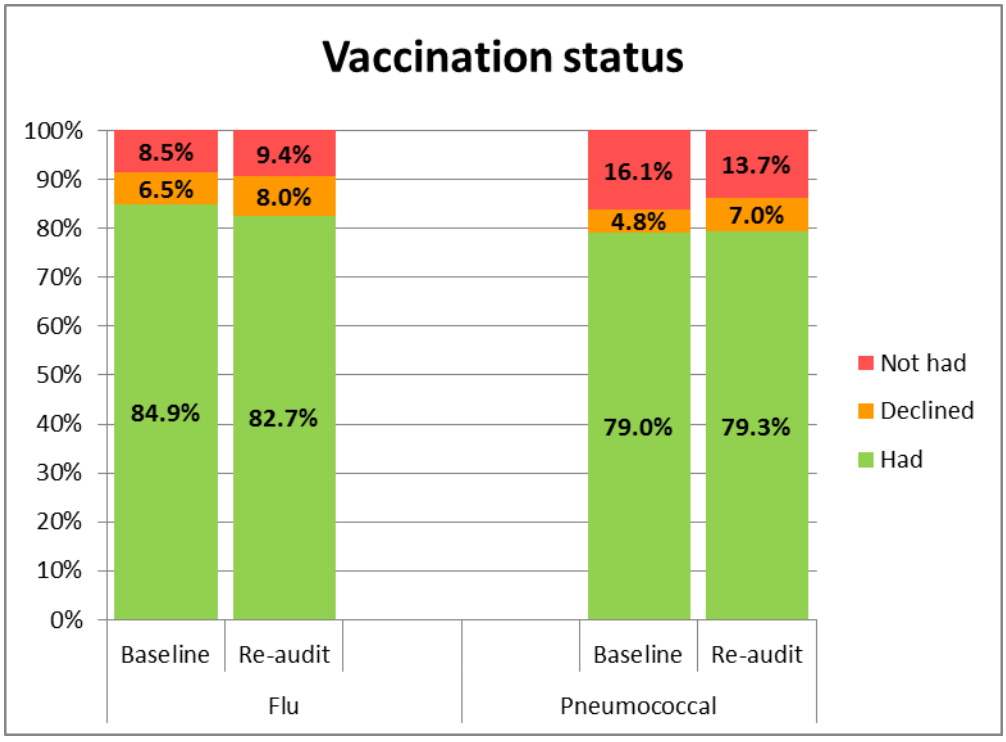

Figure 24: The overall percentage of HF patients administered the influenza and pneumococcal vaccinations at baseline and re-audit

3.5.4. Supporting self-management

Providing education and involving patients in the monitoring of their own condition is a key part of successful HF management and can have a positive effect on patients' symptoms, functional capacity, well-being, mortality and prognosis. This can range from simple interventions, such as providing patients with information about their diagnosis and the symptoms and signs that may indicate deterioration in their condition, to getting patients to actively monitor and record their weight and fluid intake on a daily basis.

At re-audit, an increase in the proportion of HF patients documented as receiving **self-management support** (**from 19.5 to 28.4%**) and **information about nutritional intake** (**from 19.5 to 29.2%**) was observed. Increases were recorded at seven (58.3%) and eight (66.7%) of GP practices for self-management advice and nutritional information respectively.

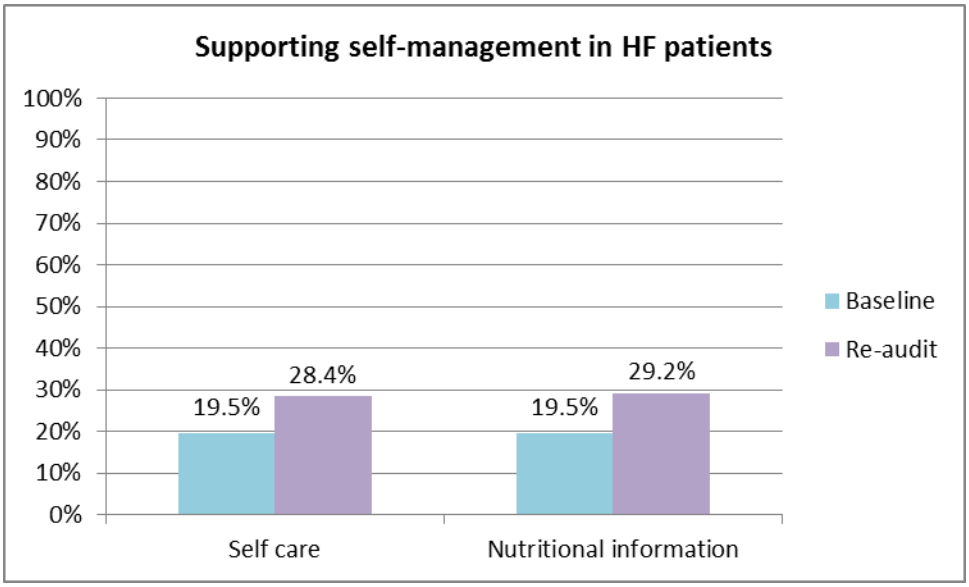

Figure 25: The overall percentage of HF patients given self-management advice and nutritional information

4. Discussion

This section discusses the main conclusions of the evaluation drawn out from evidence provided within this report and from over the course of the project.

4.1. Heart failure prevalence

At the start of the project, the 12 participating practices had a recorded prevalence of 0.77%. This figure was higher than the nationally reported figure of 0.71%, but lower than peer practices in NHS Wigan CCG which averaged 0.86%, and significantly lower than the expected HF prevalence of 1 to 2% described by the British Heart Foundation (2010). As a direct result of the activities conducted within the project reported here, in particular the case finding component of the work, an increase in HF prevalence was observed, with reported HF prevalence upon conclusion of the project averaging at 0.91%%. Reported HF prevalence, however, ranged significantly between practices, from 0.12 to 1.61%.

Despite an overall increase in prevalence, three GP practices in fact decreased in HF prevalence between the initial baseline audit and the re-audit exercise. There appear to be two primary reasons for this outcome. Firstly, two of these practices had relatively high baseline prevalences, and as a result had greater numbers of patients deemed inappropriate for the HF register which they were advised to remove, with comparatively few patients to add onto the register. Secondly, the other practice of the three struggled to resource the project work within their own practice so none or few of the recommendations were fulfilled by the time of the re-audit, whilst their overall practice list size grew simultaneously, thus lowering their HF prevalence. It is hoped that at practices where not all recommended actions were completed within the project timeframe, clinicians may be able to resource time to continue with work from the case finding element of the project, such as adding patients to the HF register and investigating those with signs and symptoms of HF. Therefore a continued increase in HF prevalence may be observed.

In contrast to the trend described above, it is also possible that the HF prevalence identified at re-audit may be over-reported for several practices. This situation may arise if practices complete the actions from the case finding process prior to the removal from the register of those patients identified through the register verification process to not have a confirmed HF diagnosis. The presence of a continuing number of patients at re-audit considered to be inappropriate for the HF register or to require further investigation would serve to suggest that this may be the case for several practices. In such circumstances, a small decline in reported HF prevalence would be anticipated in the near future, as practices remove and investigate patients who were identified at baseline as being inappropriate for the HF register or requiring further investigation. However, analysis of the baseline verification and case finding results indicates that, even where this is the case, after all actions have been completed, reported HF prevalence will still be anticipated to be higher than that observed at the start of the project.

4.2. Heart failure register validity

A significant improvement in the validity of practice-held HF registers was observed over the course of the project. At the time of the baseline audits, across participating practices a quarter of patients on the HF registers did not have a confirmed diagnosis of HF, being considered inappropriate for the register or to require further investigation. At re-audit, however, this had decreased, with only 11.6% of patients on the HF register not having a confirmed HF diagnosis. While this falls short of the project objective of ensuring that 100% of patients on practice HF register have a confirmed diagnosis, it still represents a considerable improvement.

The observed improvement in the validity of practice HF registers was principally attributable to the addition of patients who had been identified through the case finding process as having a confirmed diagnosis of HF. This, however, was also supplemented by an improvement of the validity of the diagnoses of patients who had been on the HF register at the start of the project, indicating that a number of practices actively removed patients from the register where they were considered to not have a diagnosis of HF. Further improvements in the validity of practice HF registers may be observed as practices continue to work through the actions arising from both the register verification and case finding elements of the GM-HFIT project.

It is of concern, that, at re-audit, patients investigated for HF were still being added to the HF register despite no confirmation of a diagnosis or indeed evidence to the contrary (step 6 on the project logic diagram below). This indicates that, despite the improvement reported at re-audit in the proportion of coded HF patients with a confirmed diagnosis, the validity of HF registers may steadily decline post-project as 'new' patients continue to be added to the HF register inappropriately.

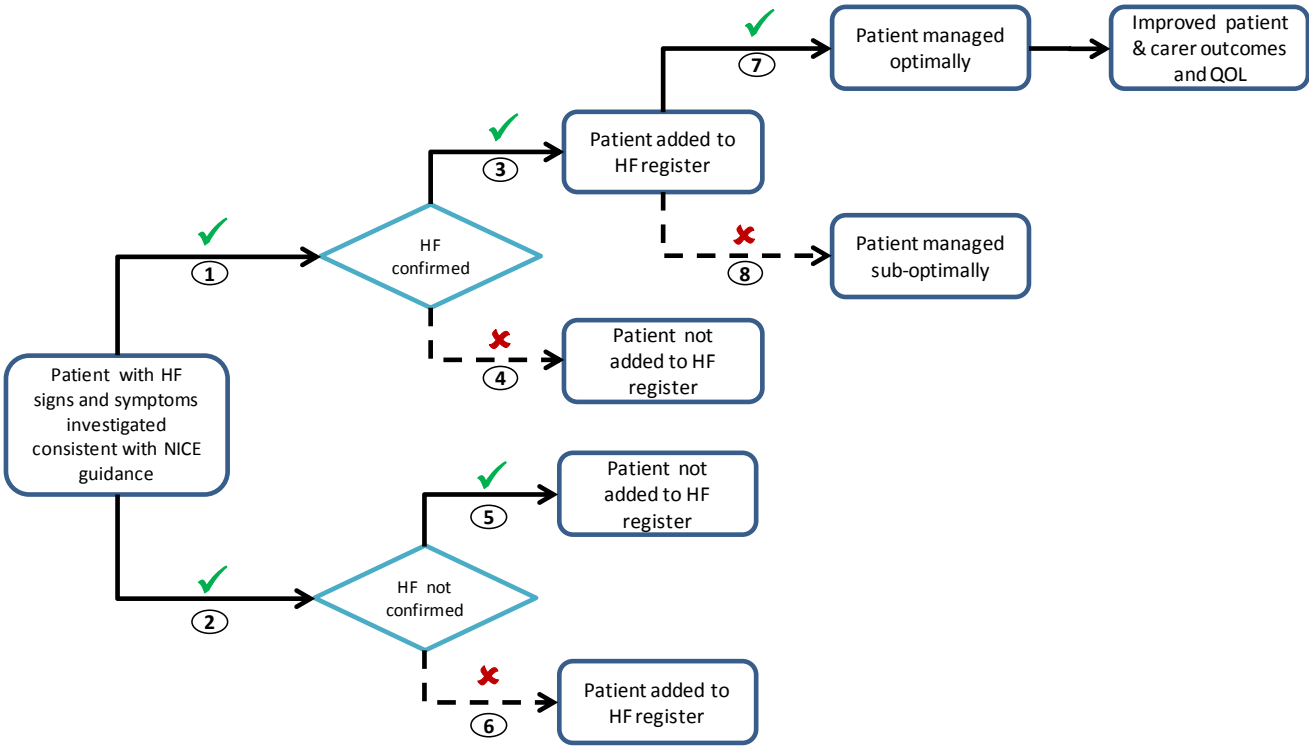

Figure 26: Project logic diagram

Analysis of data pertaining to those patients, at baseline and re-audit, on the HF register identified as inappropriate or requiring further investigation exposed a number of probable reasons why patients were, and are, being added to the HF register in the absence of a confirmed diagnosis. These reasons are documented in the box 1 below. Patients were most frequently added to the HF register in error where an echocardiogram report documented the present of valvular abnormalities (e.g. mitral or atrial regurgitation) in the absence of HF, thus representing a misinterpretation of the report. Although it is not possible to ascertain confirmation from the data, it is possible that this may occur more frequently in those practices where clinical letters and investigation results are Read-coded by individuals of a non-clinical background. In other cases, it was noted that patients may have been added to the HF register in the absence of a confirmed diagnosis due to difficulties accessing echocardiography services, such as those who are housebound. In appreciation of this difficulty and the absence of widespread use of BNP (brain natriuretic peptide) testing, it was

considered that these patients should not be on the HF register but should instead be classified using the Read code designated for 'suspected heart failure'. However, it was apparent that there was a lack of awareness of this Read code across all GP practices.

Box 1. Reasons patients may be added to the HF register in the absence of a confirmed diagnosis

- Valvular and other abnormalities documented on echocardiogram reports considered to be indicative of HF.
- Addition to the HF register on the basis of clinical signs and symptoms alone with no further diagnostic investigation, despite being able to access echocardiography services.
- Addition to the HF register on the basis of clinical signs and symptoms alone, where patients are unable to access echocardiography services (e.g. those who are housebound) or decline further investigation.
- Addition to the HF register on the basis of clinical signs and symptoms alone, where the patient has subsequently gone on to have a 'normal' echocardiogram.
- Patient transferred from another practice outside the CCG boundary with a documented, yet unconfirmed, diagnosis of HF.
- Addition to the HF register at a time before echocardiographic investigation was considered a requirement to confirm a HF diagnosis.

In addition to identifying patients added to the HF register in error, the project also set out to identify patients with confirmed diagnoses of HF that had not been added to the HF register (step 4 on the project logic diagram). It is likely that many of the patients that were coded as a result of the project were 'missed' off the HF register due to simple errors in Read coding.

Notably, HF diagnoses were also frequently 'missed' when included in discharge summaries and clinical letters, as opposed to echocardiogram reports, due to the volume of additional information provided in the former, and also anecdotally where the HF diagnosis was stated in terms of ejection fraction without direct reference to 'dysfunction' and/or 'heart failure'. In addition, several patients with HF were found to have potentially been removed inappropriately from the HF register following normalisation of their heart function, for example, attributable to the use of optimal pharmacological therapy. Of interest, a number of patients under the care of the HF specialist nurse were also found to have been 'missed' off the HF register, perhaps due to preconception that addition to the register was not warranted for patients already being managed by specialist HF services.

The re-audit process does not permit identification of whether, since the baseline audit, participating GP practices have 'missed' fewer patients off their practice-held HF registers, but it is likely that all practices, and in particular the individuals within the practices responsible for Read coding, would benefit from further input and support, particularly concerning diastolic HF, mild LVSD and the appropriate interpretation and Read coding of echocardiogram reports.

4.3. Quality of heart failure management

Between the initial baseline audit and re-audit there was an average 7.5 point increase in traffic light score across participating GP practices, indicative of an improvement in the quality of HF diagnosis and care. Much of this increase was derived from improvements in the proportion of patients with a confirmed HF diagnosis and known aetiology.

Whilst an increase in traffic light score was observed at nine of the 12 GP practices, a small decrease was seen at the remaining three, although all decreases were minimal. A number of reasons have been suggested for this trend,

including: a decrease in the proportion of patients on some practice-held HF registers receiving input from HF specialist nurse services; natural/common-cause variation in the quality of HF care; practices having completed the process of adding HF patients to the register, but not having yet addressed the clinical management of these patients. Where the latter is the case, it is possible that an increase in the quality of HF management may be seen over the coming months as practices continue to complete the clinical actions recommended by both the baseline and re-audit processes.

Improvements in the quality of HF management were supported by the provision of clinical education sessions. While the objective of having representation from all participating practices at these sessions was not met, almost 67% of participating practices were represented at the arranged session.

The project objectives also stated an intention to ensure implementation, across all GP practices, of a standard HF review template to support the conduct of standardised, evidence-based six-monthly HF reviews in primary care. This, however, was not achieved during the timeframes associated with the project due to changes in the organisation and structure of the NHS which led to significant disruption in the availability of the data quality services that were due to support the development of the template. While the template has now been developed and is being tested in collaboration with several GP practices, further work is required to refine its content and structure and to subsequently support its dissemination.

With respect to clinical care, the primary improvement observed was in the proportion of HF patients receiving, or being scheduled to receive, a primary care HF review, either six-monthly or annually, as recommended by NICE. The introduction of these reviews facilitated small yet significant improvements in some clinical process indicators, including the administration of pulse rate and rhythm, oedema and weight checks, recording of smoking status and the documented provision nutritional education in relation to HF. A small decline was observed in the recording of NYHA status, most likely reflecting the decreased proportion of HF patients receiving HF specialist input and a lack of awareness and adoption of the NYHA classification within the primary care context. A small decline was also seen in the proportion of HF patients screened for depression.

Between initial baseline audit and re-audit, a small reduction in the use of ACE-I/ARB and BB therapy for patients with confirmed LVSD was seen on average across participating practices, although this was not consistent across all practices. As, in some practices, many patients identified as requiring addition to the HF register were added only shortly before re-audit, this is likely to have been caused by virtue of the fact that these patients were added to the HF register before re-audit yet prior to their commencement on appropriate medication. In contrast to this decrease, however, it was encouraging to observe a small increase, on average across the participating practices, in the proportion of HF patients being treated with these therapies receiving optimal tolerated doses or having, or due to have, their medication up-titrated.

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Appendix 1

Heart Failure Case Finding Searches

At the beginning of the project, 20 searches were used within the case finding process to generate a list of patients who may have a confirmed diagnosis of HF but were not on the HF register. These searches were later reduced to the 15 listed below, with several searches being merged during the project.

Patients already on the HF register were excluded from all searches.

Search No.	Description
1.	(Any Angiotensin Converting Enzyme Inhibitor OR any Angiotensin Receptor Blocker) AND Beta Blocker licensed for HF
2.	Spironolactone AND Eplerenone
3.	Metolazone
4.	Ivabradine
5.	Coronary Heart Disease AND Echocardiogram
6.	(Atrial Fibrillation OR Atrial Flutter) AND Echocardiogram
7.	Cardiomyopathy
8.	Cardiomegaly AND Echocardiogram
9.	(ECG Abnormal OR Left Bundle Branch Block) AND Coronary Heart Disease
10.	Echocardiogram Abnormal
11.	Left Ventricular Systolic Dysfunction
12.	Left Ventricular Diastolic Dysfunction
13.	Suspected Heart Failure
14.	Pacemaker *in situ*
15.	Internal Cardioverter Defibrillator (ICD)