NATIONAL HEART FAILURE AUDIT

2019 SUMMARY REPORT (2017/18 DATA)

NICOR

CONTENTS

1. INTRODUCTION

1.1 WHAT IS HEART FAILURE?

Heart Failure (HF) means a defect in heart function (either emptying or filling) leading to a rise in atrial pressures (congestion) and, eventually, symptoms such as breathlessness and ankle swelling. It is common and approximately 900,000 people in the United Kingdom have HF. It causes or complicates about 5% of all emergency hospital admissions in adults and consumes up to 2% of total National Health Service (NHS) expenditure.[1] It is the final common pathway of most forms of cardiovascular disease, usually as a consequence of myocardial (heart muscle) dysfunction.

In the UK the most common type of HF is due to left ventricular systolic dysfunction, where there is impaired contraction of the left ventricle, which is called HF with reduced Ejection Fraction (HFrEF). HF can also be attributed to impaired filling of the left ventricle when the heart muscle is thickened, often as a result of long-standing high blood pressure, which is called HF with preserved Ejection Fraction (HFpEF). HF is often described as Chronic Heart Failure (CHF), when patients have relatively stable symptoms of breathlessness, fatigue and ankle swelling, and Acute Heart Failure (AHF) when the symptoms become severe and the patient usually requires admission to hospital. However, in many cases deterioration occurs gradually over several weeks before hospital admission and might be prevented if detected and managed earlier. The typical course of CHF is punctuated by periods of acute or sub-acute decompensation into AHF, although good management and monitoring will make these episodes less frequent.

HF is often associated with marked reductions in quality of life and high levels of debility, morbidity and mortality. This imposes a heavy burden not only on patients but also those who care for them. Repeated hospitalisations are a measure of the adverse effects of HF on quality of life, the failure to control symptoms and disease progression, the high levels of co-morbidity, and ultimately of an adverse prognosis; they also make a large contribution to the huge fiscal cost of HF to the NHS. Survival rates for HF patients are variable, dependent on the age and severity of disease of the patient, and the quality of care they receive.

Outcomes are consistently poor for patients who receive suboptimal care but input from the HF specialists and prescription of evidence-based HF therapies have a substantial prognostic benefit.

The National Heart Failure Audit (NHFA) deals with a specific and crucial phase in the patient journey. It reports on the characteristics of patients admitted with acute or sub-acute HF, the in-hospital investigation and care, the treatment given and the discharge planning and follow-up which is offered.

The audit is now well established, reporting key metrics on over 70% of admissions with a primary diagnosis of HF and trends on key performance indicator (KPIs) and outcomes compared to previous years.

1.2 MANAGEMENT OF PATIENTS WITH HEART FAILURE

The treatment of HF is determined by the mode of presentation, that is acute or chronic, and the underlying type of cardiac dysfunction (HFrEF or HFpEF).

There has been little progress in the treatment of AHF over the last forty years. Oxygen and intravenous diuretics rapidly relieve (usually within 30-90 minutes) symptoms of pulmonary congestion (breathlessness). Diuretics are also the mainstay of treatment for peripheral congestion although this may require several days of intensive treatment before it is controlled. Sometimes intravenous vasodilator or inotropic agents are required. Once patients are euvolaemic after intravenous therapy, they are converted to oral diuretics to ensure that they remain free from symptoms and signs of congestion (breathlessness and peripheral oedema).

For those who have HFrEF as the underlying cause of their HF, key disease modifying medicines need to be given. These are ACE inhibitors (ACEI), beta blockers (BB) and mineralocorticoid receptor antagonists (MRA). Data from numerous clinical trials in HF show that these medicines improve or reduce recurrent worsening of symptoms and reduce hospitalisations for HF and mortality. Previous audit reports show that patients discharged on all three medicines have better survival rates from discharge out to 6 years of follow-up compared to those discharged on fewer or none. The prescription of these medicines for HFrEF is a KPI in this audit.

1.3 GUIDELINES AND QUALITY STANDARDS

The NHFA dataset is continuously evolving to ensure it remains an effective representation of current evidence-based guideline recommended HF care, and wherever possible reflects the related Quality Standards. This 11th report reflects practice for the year April 2017-March 2018 and therefore should be assessed in the context of the 2010 NICE CHF Guidelines,[2] and related 2011 CHF Quality Standards,[3] the NICE Guideline for AHF in 2014[4] and the related Acute Quality Standards in 2015,[5] and the 2016 European Society of Cardiology (ESC) Heart Failure Guideline.[6] The most recent NICE CHF guideline was not published until September 2018 and so will have had little impact on the results of this audit.

The guidelines are based on evidence from many randomised controlled trials that enrolled many thousands of patients and economic modelling of the cost-effectiveness of implementing the findings of these trials using data from the National Heart Failure Audit. Thus, a virtuous cycle is established whereby audit data from routine practice is used to identify deficiencies in care that can be improved by implementing guidelines and quality standards leading to improved care and outcomes. However, patients will only derive benefit if the information is acted upon, as outlined below.

The audit data are used to determine where the Best Practice Tariff (BPT) for HF has been achieved. Hospitals are expected to include ≥70% of their HF emergency admissions in the first diagnostic position and of these 60% should have been seen by a specialist on the admission.

1.4 THE ROLE OF THE AUDIT

The National Heart Failure Audit was established in 2007 to understand contemporary practice with the aim of helping clinicians improve the quality of Heart Failure services and to achieve better outcomes for patients.

The purpose of this audit is to drive up standards of care during the acute admission phase to achieve better patient outcomes. This can be accomplished by capturing data on clinical indicators that have a proven link to improved outcomes, encouraging the increased use of clinically recommended diagnostic tools, implementing the use of disease-modifying treatments, and by robust referral pathways.

The National Heart Failure Audit aims to collect data on all hospital deaths and discharges primarily due to Heart Failure, in England and Wales. Events submitted to the audit are compared with Heart Failure episodes coded in the first diagnostic position by Hospital Episode Statistics (HES) in England or the Patient Episode Database of Wales (PEDW) in Wales.

1.5 METHODOLOGY

The National Heart Failure Audit collects data on all patients with an unscheduled admission to hospital in England and Wales who have a death or discharge with a diagnosis of heart failure in the primary position (i.e. heart failure is the main condition treated or investigated during the episode of care for the following ICD-10 codes:

- I11.0 Hypertensive heart disease with (congestive) heart failure
- I25.5 Ischaemic cardiomyopathy
- I42.0 Dilated cardiomyopathy
- I42.9 Cardiomyopathy, unspecified
- I50.0 Congestive heart failure
- I50.1 Left ventricular failure
- I50.9 Heart failure, unspecified

Patients admitted for elective procedures, for example elective pacemaker implantation or angiography, are not included. Patients must be over 18 years to be eligible for inclusion in the audit.

1.6 KEY PERFORMANCE INDICATORS (KPIs)

In an effort to drive up standards, the audit also monitors and reports on hospital activity and outcomes against a set of Key Performance Indicators (KPIs) which have been developed to provide a benchmark to show hospital variation over time.

Through the Audit we encourage hospitals to aim to achieve the following:

- 70% case ascertainment
- >85% of patients have specialist team input during admission
- >60% of patients are admitted to cardiology care
- >85% of HFrEF patients are discharged on all 3 disease-modifying medicines
- >50% of patients are discharged with 2 week follow-up appointments to see the specialist multi-disciplinary team

2. EXECUTIVE SUMMARY

- This year's Heart Failure (HF) audit is based on 68,266 admissions to hospitals in England and Wales between April 2017 and March 2018. This represents 76% of HF admissions as the patient's primary diagnosis in England and 65% in Wales. This is a 7% reduction on last year's report due to improved data cleaning filters on the new IT platform.

- During hospital admission, more than 88% of patients are investigated with an echocardiogram, a key diagnostic test. However, rates are higher for those admitted to Cardiology (95%) rather than General Medical (84%) wards. Specialist input, irrespective of the place of admission, is associated with higher rates (92%) of echocardiography. There is however considerable variation in the use of this essential diagnostic tool across institutions, leaving room for improvement.

- The prescription of key disease-modifying medicines for patients with heart failure and reduced left ventricular ejection fraction (HFrEF) has continued to increase, including beta blockers (89%) and mineralocorticoid antagonists (53%); treatments that are both life-saving and inexpensive. As with other key performance indicators (KPIs) variations between wards and between hospitals are evident and most marked for prescription of mineralocorticoid antagonists.

- Prescription rates for all three, key disease-modifying medications for patients with HFrEF have increased further from 48% to 57% for those admitted to Cardiology wards over the last three years. This is one of the KPIs with the most marked variation between institutions.

- Irrespective of the place of admission, 50% of patients with HFrEF, seen by a member of the specialist HF team as an inpatient, were prescribed all three disease modifying medications, which is a key performance indicator (KPI). This has improved from 47% last year.

- The number of patients seen by HF specialists has increased to over 82% this year. This is important as specialist care improves survival.

- The mortality of patients hospitalised with heart failure remains high overall at 10.1%. Whilst some attrition is inevitable in an elderly population, with no new treatments for acute heart failure for over 20 years, the variation in care suggests these figures can be improved.

  Greater focus on our quality improvements (QIs) of specialist and cardiology care, alongside variation between the extents to which different hospitals deliver, should lead to further improvement. Those admitted to cardiology wards had an in-patient mortality of 7.1% and those who saw specialists (no matter where they were) had an 8.6% mortality rate in hospital. Out-reach specialist care and/or an increase in access to cardiology or specialist HF beds should be further promoted.

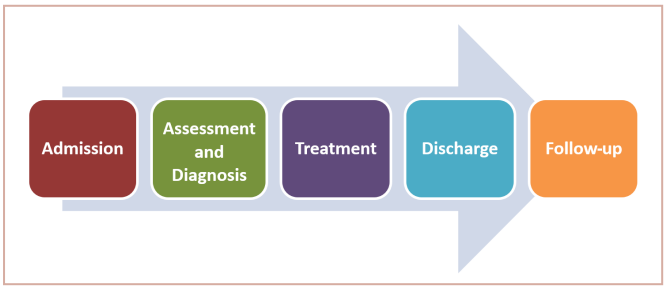
- Post-discharge mortality rates at one year are substantially, and significantly, lower for those admitted to cardiology wards, those accessing cardiology follow-up, those offered cardiac rehabilitation and those discharged on the key disease-modifying medicines for HFrEF. There is an independent association of these lower mortality rates with achievement of the KPIs and future efforts of this audit will be focused on these areas, to drive up the quality indicators and so drive down 1-year mortality rates for HFrEF.

- While this audit has seen an overall improvement in many of the KPIs, there is substantial variation between individual hospitals in the attainment of all these KPIs. The most marked variation centres around the prescription of all three disease-modifying medicines for those discharged with HFrEF. This varies from less than 10% to 100% (after excluding those with contraindications). We need to further highlight and explore the variation between centres and the opportunities to stimulate those poorer performing units to catch up with the best centres.

3. THE NATIONAL HEART FAILURE AUDIT RESULTS – 2017/18

The results will be presented according to the patient journey for people hospitalised because of HF following the scheme below.

Figure 1: *The patient pathway for a typical patient entered into the National Heart Failure Audit*



Data were provided on 58,885 hospital admissions with acute heart failure who either died as in-patients or who survived to discharge between April 2017 and March 2018 (Table 1). This is a 9% reduction on the numbers included in the 2016/17 report. Records were submitted on 68,266 admissions. Last year, the overall submission number was 73,616, so the submission reduction this year was 7%. Last year the number of confirmed HF records was 64,392, so there is a 9% reduction in confirmed admissions this year.

The explanation for the reduction relates to instigation of more stringent data quality control introduced with the new IT platform. Also, patients were excluded if a validated diagnosis of HF was not confirmed on the check list (n=5663) as were those with a normal echocardiogram (in the absence of atrial fibrillation, n=845)). Patients were also excluded if they stayed in hospital for less than 24 hours and were discharged alive (n=2873). This means that the smaller cohort is enriched by those with a tighter diagnosis of HF. This means that, of course, they are sicker, which is reflected in some of the changes in the variables we are reporting this year.

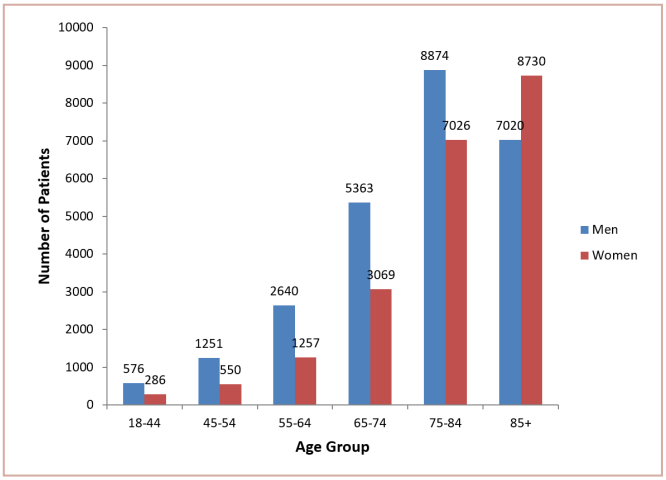
Table 1: *Records submitted and case ascertainment in 2017/18*

Region	Records submitted	Confirmed HF records	HES/PEDW	Case Asctainment (%)
Overall	68,266	58,885	90,799	75.2
England	65,409	56,285	86,392	75.7
Wales	2,857	2,600	4,407	64.8

3.1 DEMOGRAPHICS

The median age [IQR] of patients was 80 years overall but slightly higher for women and lower for men. There were more men in each age category other than the 85+ age group where women were in the majority (Figure 2).

Figure 2: *Age and gender demographics at first admission*



Mean age - 77.8 years

Median age - 80 years

Mean age men - 75.9 years

Mean age women - 80.2 years

3.2 TRENDS IN SYMPTOMS

The pattern of symptoms and signs of HF remains indicative of an advanced HF population. Thirty six percent of admissions were associated with symptoms at rest (NYHA Class IV) and 80% are either in NHYA Classes III or IV. Over half of admissions (56%) were associated with moderate or severe oedema. As peripheral oedema usually accumulates over days or weeks there is an opportunity to reduce admissions through better community referrals. As peripheral oedema is also associated with longer stays, better management might shorten admissions.

Figure 3: *Trends in symptoms and signs of HF over the last 4 years*

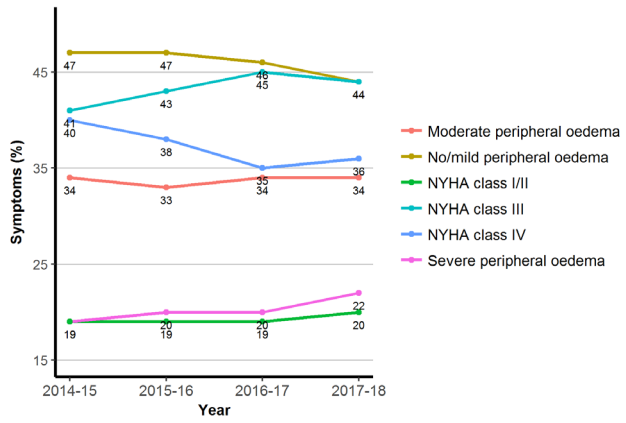


Table 2: *Causes and comorbidities of Heart Failure*

Medical History	HFrEF (%)	HFpEF (%)
IHD	46	37
Atrial fibrillation (from ECG)	41	51
Valve disease	27	33
Hypertension	52	61
Diabetes	34	34
COPD	18	20
Asthma	9	9

3.3 CAUSES AND COMORBIDITIES OF HEART FAILURE

66% of patients are reported to have HFrEF (very similar to last year). As in previous years ischaemic heart disease (IHD) is more common in those with HFrEF, whereas hypertension and valve disease are associated with HFpEF. There is a high co-morbidity burden; now over one third of patients have diabetes and almost 20% have chronic obstructive pulmonary disease. A further 8-9% are recorded as having asthma (Table 2).

4. ASSESSMENT AND DIAGNOSIS

Electrocardiograms (ECGs) and echocardiography are done in 86% and 88% of patients respectively, in line with the key performance indicators (KPIs) for accurate diagnosis. The retrospective rates displayed in Figure 4a are derived by running previous years' analyses using the new IT platform data filters. It shows lower rates of ECGs being recorded than in previous reports.

Echocardiography rates are similar to those seen before. High levels of echocardiography have been maintained over the last four years. However, 12% of patients are either not accessing echocardiography in hospital and/or have no record of a recent echo within the last 12 months (Figure 4a). Figure 4b depicts the variation in the percentage of echocardiography achieved between trusts. Although recent NICE guidelines recommend an echocardiogram within 48 hours for all patients admitted with a new diagnosis of acute heart failure with a raised BNP,[5] the hospitals have been reviewed against the standard of 90% of all patients having an echocardiogram during the hospital stay, regardless of BNP measurement. This is because the current dataset does not allow a measure of the time to the performance of the echocardiogram. Compliance with the NICE Acute Heart Failure Quality Standard will be addressed with the implementation of the new dataset as soon as possible.

4.1 ECG AND ECHO DIAGNOSTIC TESTS

Figure 4a: *HF patients receiving ECG and echo diagnostics tests over 4 years*

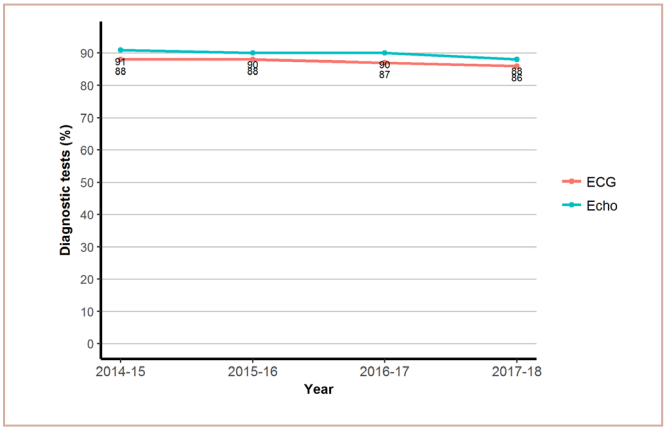
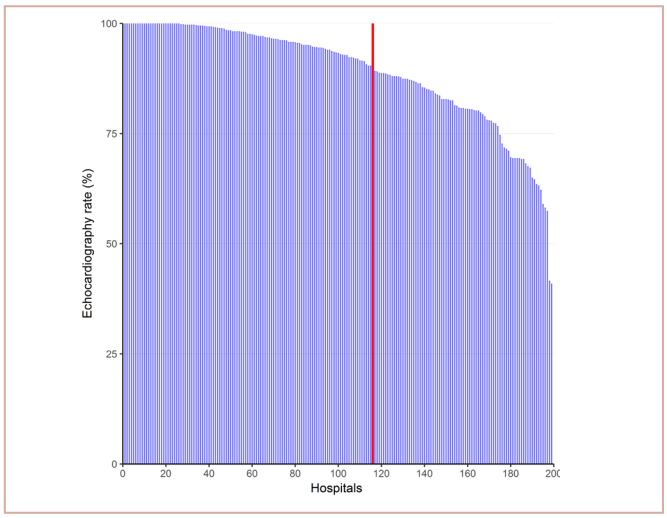


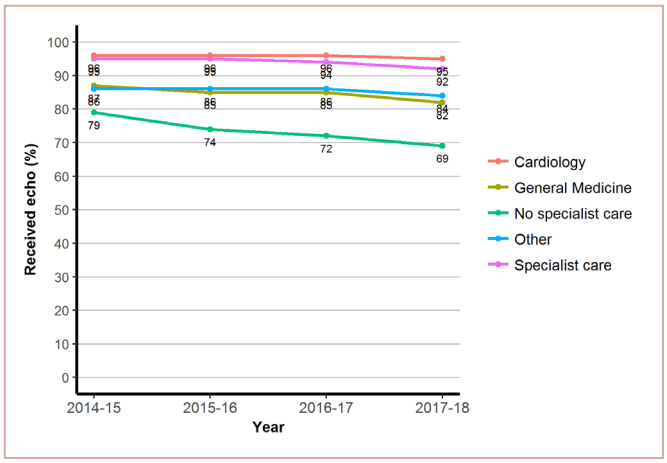
Figure 4b: *Variation between hospitals by percentage undergoing echocardiography (2017/18)*



(**Note**: *Hospitals to the right of the red line are* **not** *achieving the target of 90% of heart failure patients receiving echocardiography. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded.)*

Patients admitted to cardiology wards were more likely to have echocardiography than those admitted to general medical wards (95% versus 84%). However, it should be noted that patients receiving specialist input to their care no matter where they are admitted have similar rates of echocardiography (92%) as those on cardiology wards (Figure 5). There is a substantial drop in the echocardiography rate for those not having access to specialist care (69%). Fifty-eight percent of hospitals achieved an echocardiography rate of 90% or more, 42% were less than 90%.

Figure 5: *Percentage of patients receiving echocardiography by place of care (or with specialist input regardless of the place of care) (2014/15-2017/18)*



4.2 ECHO DIAGNOSIS

Echocardiography provides important information on the underlying aetiology of HF. Fewer patients have a normal echo this year (1%) due to better data quality. Those with a normal echocardiogram were excluded unless they had atrial fibrillation recorded in this audit cycle. Most patients have HFrEF, as in previous years. The proportion with left ventricular hypertrophy (LVH) and diastolic dysfunction has remained unchanged since last year. However there has been an increase in 5% in the reporting of significant valve disease (Table 3).

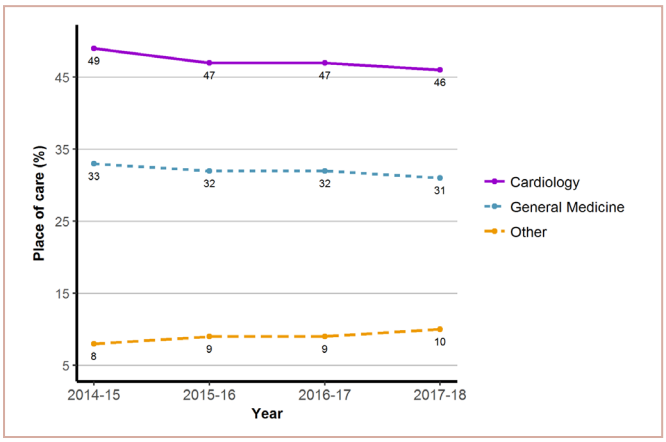
Table 3: *Overall echo diagnosis breakdown (2017/18)*

	Total (%)
Normal Echo	1
Left ventricular systolic dysfunction (LVSD)	66
Left ventricular hypertrophy (LVH)	7.3
Valve disease	41
Diastolic dysfunction	12
Other diagnosis	18

4.3 TRENDS IN PLACE OF CARE

Place of care is a key quality indicator for HF. In this audit cycle, as in the preceding four years, just under half of patients were admitted to cardiology wards (Figure 6). Whilst some of this may reflect a fixed number of cardiology beds being available in most hospitals, there is an enormous variation within the audit in the percentage accessing care in cardiology wards (0-100%). There is therefore scope for more of these high-risk cardiac patients to have access to cardiology wards in those hospitals where this is not happening.

Figure 6: *Trends in place of care over 4 years (2014/15-2017/18)*



4.4 TRENDS IN INPUT BY HEART FAILURE SPECIALISTS

Eighty two per cent of patients were seen by a HF specialist during the admission. This can either be a Consultant Cardiologist, another Consultant with specialist HF interest (usually a Care of the Elderly Physician) or a HF specialist nurse (some are seen by more than one member). Fifty-seven per cent of patients see a Consultant Cardiologist and 49% of patients now see a HF specialist nurse during their admission. The absolute percentages for those seen by nurses are higher than those in previous reports, as a result of the higher data accuracy.

For those on cardiology wards, 99% are seen by specialists, 93% are seen by Consultant Cardiologists and 52% by HF nurses. The slight increase of 2% specialist input in the general medical wards is due to other Consultants with an interest in HF (usually Care of the Elderly Physicians). The proportion of those on general medical wards seen by a specialist HF nurse has remained static at 44% (Figure 7a).

Specialist input is another KPI with huge inter-hospital variability and therefore with scope for improvement (Figure 7b). Only 59% of hospitals achieved specialist review rates of over 80%, 41% saw less than 80% of patients.

Figure 7a: *Specialist input trends by place of care (2014/15 -2017/18)*

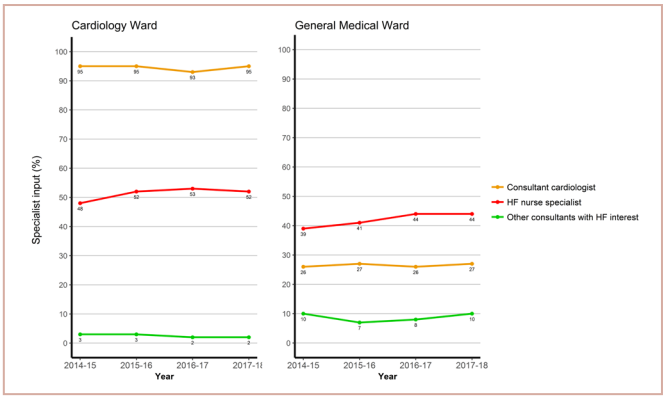
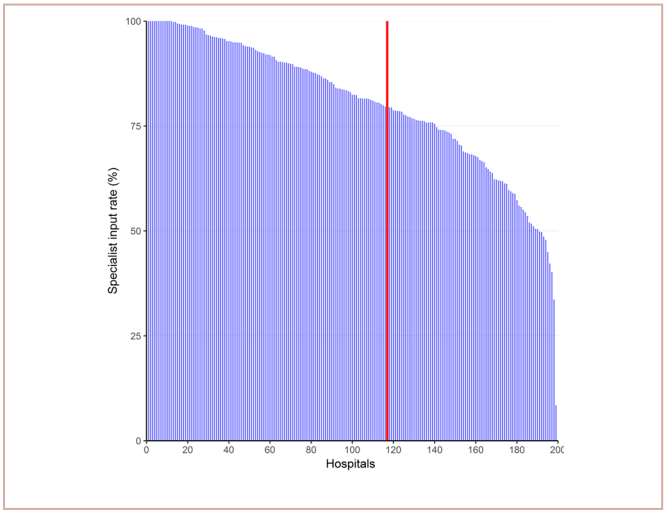
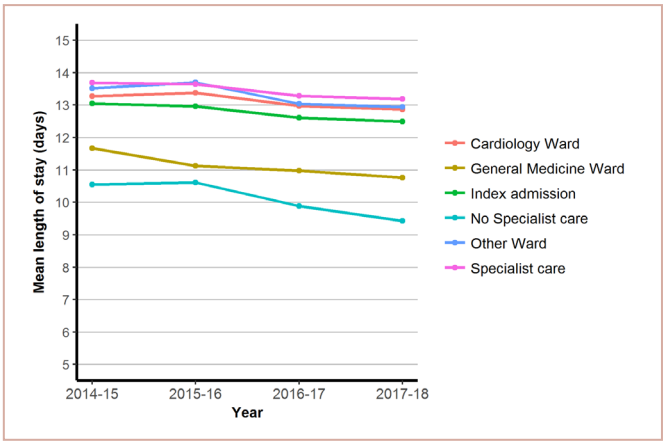


Figure 7b: *Inter-hospital variation in percentage of HF patients seen by a specialist (2017/18)*



(Note: Hospitals to the right of the red line are **not** *achieving target of 80% of heart failure patients seen by a specialist. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded).*

Figure 8: *Trend of mean length of stay based on place of care and specialist input (2014/15-2017/18)*



4.5 TRENDS IN LENGTH OF STAY (LOS)

The median length of stay (LOS) in 2017/18 was 9 days for those admitted to Cardiology wards and 6 days for those in General Medicine, unchanged compared to the 2016/17 data. Those receiving specialist care also have a higher median LOS at 9 days compared to 5 days for patients not seeing specialists.

LOS has remained static for patients in cardiology wards and those seeing specialists, but is becoming shorter for those in general medical wards and those not being reviewed by specialists. The longer length of stay for patients receiving specialist care will include referral of more severe cases for expert care, higher rates of implementation of disease modifying therapies and greater care to ensure that the patient is stable prior to discharge (Figure 8).

5. TREATMENT

Prescription of ACEIs, beta blockers and MRAs are key performance indicators for patients with HFrEF. This year, high aggregate standards were again achieved with 84% being discharged on an ACEI or angiotensin receptor blocker (ARB). Further improvements were seen compared to 2016/17 with 89% discharged on a beta blocker and 53% on an MRA. However, arguably a more relevant and challenging target is the number discharged on all three medicines which has increased to 47% (Table 4), from 42% last year. Prescription of diuretics and digoxin has remained static.

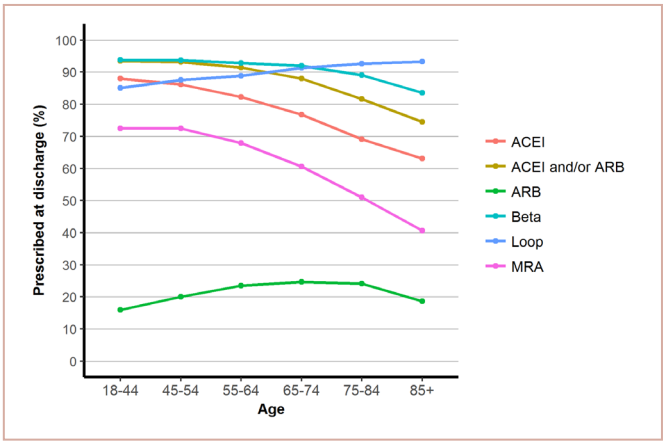
5.1 TREATMENT AT DISCHARGE FOR HFrEF

Table 4: *Treatment on discharge for HFrEF in 2017/18*

Medication	Total prescribed (%)
ACE inhibitor	73
ARB	22
ACEI or ARB	84
Beta blocker	89
MRA	53
ACEI or ARB, beta blocker and MRA	47
Loop diuretic	92
Thiazide diuretic	5
Digoxin	22

The differential prescribing of disease modifying treatment with an ACEI/ARB, BB and MRA with age was also seen again this year (Figure 9). The inflexion point for reduction in these medicines is in the 55-64 age group. The problem is greatest for MRA use. This is an area for targeting better practice in the next few years.

Figure 9: *Treatment on discharge for HFrEF by age in 2017/18*



Angiotensin Converting Enzyme Inhibitor (ACEI); Angiotensin Receptor Blocker (ARB); Mineralocorticoid (aldosterone) Receptor Antagonist (MRA)

5.2 TRENDS IN PRESCRIBING FOR HFrEF

The trends in prescribing of the three key medicines over the last 4 years is either maintained or improving; in particular the prescription of beta blockers has improved markedly with 89% of patients with HFrEF now being discharged on these. MRAs are now prescribed to >50% of patients (see Figure 10a). Some would argue that this could be higher; however, prescription rates of MRAs and the other key medicines are compatible with contemporary clinical trial data and are superior to other registries. However, the data presented in this audit are for patients eligible for these therapies (i.e. those with contraindications are excluded from this statistic). One could therefore argue that the rates of prescriptions for all three medicines should be approaching 100%.

We have set benchmarks for prescription of ACEI/ARB and BB at ≥90% and at 60% for MRAs. The inter-hospital variation in percentage prescription of these medicines demonstrates that many hospitals fall far short of this (Figures 10 b, c, d and e). In particular, prescribing rates for the combination of all three medicines needs to improve in the in-patient setting (NICE AHF Guidelines 2014).

Figure 10a: *Trends in prescription of disease modifying therapies for HFrEF (2014/15 – 2017/18)*

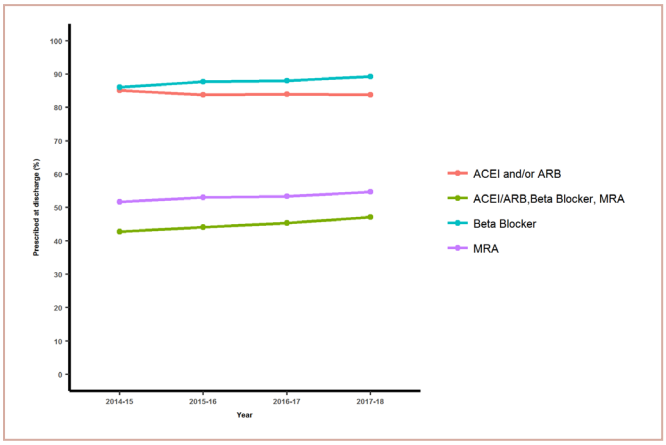
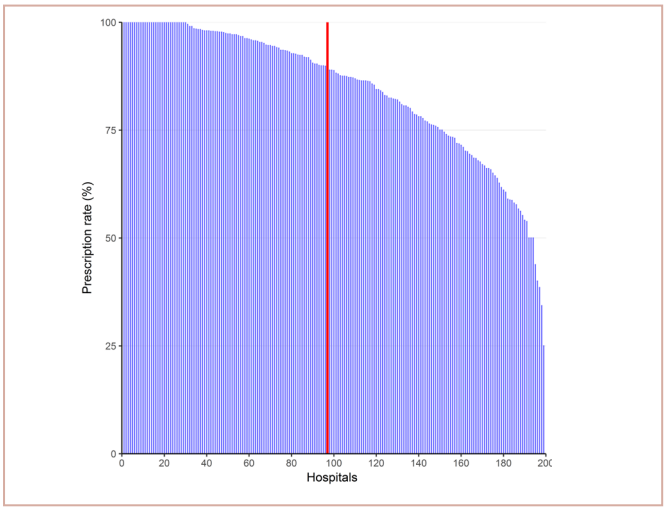


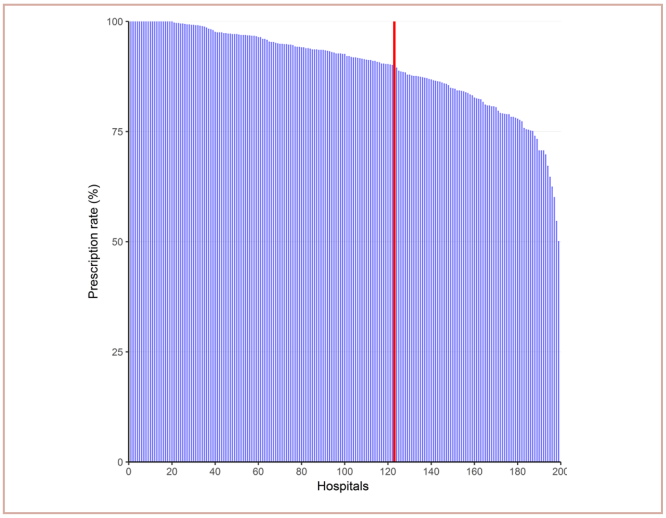
Figure 10b: *Proportion of patients with HFrEF receiving ACEI/ARB per Hospital (2017/18)*



The red line shows those achieving 90% or greater. 97 (49%) of hospitals achieved this.

*(**Note**: Hospitals to the right of the red line are **not** achieving the target of 90% of eligible HFrEF patients receiving an ACEI/ARB. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded.)*

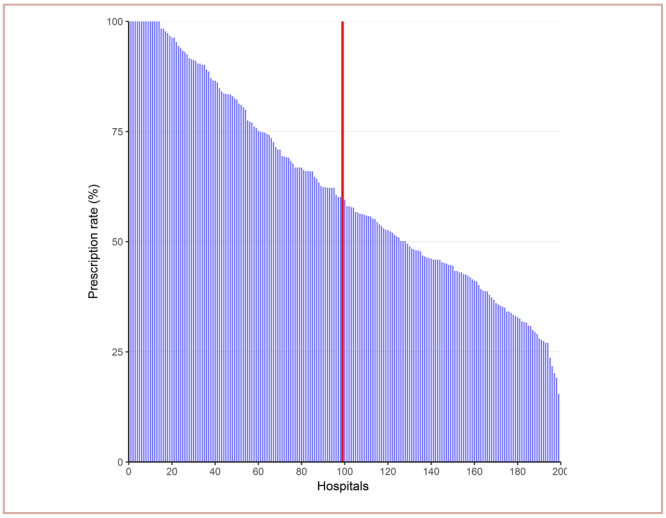
Figure 10c: *Proportion of patients with HFrEF receiving a beta blocker per Hospital (2017/18)*



The red line shows those achieving 90% or greater. 123 (62%) of hospitals achieved this.

*(**Note**: Hospitals to the right of the red line are **not** achieving the target of 90% of eligible HFrEF patients receiving a beta blocker. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded.)*

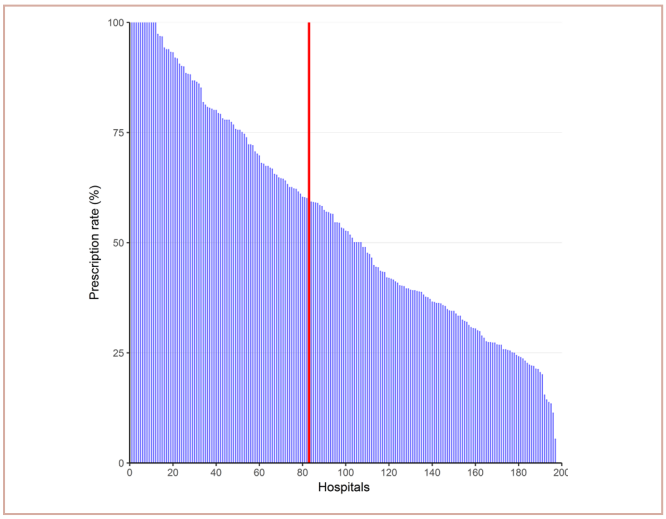
Figure 10d: *Proportion of patients with HFrEF receiving an MRA per Hospital (2017/18)*



The red line shows those achieving 60% or greater. 99 (50%) of hospitals achieved this.

*(**Note**: Hospitals to the right of the red line are **not** achieving the target of 60% of eligible HFrEF patients receiving an MRA. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded.)*

Figure 10e: *Proportion of Patients with HFrEF receiving all 3 medicines per Hospital (2017/18)*



The red line shows those achieving 60% or greater. 83 (42%) of hospitals achieved this.

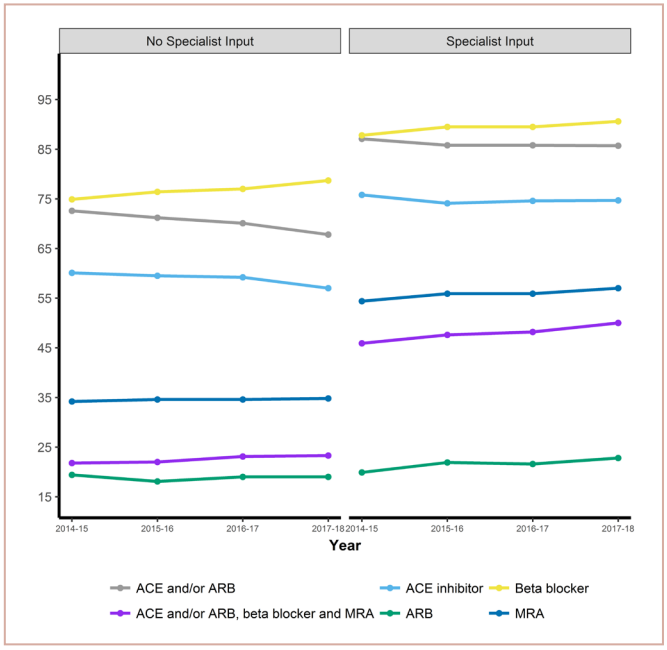
(**Note**: *Hospitals to the right of the red line are* **not** *achieving the target of 60% of eligible HFrEF patients receiving all 3 disease-modifying medicines. Data from 199 hospitals, 4 hospitals reporting <20 cases are excluded.)*

5.3 TRENDS IN TREATMENT BY PLACE OF CARE AND SPECIALIST INPUT

The rate of prescription of all three disease-modifying medicines in combination has increased from 48% to 57% over the last three years on cardiology wards. It has also gone up, but more modestly to 35% on general medical wards (Figure 11). For those seen by a specialist, there was an increase from 47% to 50% for being on all 3 medicines, compared to an increase from 22% to 23% of those not seen by a specialist, in the last year, irrespective of their ward allocation. Thus, outreach services to other wards can improve care.

The trend seen over the last four years is for an increase in the prescription of BB, MRA and their combination in patients who have specialist input. Prescription rates for those who lack specialist input are largely static or falling.

Figure 11: *Trend of treatment of HFrEF on discharge by place of care and specialist input (2014/15-2017/18)*



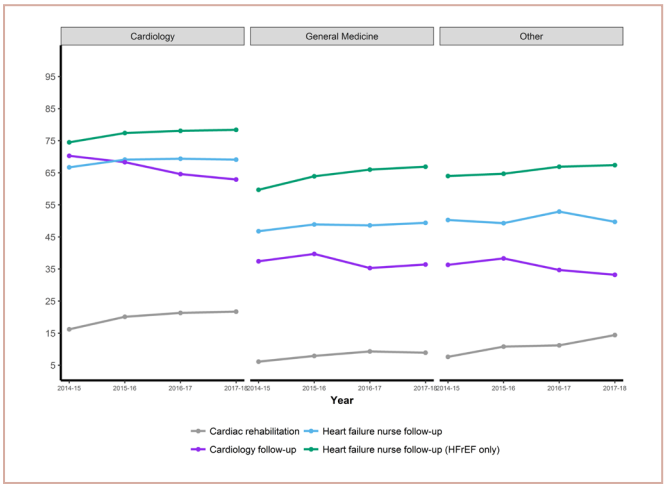
6. DISCHARGE AND FOLLOW-UP

People admitted to hospital because of HF should be discharged only when stable and should receive a clinical assessment from a member of a multidisciplinary HF team within 2 weeks of discharge. However, in 2017/18 only 37% of patients are recorded as having this FU appointment in place at discharge.

Overall 47% of those discharged have cardiology follow-up, and 58% have HF specialist nurse appointments post discharge (Figure 12). These rates are higher for those being admitted to cardiology wards at 63% and 69% respectively. Trends for both cardiology and HF nurse follow-up are static (Figure 14). This is a key area for future improvement as such follow-up has been demonstrated repeatedly by this audit to be associated with improved outcomes.

Overall 15.2% of patients are referred for cardiac rehabilitation during hospitalization. Rates are higher for those cared for in cardiology wards (22%) compared to 9% for those seen on general medical wards. Many more are said to have been referred after discharge by community teams; however, the audit does not capture this. The variation is enormous between hospitals (0% to 100%) and requires further investigation regarding referral practice, barriers to HF patients in rehab programmes, age, frailty and comorbidity. In addition, in this and previous audit cycles, there was no facility to record those declining the offer of rehabilitation. The revised dataset for 2020/21 addresses this.

Figure 12: *Trends in multidisciplinary HF team follow-up post discharge (2014/15 – 2017/18)*



6.1 IN-HOSPITAL MORTALITY

In-hospital mortality this year was 10.1%. Mortality varies with age, being 5.7% for those <75yrs and 12% for those ≥75yrs. As in previous years outcomes are better for patients admitted to cardiology (7.1%) compared to general medical (10.7%) wards and for those accessing specialist care (8.6%) compared to those who do not (14.6%) as in Figure 13.

Figure 13: *In-hospital mortality (2017/18)*

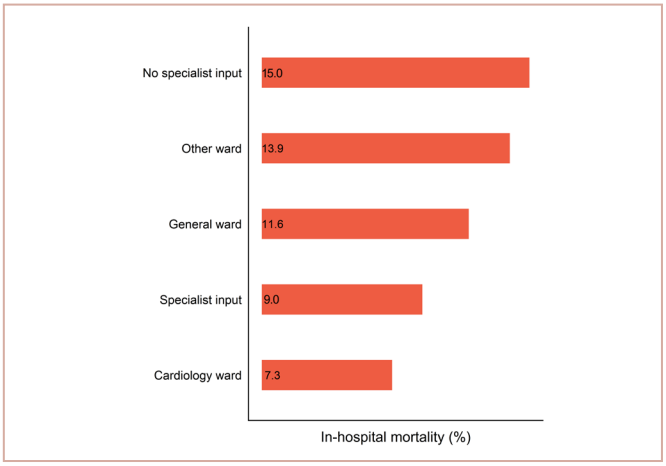
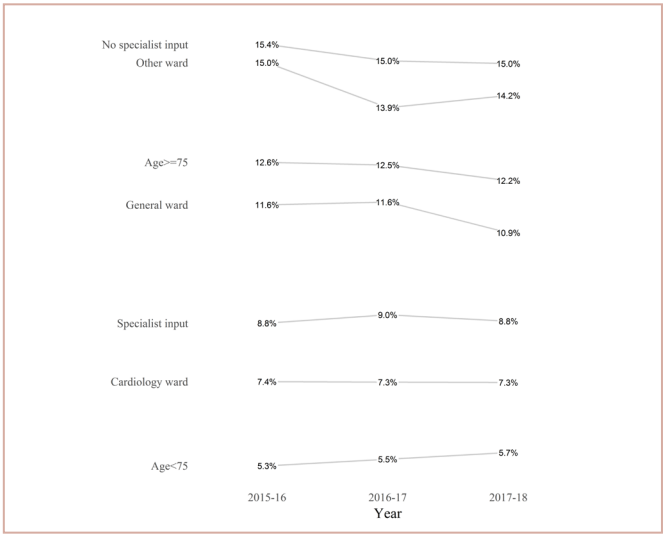


Figure 14: *Trends for in-hospital mortality by specialist care, age and ward allocation (2015/16 – 2017/18)*



There is great variation between hospital survival/mortality rates. This may be due to differences in patient characteristics and variations in care. A risk adjustment model has been derived

using data from the audit from its inception, to date. This will be validated in this year's audit data. Once the risk adjustment model is robust, funnel plot analyses will be carried out to detect outliers for mortality.

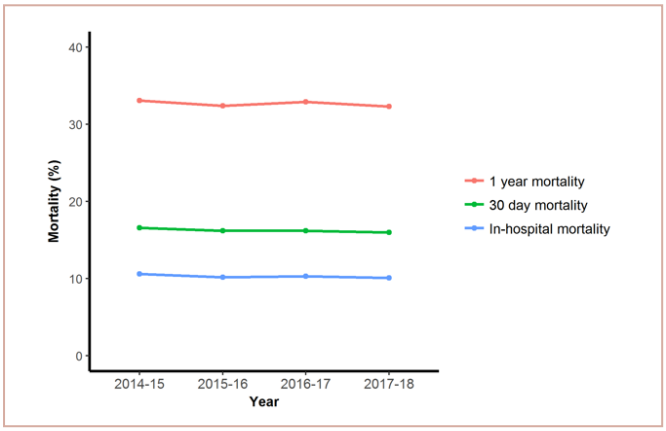
6.2 TRENDS IN MORTALITY

In-patient, 30-day and 1-year mortality rates have been fairly unchanged over the last 4 years (Figure 15). Applying the new data quality filters to the last four years' data shows that in-hospital mortality is static. Clearly the aim is to drive improvements in this in the years to come.

The audit is now large, comprehensive and representative of all patients admitted with HF, dominated by an elderly, co-morbid population, including those with HFpEF as well as HFrEF, who have a high inpatient mortality. As we have had no new treatments for acute heart failure for over 20 years and no disease modifying treatments for HFpEF, it could be argued that this is not surprising. However, the variation in in-patient mortality by place of care and specialist input might suggest otherwise and underscores the need to improve comprehensive, state of the art multidisciplinary heart failure care in all wards and hospitals as it is associated with better outcomes.

In addition, the quality of in-patient care is also associated with improved longer-term mortality. Hence in the future the audit will be focusing on one-year mortality, particularly for those discharged with HFrEF as a quality improvement target.

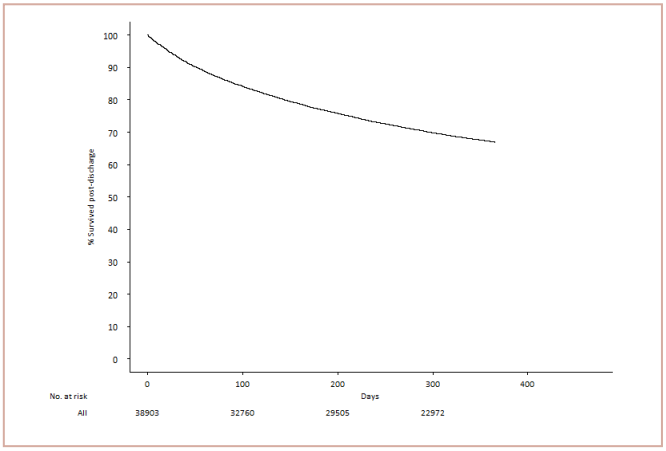
Figure 15: *Trends for in-hospital mortality, 30-day and 1-year mortality from admission (2014/15-2017/18)*



In multivariable analyses adjusted for age, not being admitted to a cardiology ward (HR 1.58, p<0.001) continues to be an independent predictor of worse survival when other common markers of disease severity are included in the model (see Cox Proportional Hazards Table in Appendix A for in-hospital mortality and Appendix B for 30-day mortality).

6.3 POST DISCHARGE MORTALITY

Figure 16: *Kaplan Meier plot of all-cause mortality following discharge from hospital (2017/18)*



Amongst patients surviving to discharge, the one year mortality rate was 32% (Figure 16). As in previous years, mortality at 1 year was lower for patients admitted to cardiology wards at 27% (Figure 17). Similarly mortality at 1 year of follow-up was lower for those having cardiology follow-up at 24% (c.f. 39% without) (Figure 18) and for those seen by HF nurses -30% c.f. 36% for no nurse follow-up (Figure 19). Referral to cardiac rehabilitation is also associated with a better outcome at one year, 21% compared to 33% for those not referred for rehabilitation (Figure 20). This presumably reflects a selection bias for those being offered rehabilitation.

Figure 17: *Kaplan Meier plot of all-cause mortality following discharge from hospital according to place of care during the admission (2017/18)*

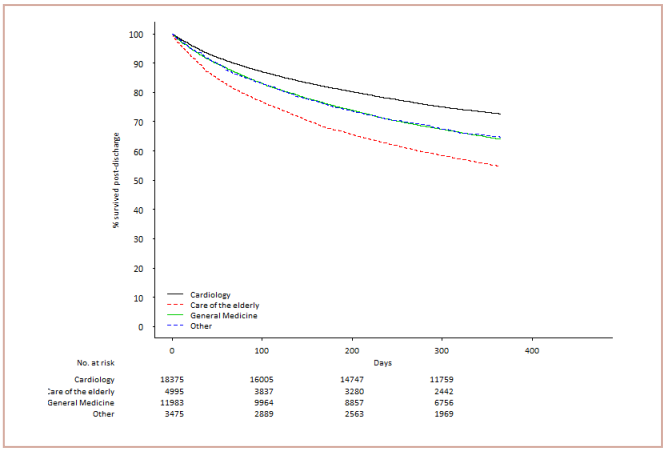


Figure 18: *1-year mortality according to cardiology follow-up (2017/18)*

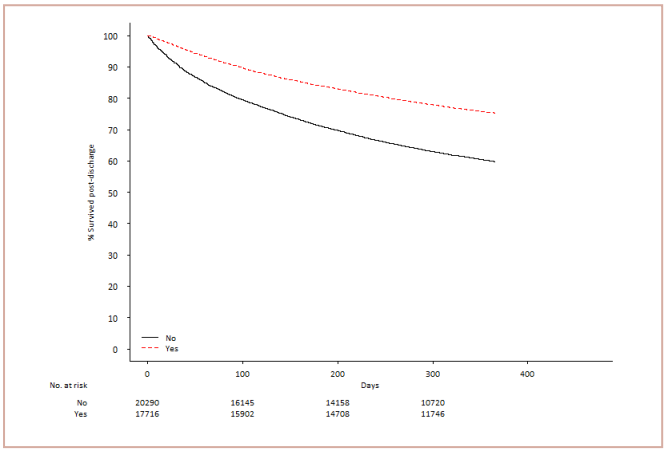


Figure 19: *1-year mortality according to HF nurse follow-up (2017/18)*

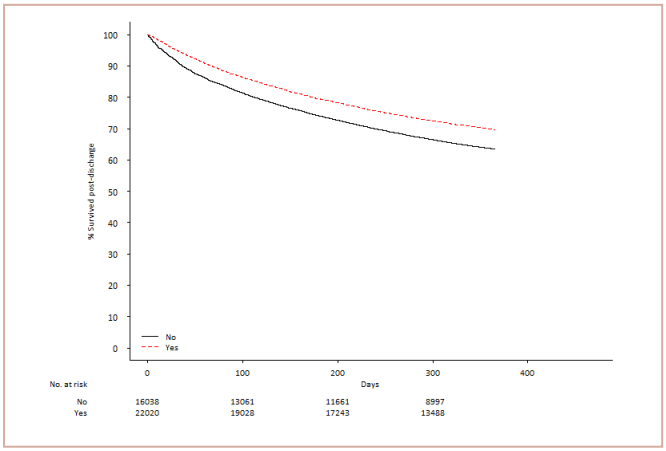
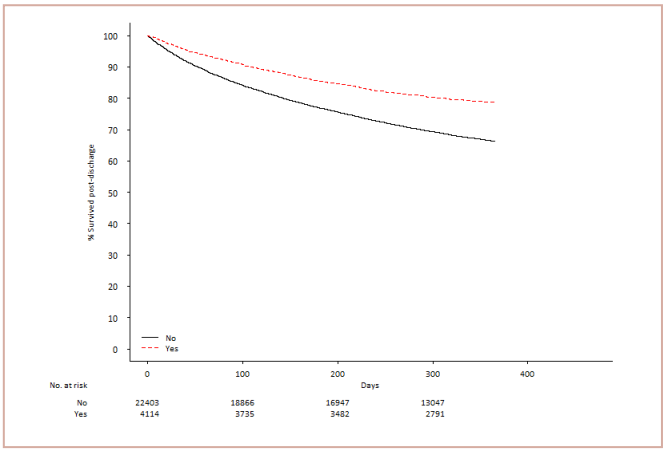
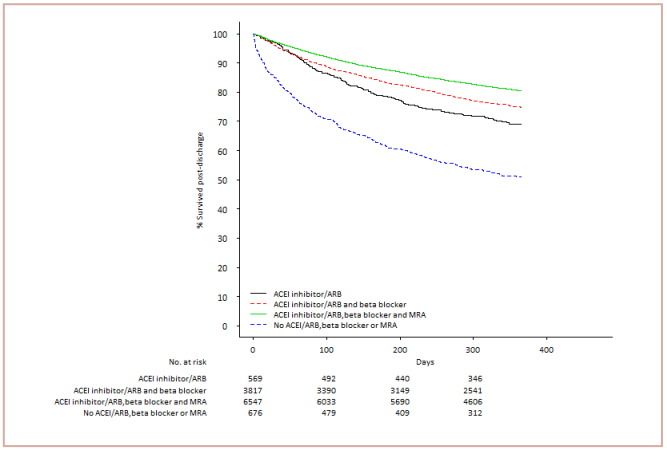


Figure 20: *1-Year mortality stratified by referral to cardiac rehabilitation (2017/18)*



Mortality post-discharge is highly dependent upon the prescribing of each of three disease modifying medicines, with the greatest cumulative benefit seen in those who leave hospital on all three key modifying medicines (Figure 21).

Figure 21: *Mortality post-discharge associated with prescribing for patients with HFrEF (2017/18)*



Those discharged on all three disease-modifying medicines had a 1-year mortality rate of 19% compared to 48% for those leaving hospital without any of the three key medicines.

The Cox Proportional Hazards Model for 1-year mortality is shown in Appendix C. Not being a cardiology in-patient, not having cardiology follow-up and not being on an ACEI/ARB or a beta blocker are all independent predictors of worse 1-year mortality.

7. RESULTS RELATING TO KPIs

In summary regarding the KPIs in this audit cycle:

- Application of the gold standard diagnostic test, echocardiography, remains acceptable overall but the inter-hospital and ward-base variation needs improvement.
- Prescribing rates of key disease modifying medicines for those with HFrEF have continued to increase. However less than 50% of eligible HFrEF patients go home on all three medicines. Again, there is marked variation by place of care and hospital.
- The proportion of patients admitted to cardiology wards is static at <50% and leaves scope for improvement in many hospitals.
- The proportion of patients who have input from a HF specialist has increased to >80% and more patients have HF specialist nurse input.
- Inpatient mortality remains unchanged, but is lower for those admitted to cardiology wards and for those who access specialist care.
- 1-year mortality is significantly lower for those having cardiology follow-up, HF nurse input, and cardiac rehabilitation.
- 1-year mortality rates for HFrEF are substantially lower for those discharged on all three disease modifying medicines.

8. FUTURE DIRECTIONS FOR QUALITY IMPROVEMENT

We will continue to use the audit data to highlight the importance of cardiology care and access to specialist care to drive down in-patient mortality rates.

In future years there will be increasing identification of those units that are not meeting the KPIs and the subsequent impact on outcome using risk adjusted statistics. This should improve both inpatient quality of care and mortality alongside the outcomes at 1 year and specifically mortality for patients with HFrEF, where there is strong evidence that leaving hospital on disease-modifying medicines improves outcomes. Addressing the huge variation between hospitals in medicine prescribing at discharge is a priority, alongside early specialist follow-up.

The poor uptake of cardiac rehabilitation will also be a key KPI in future cycles.

As we have now excluded patients being admitted for less than 24 hours (to ambulatory care units/other non-admission beds) within hospitals from the QI part of this audit (as they do not stay long enough for optimising care or having specialist assessment, but are coded in HES), we will continue to track their 1-year mortality to ascertain whether this practice is safe in the longer term.

9. APPENDICES

Appendix A: *Random effects Cox proportional hazards model for death in hospital 2017/18*

In-hospital mortality					N=21036
	Hazard Ratio	Lower	Upper	p	
Age>=75	1.87	1.62	2.17	<0.001	
NYHA III/IV	1.05	0.91	1.21	0.53	
Systolic Blood Pressure (10 mHg decrease)	1.2	1.16	1.24	<0.001	
COPD	1.12	0.98	1.27	0.089	
Ischaemic Heart Disease	1.12	1	1.24	0.045	
Valve Disease	1.03	0.92	1.16	0.64	
Urea (5mEq/dL increase)	1.14	1.12	1.17	<0.001	
Sodium electrolytes (5mEq/dL increase)	1.12	1.06	1.17	<0.001	
Haemoglobin (g/dL increase)	1.01	0.99	1.04	0.31	
Creatinine (10 umol/L increase)	1.02	1.01	1.03	<0.001	
Potassium <3.5 (mEq/L)	1.48	1.25	1.75	<0.001	
Potassium 3.5-4.5 (mEq/L)	1				
Potassium >4.5-5.5 (mEq/L)	1.67	1.48	1.89	<0.001	
Potassium >5.5 (mEq/L)	3.35	2.76	4.07	<0.001	
Not cardiology inpatient	1.58	1.4	1.78	<0.001	
Female	1.1	0.81	1.02	0.1	
Heart rate (5 bpm increase)	1.16	1.14	1.18	<0.001	

Appendix B: *Random effects Cox proportional hazards model for 30-day post discharge mortality 2017/18*

30 day post discharge mortality					N=13926
	Hazard Ratio	Lower	Upper	p	
Age≥75	1.32	1.09	1.61	0.005	
NYHA III/IV	1.19	0.94	1.49	0.14	
No ACE inhibitor and/or ARB	2.13	1.79	2.53	<0.001	
No cardiology follow-up	2.01	1.66	2.43	<0.001	
Systolic blood pressure (10 mm Hg decrease)	1.13	1.08	1.18	<0.001	
Ischaemic Heart Disease	1.22	1.04	1.43	0.015	
Urea (5mEq/dL increase)	1.09	1.05	1.13	<0.001	
Sodium electrolytes (5mEq/dL decrease)	1.29	1.19	1.4	<0.001	
Haemoglobin (g/dLdecrease)	1.05	1	1.09	0.04	
Creatinine (10 umol/L increase)	1.02	1.01	1.03	0.3	
Not cardiology inpatient	1.36	1.14	1.64	0.001	
COPD	1.25	1.04	1.5	0.02	
Male	1.07	0.91	1.26	0.4	
Length of stay 0- 4 days	1			0	
Length of stay 5-8 days	1.19	0.93	1.52	0.18	
Length of stay 9-15	1.46	1.15	1.86	0.002	
Length of stay ≥16 days	2.24	1.79	2.8	<0.001	

Appendix C: *Random effects Cox proportional hazards model for 1-year post discharge mortality 2017/18*

1-year post discharge mortality					N=12330
	Hazard Ratio	Lower	Upper	p	
Age>=75	1.61	1.48	1.76	<0.001	
NYHA III/IV	1.12	1.02	1.24	0.02	
No beta blocker	1.15	1.05	1.26	0.002	
No ACE inhibitor and/or ARB	1.44	1.33	1.57	<0.001	
No cardiology follow-up	1.53	1.42	1.66	<0.001	
Systolic blood pressure (10 mm Hg decrease	1.1	1.08	1.12	<0.001	
COPD	1.35	1.24	1.47	<0.001	
Ischaemic Heart Disease	1.21	1.13	1.3	<0.001	
Valve Disease	1.18	1.09	1.27	<0.001	
Urea (5mEq/dL increase)	1.08	1.06	1.1	<0.001	
Sodium electrolytes (5mEq/dL decrease)	1.12	1.08	1.16	<0.001	
Haemoglobin (g/dLdecrease)	1.06	1.04	1.08	<0.001	
Creatinine (10 umol/L increase)	1.02	1.01	1.02	<0.001	
Potassium <3.5 (mEq/L)	1.25	1.12	1.4	<0.001	
Potassium 3.5-4.5 (mEq/L)	1				
Potassium >4.5-5.5 (mEq/L)	0.97	0.89	1.05	0.44	
Potassium >5.5 (mEq/L)	1.21	0.92	1.59	0.18	
Not cardiology inpatient	1.3	1.2	1.41	<0.001	
Male	1.08	1	1.16	0.049	
Length of stay 0- 4 days	1			<0.001	
Length of stay 5-8 days	1.21	1.1	1.34	<0.001	
Length of stay 9-15	1.37	1.24	1.52	<0.001	
Length of stay >=16 days	1.85	1.68	2.04	<0.001	

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NATIONAL INSTITUTE FOR CARDIOVASCULAR OUTCOMES RESEARCH (NICOR)

NICOR is a partnership of clinicians, IT experts, statisticians, academics and managers which manages six cardiovascular clinical audits and a growing portfolio of new health technologies, including the TAVI registry. Hosted by Barts Health, NICOR collects, analyses and translates vital cardiovascular data into relevant and meaningful information to drive sustainable improvements in patients' well-being, safety and outcomes. It is commissioned by the Healthcare Quality Improvement Partnership (HQIP) with funding from NHS England and GIG Cymru /NHS Wales, and additional support from NHS Scotland. Funding is being sought to aid the participation of hospitals in Northern Ireland, the Republic of Ireland and the private sector.

BRITISH SOCIETY FOR HEART FAILURE (BSH)

The BSH is a national organisation of healthcare professionals which aims to improve care and outcomes for patients with heart failure by increasing knowledge and promoting research about its diagnosis, causes and management.

BARTS HEALTH NHS TRUST

With a turnover of £1.5 billion and a workforce of around 17,000, Barts Health is a leading healthcare provider in Britain and one of the largest NHS Trusts in the country. The Trust's five hospitals – St Bartholomew's Hospital in the City, including the Barts Heart Centre, The Royal London Hospital in Whitechapel, Newham University Hospital in Plaistow, Whipps Cross University Hospital in Leytonstone and Mile End Hospital – deliver high quality compassionate care to the 2.5 million people of east London and beyond.

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HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that Clinical Audit, outcome review programmes and registries have on healthcare quality in England and Wales. HQIP holds the contract to commission, manage and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies. https://www.hqip.org.uk/national-programmes

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