

Health service use by patients with heart failure living in a community setting:

a cross-sectional analysis in North West London

Abstract

Background

The complex nature of heart failure (HF) management, often involving multidimensional care, is widely recognised, but overall health service utilisation by patients with HF has not previously been described.

Aim

To describe overall health service use by adults with HF living in a community setting.

Design and setting

Cross-sectional analysis of prevalent HF cases from January 2015 to December 2018 using an administrative dataset covering primary and secondary care, and 'other' (community, mental health, social care) services in North West London.

Method

Healthcare use of each service was described overall and by individual components of secondary care (such as, outpatient appointments), and 'other' services (such as, nursing contacts). Usage patterns were identified using k-means cluster analysis, using all distinct contacts for the whole study period, and visualised with a heatmap.

Results

A total of 39 301 patients with a prevalent diagnosis of HF between 1 January 2015 and 31 December 2018 were found. Of those, approximately 90% used health services during the study period, most commonly outpatient services, GP consultations, unplanned accident and emergency visits, and community services. Use of cardiology-specific services ranged from around 3% (cardiology-related community care) to around 20% (outpatient cardiology visits). GP consultations decreased by 11% over the study period. Five clusters of patients were identified, each with statistically significantly different care usage patterns and patient characteristics.

Conclusion

Patients with HF make heavy but heterogeneous use of services. Relatively low and falling use of GP consultations, and the apparently low uptake of community rehabilitation services by patients with HF, are concerning and suggest challenges in primary care access and integration of care.

Keywords

Heart failure; primary care; secondary care; outpatient services; cluster analysis; London.

INTRODUCTION

Heart failure (HF) affects >900 000 people in the UK¹ and results in significant morbidity and mortality, frequent hospitalisations, and reduced quality of life. Patients with HF are usually older with comorbidities, and may have complex and highly heterogeneous medical and social needs.¹ A multidisciplinary team (MDT) approach is considered the gold standard model for HF management² and is recommended for high-risk patients in the Health and Social Care Act of 2012,³ and other national⁴⁻⁶ and international guidelines.^{7,8} Despite this, there is currently little understanding of the nature of HF care beyond the hospital setting in the UK. Therefore, this study aimed to describe overall health and social service use and care usage patterns by patients with HF in North West London (NWL).

METHOD

Data

Whole Systems Integrated Care (WSIC) data were used: a linked de-identified dataset of individual-level patient records of events from primary, secondary, community, mental health, and social care services in NWL, covering >2 million patients across 400 GP practices.^{9,10} It has some similarities with primary care-based research databases like Clinical Practice Research Datalink (CPRD) and The Health Improvement Network (THIN),^{11,12} but with

the addition of community, mental health, and social care service records.

Definitions

Patient characteristics. Sex, age, ethnicity, deprivation level, comorbidities, care status, blood pressure, body mass index (BMI), and smoking and alcohol drinking statuses were defined using primary care data at the start of each 1-year period, looking back 5 years to retrieve data. Socioeconomic status was based on the 2015 Index of Multiple Deprivation (IMD)¹³ and divided into quintiles (1 = most deprived; 5 = least deprived). Comorbidities were defined as per the Charlson Index in Khan *et al*,¹⁴ with some extra ones defined by the authors (see Supplementary Table S1 for details).

Health service use. Health service use was described for each cohort using data for that 1-year period. Primary care use was defined as having a consultation with a GP. Secondary care use included emergency admissions, elective admissions, unplanned accident and emergency (A&E) visits, and outpatient visits. Use of 'other' health services (community, mental health, and social care services) were described overall and by individual components. Variables in these 'other' health service tables were often not in coded form, so contacts were first indexed with keywords (Box 1) arrived at iteratively by manually searching for the most common terms in each table.

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Submitted: 29 September 2019; **Editor's response:** 18 November 2019; **final acceptance:** 16 January 2020.

©British Journal of General Practice

This is the full-length article (published online 16 Jun 2020) of an abridged version published in print. Cite this version as: **Br J Gen Pract 2020**; DOI: <https://doi.org/10.3399/bjgp20X711749>

How this fits in

Heart failure (HF) prevalence is increasing and requires multidisciplinary management, including within primary care. Using a linked database for North West London's 2.2 million population, this study found that in 39 301 patients with HF, only 60% had seen their GP and 20% had been referred for cardiac rehabilitation during the study period, while overall use of unscheduled care by patients with HF was high, with >40% using accident and emergency services. Findings from cluster analysis, highlighting groups of patients with HF that are particularly high and low users of elements of care, may facilitate active case finding and provision of more supportive and preventative care to improve outcomes for these patients.

Cluster analysis

The authors sought to discover patterns of healthcare utilisation via k-means cluster analysis.¹⁵ Nine healthcare utilisation count variables, reflecting total usage from 2014 to 2018, were used to define clusters: emergency admissions; elective admissions; unplanned A&E visits not ending in admission; outpatient visits (cardiology); outpatient visits (other); GP consultations; and community, mental health, and social care contacts. Only distinct contacts and attended outpatient visits were included, and extreme high users (in the top 0.1% for any of these variables) were excluded.

Data were log-transformed and normalised (min-max method) before analysis to give higher weighting to lower values and equal weighting to all variables, respectively. K-means required the number of clusters ($k = 5$) to be pre-specified (see Supplementary Box S1 for details).

Statistical analysis

Patient characteristics and prevalence of health service use were summarised for the four yearly cohorts and clusters separately. Usage patterns for each cluster were visualised using a heatmap by comparing the cluster mean usage with the average population usage, taking the percentage difference between these two means.

Differences in healthcare utilisation variables and key patient characteristics across clusters were analysed using Kruskal-Wallis tests for continuous variables and Pearson χ^2 tests for categorical variables, with two-tailed testing and a significance level of 0.05. All analyses were conducted using R (version 3.4.0).

RESULTS

Patient characteristics

A total of 39 301 patients from 359 GP practices between 1 January 2015 and 31 December 2018 had an HF diagnosis recorded and met the inclusion criteria (see Supplementary Figure S1 for flowchart of study population), that is, approximately 10 new patients with HF per practice per year. The vast majority of patients were in each of the four yearly cohorts.

In 2018, most patients were female (56.2%, $n = 19\,463$), aged ≥ 65 years (58.1%, $n = 20\,129$), and were of white (31.1%, $n = 10\,793$), Asian (25.7%, $n = 8905$), or unknown (27.3%, $n = 9454$) ethnicity (Table 1). Almost two-thirds (63.8%, $n = 22\,092$) had multimorbidity, that is, had a comorbidity in addition to existing HF, and of these more than half had at least two additional comorbidities, most commonly diabetes (26.1%, $n = 9053$) or hypertension (36.1%, $n = 12\,507$).

A total of 6999 (17.8%) people died and 110 (0.3%) opted out of the WSIC dataset.

Most patient characteristics remained constant during the study period except for an increase in proportion of the underweight (60% increase) and the oldest age group (40% increase), and a nearly 20% reduction in the prevalence of hypertension (Table 1).

Health service use

Approximately 90% of patients used health services during the study period (data not shown). In 2018, the most commonly used healthcare services were outpatients (70.1%, $n = 24\,283$), GP consultations (59.9%, $n = 20\,741$), unplanned A&E (40.8%, $n = 14\,145$), community (39.7%, $n = 13\,762$), emergency admissions (26.7%, $n = 9257$) and outpatient cardiology (23.8%, $n = 8231$) services (Table 2). Community care was the most common 'other' service used, of which the most frequent components were nursing (23.2%, $n = 8052$), podiatry (15.6%, $n = 5397$), and rehabilitation-related services (8.3%, $n = 2861$). Few (2.9%, $n = 1005$) used community care related to cardiology even though >1 in 5 had a GP record of referral to cardiac rehabilitation. In total, 6.3% ($n = 2178$) had a referral for echocardiogram, of which over half had abnormal results (51.1%, $n = 1113$). Both social care and mental health service use were less common (3.9% and 4.5%, respectively). When used, mental health contacts were commonly community-related (4.3%, $n = 1489$), suggesting a community integrated approach; social care contacts were personal care (3.1%, $n = 1057$), community (0.7%, $n = 232$),

Box 1. Key terms used to index individual components in ‘other’ services to describe the types of services used by patients with HF in respective settings

Service and component	Index terms
Community	
Nursing	<i>nursing</i>
Rehabilitation	<i>rehab^a</i>
Urgent	<i>rapid, acute, urgent, emergency, A&E, unplanned, admit^a, hospital adm^a, inpatient, ambulance</i>
Intermediate	<i>intermediate, CIS</i>
Cardiology	<i>heart, cardi^a, stroke</i>
Diabetes	<i>diabet^a, endocri^a</i>
Physio- or occupational therapy	<i>occupation^a, physio^a</i>
Podiatry	<i>foot, pod^a</i>
Respiratory	<i>pulmon^a, respir^a, COPD, TB, tubercul^a, thorac^a</i>
Neurology	<i>musculo^a, MSK, neuro^a, parkinson^a</i>
Urinary	<i>genito^a, bladder, bowel, continenc^a, urinary</i>
Speech language therapy	<i>SLT, speech, language</i>
Falls	<i>falls</i>
Diet and nutrition	<i>diet, nutrition^a</i>
Memory and cognition	<i>memory, cognition</i>
Home	<i>home</i>
Phone	<i>phone</i>
Unknown	(none of the above key terms)
Mental health	
Outpatient	<i>outpatient, day case</i>
Community	<i>community</i>
Urgent	<i>rapid, acute, urgent, emergency, A&E, unplanned</i>
Specialist	<i>special^a, nurs^a, ^aist</i>
Dementia	<i>dementi^a, memory, cogni^a</i>
Learning disability	<i>learning</i>
Eating disorder	<i>eating, anorexi^a</i>
Psychiatric	<i>psy^a</i>
Review	<i>review^a</i>
Consultation	<i>consult^a</i>
Treatment	<i>treat^a</i>
Assessment	<i>assess^a</i>
Unknown	(none of the above key terms)
Social care	
Nursing	<i>nursing</i>
Rehabilitation	<i>rehab^a</i>
Urgent	<i>rapid, acute, urgent, emergency, A&E, unplanned</i>
Personal care	<i>personal care, home care, day care, bathing, extra care, reable^a, care service</i>
Food	<i>food, meal</i>
Domestic	<i>domiciliary, domestic, housework, laundry, shopping, cleaning, washing</i>
Transport	<i>transfer, transport, migration, trip, mobil^a</i>
Disability	<i>dis^a, disabilit^a, disable^a</i>
Occupational therapy	<i>occupational therapy</i>
Memory and cognition	<i>dementia, memory, cognition</i>
Assisted equipment technology	<i>assistive tech^a, assisted equipment, equipment, technology</i>
Nursing home	<i>nursing home, residential home, residential care, care home</i>
Mental health	<i>mental, CMHT</i>
Community	<i>community</i>
Social	<i>social</i>
Carer	<i>carer</i>
Housing and living	<i>housing, living</i>
Unknown	(none of the above key terms) ^a

^aSuperscript used as a wildcard character during key term search. When used, search returns results containing text preceding ^a. A&E = accident and emergency. CIS = community independence service. CMHT = community mental health team. COPD = chronic obstructive pulmonary disease. HF = heart failure. MSK = musculoskeletal. SLT = speech language therapy. TB = tuberculosis.

domestic [0.7%, *n* = 253], and disability-related [0.7%, *n* = 248] (Table 2).

In 2018, only 3067 (8.9%) patients did not use any services, while around one-quarter used >3 different types (24.8%, *n* = 8607). Services were most commonly used in combination with secondary care and least commonly with ‘other’ health services (Table 2 and Figure 1). Few patients used only primary care and ‘other’ services (2.3%, *n* = 781) or ‘other’ services alone (2.0%, *n* = 682).

Over the study period, health service use increased for all elements of secondary care analysed, particularly elective admissions (37% increase) and outpatient visits (24% increase), but decreased for primary care (11% decrease). Though many components of the community contacts remained constant, there were more than double contacts related to diet and nutrition (Table 2).

Cluster analysis

Altogether 318 patients were excluded from the k-means cluster analysis due to extremely high usage. Of the four and five-cluster solutions identified via preliminary analysis (see Supplementary Box S1), the five-cluster solution was chosen as the extra cluster had distinct usage patterns (Figure 2). Additionally, all patient characteristics differed significantly across clusters (see Supplementary Table S2 and Supplementary Figure S2). Patients who were younger, female, with less comorbidity, and not living in care homes were generally low users of health care (clusters 1 and 2). Perhaps unsurprisingly, those with higher blood pressure and more comorbidities had relatively more GP consultations (cluster 2). Patients who were older, male, and had more comorbidities were generally higher users of health care (clusters 3, 4 and 5). The lowest users of GP appointments were very high users of all other services (cluster 3, Figure 2). Those with the most cardiovascular comorbidity (cluster 4) had the highest usage of cardiology-related outpatient services and referrals to echocardiography (42.0%) (Figure 2). The oldest patients with the highest mortality (cluster 5) were the highest users of emergency inpatient, A&E, and ‘other’ services (Figure 2).

DISCUSSION

Summary

Overall health service utilisation was high. Almost everyone in the present study population used some kind of health service during the study period: outpatients (7 in 10),

Table 1. Patient characteristics for each cohort

Characteristics	Year							
	2015		2016		2017		2018	
	n (N= 23 828)	%	n (N= 27 443)	%	n (N= 31 554)	%	n (N= 34 651)	%
Sex								
Female	13 178	55.3	15 246	55.6	17 506	55.5	19 463	56.2
Age group, years								
<45	3293	13.8	3958	14.4	4619	14.6	5227	15.1
45 to <65	6760	28.4	7661	27.9	8600	27.3	9295	26.8
65 to <75	5542	23.3	5957	21.7	6601	20.9	7007	20.2
75 to <85	6002	25.2	6952	25.3	7948	25.2	8470	24.4
>85	2231	9.4	2915	10.6	3786	12.0	4652	13.4
Deprivation level, IMD								
1 (most)	3166	13.3	3883	14.1	4656	14.8	5205	15.0
2	6568	27.6	7673	28.0	9001	28.5	9954	28.7
3	5869	24.6	6833	24.9	7875	25.0	8759	25.3
4	4089	17.2	4596	16.7	5197	16.5	5653	16.3
5 (least)	3430	14.4	3636	13.2	3866	12.3	3975	11.5
Unknown	706	3.0	822	3.0	959	3.0	1105	3.2
Ethnicity								
White	7712	32.4	8741	31.9	9963	31.6	10 793	31.1
Asian	6237	26.2	7147	26.0	8161	25.9	8905	25.7
Black	1721	7.2	1990	7.3	2245	7.1	2412	7.0
Mixed	1767	7.4	2162	7.9	2630	8.3	3087	8.9
Unknown	6391	26.8	7403	27.0	8555	27.1	9454	27.3
Care status								
Care home	619	2.6	682	2.5	732	2.3	686	2.0
Have carer	125	0.5	162	0.6	191	0.6	219	0.6
Status								
Died	1294	5.4	1543	5.6	1811	5.7	2351	6.8
Opted out	—	0.0	21	0.1	92	0.3	5	0.0
Smoking status								
Non	9612	40.3	11 455	41.7	13 395	42.5	14 955	43.2
Current	2290	9.6	2648	9.6	3174	10.1	3377	9.7
Former	7626	32.0	8390	30.6	9267	29.4	9685	28.0
Unknown	4300	18.0	4950	18.0	5718	18.1	6634	19.1
Drinking status								
Non	1607	6.7	1934	7.0	2079	6.6	2197	6.3
Current	382	1.6	439	1.6	485	1.5	578	1.7
Former	43	0.2	58	0.2	70	0.2	83	0.2
Unknown	21 796	91.5	25 012	91.1	28 920	91.7	31 793	91.8
BMI category								
Underweight	423	1.8	526	1.9	714	2.3	1000	2.9
Ideal	5210	21.9	6000	21.9	7032	22.3	7814	22.6
Overweight	6296	26.4	7089	25.8	7959	25.2	8503	24.5
Obese	6255	26.3	7213	26.3	8323	26.4	8891	25.7
Unknown	5644	23.7	6615	24.1	7526	23.9	8443	24.4
Systolic blood pressure, mm Hg								
<110	1109	4.7	1303	4.7	1535	4.9	1789	5.2
110–119	2386	10.0	2886	10.5	3497	11.1	3966	11.4
120–139	10 943	45.9	12 768	46.5	14 820	47.0	16 465	47.5
140–159	5925	24.9	6540	23.8	7270	23.0	7623	22.0
>159	510	2.1	570	2.1	627	2.0	609	1.8
Unknown	2955	12.4	3376	12.3	3805	12.1	4199	12.1

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primary care (6 in 10 saw a GP), community services, especially nursing (2 in 10), and unplanned A&E visits (4 in 10). Community care use related to cardiology was low. Few patients used only primary care and 'other'

services, which may reflect modest needs or a lack of community and primary care provision suitable for complex needs.

Patterns of health service utilisation depended on age and comorbidity but were

Table 1 Continued. Patient characteristics for each cohort

Characteristics	Year							
	2015		2016		2017		2018	
	n(N= 23 828)	%	n(N= 27 443)	%	n(N= 31 554)	%	n(N= 34 651)	%
Diastolic blood pressure, mm Hg								
<80	13 969	58.6	16 434	59.9	19 215	60.9	21 261	61.4
80 to 89	5586	23.4	6195	22.6	6959	22.1	7536	21.7
90 to 99	962	4.0	1053	3.8	1159	3.7	1219	3.5
>99	134	0.6	148	0.5	166	0.5	179	0.5
Unknown	3177	13.3	3613	13.2	4055	12.9	4456	12.9
Comorbidities								
Acute myocardial infarction	1006	4.2	1123	4.1	1309	4.1	1398	4.0
Atrial fibrillation	2700	11.3	3362	12.3	4018	12.7	4549	13.1
Chronic pulmonary disease	3346	14.0	3928	14.3	4623	14.7	5084	14.7
Congenital heart disease	73	0.3	91	0.3	122	0.4	135	0.4
Coronary heart disease	1516	6.4	1658	6.0	1856	5.9	1965	5.7
Diabetes	6116	25.7	7102	25.9	8208	26.0	9053	26.1
Hypertension	10 474	44.0	11 352	41.4	12 241	38.8	12 507	36.1
Myocardial infarction	1034	4.3	1146	4.2	1331	4.2	1444	4.2
Myocarditis	614	2.6	697	2.5	797	2.5	868	2.5
Other arrhythmias	2181	9.2	2680	9.8	3266	10.4	3782	10.9
Peripheral vascular disease	563	2.4	634	2.3	681	2.2	771	2.2
Renal diseases	1048	4.4	1129	4.1	1301	4.1	1400	4.0
Stroke	667	2.8	762	2.8	933	3.0	1052	3.0
Comorbidities, n								
0	7793	32.7	9329	34.0	11 073	35.1	12 559	36.2
1	7155	30.0	7978	29.1	8950	28.4	9667	27.9
2	4976	20.9	5640	20.6	6264	19.9	6659	19.2
3	2291	9.6	2632	9.6	3082	9.8	3363	9.7
≥4	1613	6.8	1864	6.8	2185	6.9	2403	6.9

BMI = body mass index. IMD = Index of Multiple Deprivation.

highly heterogeneous. Younger patients with fewer comorbidities (clusters 1 and 2) had the lowest usage, which may partly indicate underutilisation and/or lack of access. For instance, those with infrequent GP consultations (clusters 1 and 3) were also more likely to be of mixed ethnicity and living in areas of higher deprivation

and demographics known to be associated with poorer primary care access.^{17,18} These patients also showed the highest levels of unknown values for patient variables (derived from GP data) and lower than average GP consultation rates, which could reflect both poor health management and low engagement of patients in their

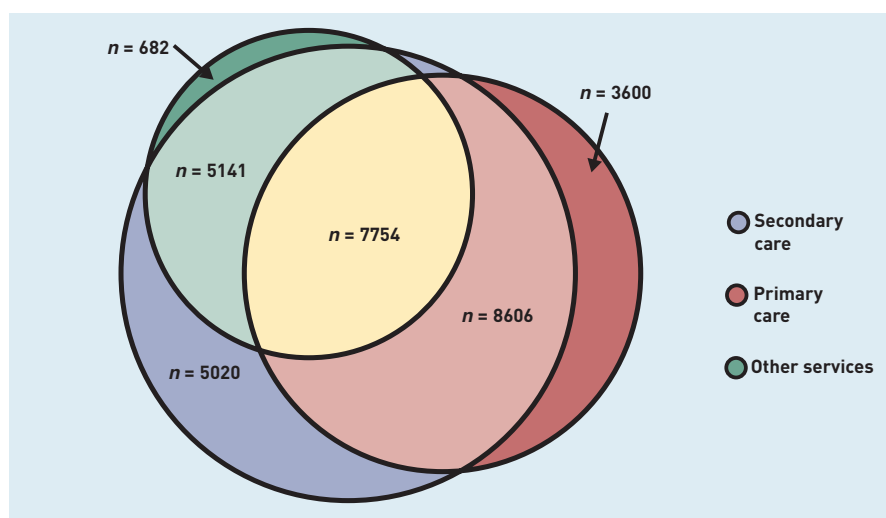


Figure 1. Venn diagram of service use in 2018, showing an approximation of group sizes. An intersection is missing between primary care and 'other' services (2.3%) – documentation of R eulerr package states 'with three or more sets intersecting, exact Euler diagrams are often impossible. For such cases eulerr attempts to provide a good approximation.'¹⁶

Table 2. Health service ever used by patients with HF in NWL between 2015 and 2018

Service	Year							
	2015		2016		2017		2018	
	n(N= 23 828)	%	n(N= 27 443)	%	n(N= 31 554)	%	n(N= 34 651)	%
Secondary care								
Emergency admission	5163	21.7	6592	24.0	8276	26.2	9257	26.7
Elective admission	910	3.8	1495	5.4	1803	5.7	1798	5.2
Unplanned A&E	8238	34.6	10 697	39.0	12 250	38.8	14 145	40.8
Outpatient (any specialty)	13 492	56.6	18 560	67.6	22 115	70.1	24 283	70.1
Outpatient (top 1)								
(cardiology)	4117	17.3	6518	23.8	8040	25.5	8231	23.8
Outpatient (top 2) ^a	2645	11.1	4662	17.0	5600	17.7	6049	17.5
Outpatient (top 3) ^a	1992	8.4	3444	12.5	4127	13.1	5053	14.6
Outpatient (top 4) ^a	1645	6.9	3156	11.5	4018	12.7	4500	13.0
Outpatient (top 5) ^a	1563	6.6	2554	9.3	3220	10.2	3383	9.8
Primary care								
GP consultation	16 014	67.2	17 573	64.0	19 494	61.8	20 741	59.9
Echocardiogram	1826	7.7	2016	7.3	2156	6.8	2178	6.3
Echocardiogram abnormal	1010	4.2	1066	3.9	1150	3.6	1113	3.2
Community								
Any	8801	36.9	9869	36.0	11 195	35.5	13 762	39.7
Nursing	6590	27.7	5893	21.5	6311	20.0	8052	23.2
Rehabilitation	2052	8.6	2489	9.1	2065	6.5	2861	8.3
Urgent	918	3.9	811	3.0	999	3.2	1203	3.5
Intermediate	1841	7.7	1754	6.4	1397	4.4	1526	4.4
Cardiology	859	3.6	578	2.1	797	2.5	1005	2.9
GP referral to cardiac rehabilitation	4333	18.2	5465	19.9	6585	20.9	7187	20.7
Diabetes	1011	4.2	955	3.5	1171	3.7	1654	4.8
Physio-/occupational therapy	1091	4.6	1160	4.2	1148	3.6	1853	5.3
Podiatry	3760	15.8	4076	14.9	4404	14.0	5397	15.6
Respiratory	217	0.9	163	0.6	206	0.7	302	0.9
Neurological	1054	4.4	1427	5.2	1481	4.7	2138	6.2
Urinary	452	1.9	597	2.2	747	2.4	1374	4.0
Speech language therapy	108	0.5	68	0.2	60	0.2	102	0.3
Falls	165	0.7	332	1.2	365	1.2	450	1.3
Diet and nutrition	644	2.7	1399	5.1	1696	5.4	2197	6.3
Home	1229	5.2	1411	5.1	1738	5.5	1654	4.8
Phone	949	4.0	317	1.2	418	1.3	393	1.1
Unknown	178	0.7	203	0.7	206	0.7	248	0.7
Mental health								
Any	1064	4.5	1421	5.2	1718	5.4	1557	4.5
Outpatient	354	1.5	360	1.3	428	1.4	169	0.5
Community	964	4.0	1305	4.8	1589	5.0	1489	4.3
Urgent	387	1.6	695	2.5	950	3.0	631	1.8
Specialist	62	0.3	197	0.7	253	0.8	78	0.2
Dementia	527	2.2	585	2.1	706	2.2	732	2.1
Learning disability	33	0.1	39	0.1	48	0.2	29	0.1
Psychology	91	0.4	236	0.9	279	0.9	261	0.8
Review	109	0.5	159	0.6	214	0.7	92	0.3
Consultation	51	0.2	82	0.3	118	0.4	951	2.7
Treatment	61	0.3	84	0.3	110	0.3	117	0.3
Assessment	151	0.6	254	0.9	309	1.0	267	0.8
Unknown	<5	0.0	<5	0.0	—	0.0	—	0.0

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own health (they were also more likely to be smokers). The oldest and most likely to live in care homes (cluster 5) had the highest usage of emergency inpatient, A&E,

and 'other' services, and had high levels of comorbidity, especially renal disease, and the highest mortality. Higher usage of care is expected in older patients with

Table 2 Continued. Health service ever used by patients with HF in NWL between 2015 and 2018

Service	Year							
	2015		2016		2017		2018	
	<i>n</i> (<i>N</i> = 23 828)	%	<i>n</i> (<i>N</i> = 27 443)	%	<i>n</i> (<i>N</i> = 31 554)	%	<i>n</i> (<i>N</i> = 34 651)	%
Social care								
Any	1042	4.4	1236	4.5	1912	6.1	1350	3.9
Nursing	89	0.4	109	0.4	169	0.5	128	0.4
Personal care	709	3.0	890	3.2	1485	4.7	1057	3.1
Food	68	0.3	82	0.3	44	0.1	10	0.0
Domestic	165	0.7	238	0.9	350	1.1	253	0.7
Transport	78	0.3	78	0.3	99	0.3	70	0.2
Disability	181	0.8	230	0.8	277	0.9	248	0.7
Occupational therapy	8	0.0	15	0.1	18	0.1	28	0.1
Memory and cognition	53	0.2	76	0.3	104	0.3	63	0.2
Assisted equipment technology	129	0.5	28	0.1	47	0.1	7	0.0
Nursing home	58	0.2	76	0.3	123	0.4	80	0.2
Mental health	43	0.2	49	0.2	95	0.3	36	0.1
Community	250	1.0	122	0.4	198	0.6	232	0.7
Social	64	0.3	87	0.3	165	0.5	88	0.3
Carer	127	0.5	125	0.5	142	0.5	159	0.5
Housing and living	119	0.5	66	0.2	98	0.3	41	0.1
Unknown	68	0.3	110	0.4	119	0.4	66	0.2
Number of services used								
0	2602	10.9	2567	9.4	2891	9.2	3067	8.9
1	7036	29.5	7438	27.1	8572	27.2	9267	26.7
2	8200	34.4	10 549	38.4	12 211	38.7	13 710	39.6
>3	5990	25.1	6889	25.1	7880	24.9	8607	24.8
Service type								
None	2602	10.9	2567	9.4	2891	9.2	3067	8.9
Secondary care only	2508	10.5	3569	13.0	4586	14.5	5020	14.5
Primary care only	4134	17.3	3443	12.5	3538	11.2	3600	10.4
Other services only	460	1.9	467	1.7	486	1.5	682	2.0
Secondary care and primary care	5298	22.2	7331	26.7	8465	26.8	8606	24.8
Secondary care and other services	2244	9.4	3267	11.9	4097	13.0	5141	14.8
Primary care and other services	1133	4.8	606	2.2	614	1.9	781	2.3
All three	5449	22.9	6193	22.6	6877	21.8	7754	22.4

^aTop five outpatient specialties by year: 2015 ranking: 1) cardiology; 2) general surgery; 3) ophthalmology; 4) trauma and orthopaedics; 5) allied health professional episode. 2016 to 2018 ranking: 1) cardiology; 2) ophthalmology; 3) general surgery; 4) allied health professional episode; 5) radiology. A&E = accident and emergency department. HF = heart failure. NWL = North West London.

comorbidities,¹⁹⁻²¹ but some use might be excessive and avoidable.^{19,20} Health service use was high in the present population of adults with HF living in a community setting. However, overall, relatively low GP service use, which decreased over the study period, and high use of emergency and other unscheduled care in these vulnerable patients is of significant concern and may suggest challenges in access to primary care services. These findings warrant further investigation to ensure equity of access and appropriate integrated care provision for patients with HF.

Strengths and limitations

The authors used a linked dataset with near-complete population coverage for the region and employed both descriptive analysis and clustering algorithms to describe health service use by this highly heterogeneous population. The dataset is large and reflective of current medical practice, but the study has several limitations.

Electronic health records are not specifically intended for research, and coding is highly variable.²² Coding in some of the WSIC tables required additional cleaning and processing, which could

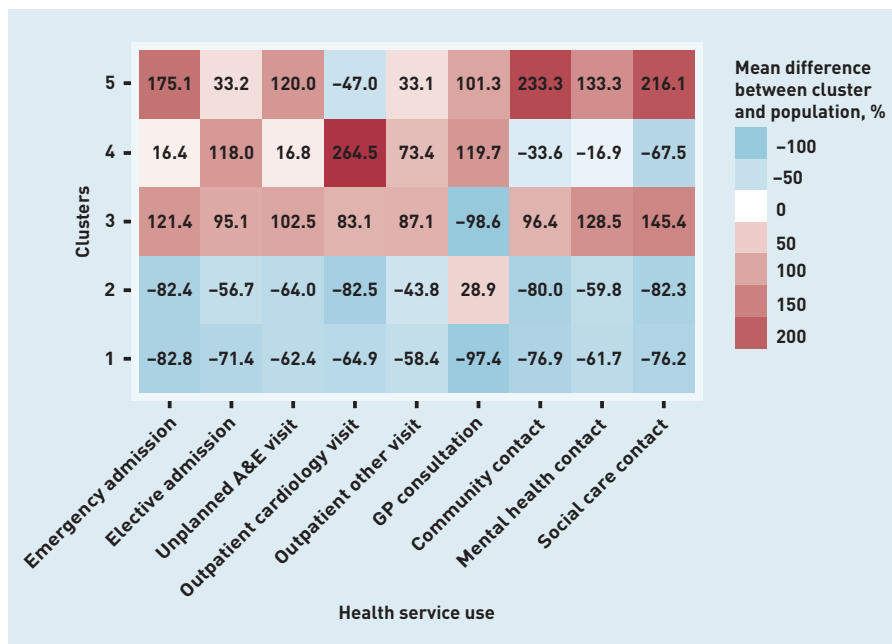


Figure 2. Heatmap of service utilisation by cluster. Numbers represent percentage difference between cluster mean and population mean values of each health utilisation variable. A&E = accident and emergency.

introduce bias; however, a transparent coding methodology to mitigate this was provided. Moreover, coded data rely on recorded information, meaning that certain diseases or service components may have been underestimated, for example, cardiac rehabilitation, or that certain primary care data coding may have been affected by pay-for-performance schemes. The authors were unable to ascertain the reasons for the community care or mental health consultations as diagnosis coding was irregular. It is also likely that the fall in GP consultations during the study period was offset by more practice nurse contacts, which were not included in the dataset.

Lastly, though the dataset was based on adults living in a community setting from a large and ethnically diverse area in England, the findings may not be generalisable to the wider population of people with HF.

Comparison with existing literature

Few studies have attempted to quantify individual patterns of care in real-world settings beyond the hospital. Robertson *et al* described the burden of HF on the Australian healthcare system, but were only able to assess hospitalisation data,²³ as was the case for the present authors' previous work.^{24,25} Similarly, other studies have described a single dimensional aspect of health service use by the population of people with HF.^{26,27} The present findings are consistent with these, showing that secondary care use is high,²³ participation in cardiac rehabilitation in the community is low,^{26,28} and that requirement for personal

care, such as nursing and homecare services, is relatively common.²⁷

An increase over time in most healthcare services use was observed in the present study, especially outpatient visits, but a surprising decrease of 11% in GP consultations. Furthermore, only 60% of patients had GP appointments during the study period, which contrasts with the national GP Patient Survey of 2019,²⁹ where 85% of patients reported having had a GP appointment in the past year. Potential explanations include the increasing workload and workforce pressures on primary care, changes in primary care practice with more frequent contacts with practice nurses and allied health professionals, a significant problem of access to care, and/or differences in case mix.

Another surprising finding is the apparently limited uptake of community cardiac rehabilitation. The National Audit of Cardiac Rehabilitation 2018 report²⁸ suggests that around half of eligible patients take up cardiac rehabilitation. The report did indicate significant regional variation. However, it seems likely that differences in coding of data are responsible for the very low uptake in this analysis; 'rehabilitation' events may be recorded elsewhere and currently unavailable in WSIC, and 'community cardiology' may also include HF nurse domiciliary care.

The authors further report low use of mental health and social care services by patients with HF, but whether this observed level is appropriate is unclear without further assessment.

Implications for research and practice

The present finding of increased secondary and urgent care service use, low GP appointment use, and apparently limited cardiac rehabilitation is of concern and suggests a lack of multidisciplinary HF care. National Institute for Health and Care Excellence guidelines recommend an MDT approach, but there is no standard definition besides who should be involved and what should be achieved.¹ Each local area has unique challenges and requires tailored solutions; research is needed to establish the nature, location, timing, and intensity of the support needed by patients with HF. In an ethnically diverse area with a relatively young population like NWL, where deprivation level and ethnicity may affect a person's access to health care, creating a strong MDT embedded in primary care may be very pertinent. For example, practice nurses may target recently diagnosed

Funding

The Dr Foster Unit at Imperial College London is partially funded by a grant from Dr Foster, a private healthcare information company. It is also partly funded by research grants from the National Institute for Health Research (NIHR) Health Services and Delivery Research (HS&DR) (ref: 17/99/72). Martin R Cowie's salary is supported by the NIHR Cardiovascular Biomedical Research Unit at the Royal Brompton Hospital, London. None of the funders had any role in the conception, design, analysis, or reporting of this study

Ethical approval

Whole Systems Integrated Care (WSIC) is a dataset of North West London (NWL) residents who have consented to the anonymous data in their online health records for research purposes. Additionally, this specific study was approved by the Discover Research Advisory Group (DRAG), which is a nominated body that provides a governance mechanism for evaluating project applications requesting the WSIC de-identified dataset.

Provenance

Freely submitted; externally peer reviewed.

Competing interests

Alex Bottle, Dani Kim, and Paul Aylin had financial support through a research grant from Dr Foster for the submitted work. There were no financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years and no other relationships or activities that could appear to have influenced the submitted work. Benedict Hayhoe is a GP working in the NHS.

Acknowledgements

The Department of Primary Care and Public Health at Imperial College London is grateful for support from the NWL NIHR Applied Research Collaboration and the Imperial NIHR Biomedical Research Centre.

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patients in primary care, that is, younger patients with fewer comorbidities, on early education and management, which may include additional telephone and/or specialist community support for those with lower socioeconomic status. This, in conjunction with hospital-based solutions, like early supported discharge plans for older patients, who are the highest users of secondary care, may provide significant and long-term benefits for the NWL area. Local solutions like these have been shown not only to reduce utilisation of health services but also to improve patient wellbeing and result in large cost savings for the NHS.³⁰

Though the present data could not establish whether an MDT approach was implemented in the NWL area, it may well be that MDTs exist but their solutions are not

translating into reduced secondary care use. Successful MDTs will require cooperation, coordination, and communication across health services. Reasons for ineffective multidisciplinary care could be posited through the following questions: is there an overarching coordinating unit for multidisciplinary care? Are the IT systems compatible for such care? Is information exchange readily available and safe? Is communication across settings both smooth and frequent? Is the approach sustainable? These questions illustrate how successful solutions will require sustained financial investments and the solid backing of all relevant stakeholders, and the sheer challenge of this may explain why many MDTs have had only neutral effects.²

REFERENCES

1. National Institute for Health and Care Excellence. *Chronic heart failure in adults: diagnosis and management. NG106*. 2018. <https://www.nice.org.uk/guidance/ng106> [accessed 19 May 2020].
2. Morton G, Masters J, Cowburn PJ. Multidisciplinary team approach to heart failure management. *Heart* 2018; **104(16)**: 1376–1382.
3. Legislation.gov.uk. Health and Social Care Act 2012. <http://www.legislation.gov.uk/ukpga/2012/7/contents/enacted> [accessed 19 May 2020].
4. National Collaboration for Integrated Care and Support. *Integrated care and support: our shared commitment*. 2013. assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/198748/DEFINITIVE_FINAL_VERSION_Integrated_Care_and_Support_-_Our_Shared_Commitment_2013-05-13.pdf [accessed 19 May 2020].
5. Department of Health Cardiovascular Disease Team. *Cardiovascular disease outcomes strategy: improving outcomes for people with or at risk of cardiovascular disease*. 2013. assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/217118/9387-2900853-CVD-Outcomes_web1.pdf [accessed 19 May 2020].
6. NHS England. *Five year forward view*. 2014. www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf [accessed 19 May 2020].
7. Ponikowski P, Voors AA, Anker SD, et al. 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure: the task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J* 2016; **37(27)**: 2129–2200.
8. Yancy CW, Jessup M, Bozkurt B, et al. Writing Committee Members, American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *Circulation* 2013; **128(16)**: e240–e327.
9. Imperial College Health Partners, NHS. About Discover. <https://www.registerfordiscover.org.uk/about-discover/overview> [accessed 19 May 2020].
10. NHS North West London Collaboration of Clinical Commissioning Groups. About us. <https://www.healthnorthwestlondon.nhs.uk/about/about> [accessed 19 May 2020].
11. Herrett E, Gallagher AM, Bhaskaran K, et al. Data resource profile: Clinical Practice Research Datalink (CPRD). *Int J Epidemiol* 2015; **44(3)**: 827–836.
12. Lewis JD, Schinnar R, Bilker WB, et al. Validation studies of The Health Improvement Network (THIN) database for pharmacoepidemiology research. *Pharmacoepidemiol Drug Saf* 2007; **16(4)**: 393–401.
13. Ministry of Housing, Communities and Local Government. English indices of deprivation 2015. <http://imd-by-postcode.opendatacommunities.org/imd/2015> [accessed 19 May 2020].
14. Khan NF, Perera R, Harper S, Rose PW. Adaptation and validation of the Charlson index for Read/OXMIS coded databases. *BMC Fam Pract* 2010; **11**: 1.
15. Windgassen S, Moss-Morris R, Goldsmith K, Chalder T. The importance of cluster analysis for enhancing clinical practice: an example from irritable bowel syndrome. *J Ment Health* 2018; **27(2)**: 94–96.
16. The Comprehensive R Archive Network. eulerr. <https://cran.r-project.org/web/packages/eulerr/readme/README.html> [accessed 19 May 2020].
17. Szczepura A. Access to health care for ethnic minority populations. *Postgrad Med J* 2005; **81(953)**: 141–147.
18. M Morteruel, Rodriguez-Alvarez E, Martin U, Bacigalupe A. Inequalities in health services usage in a National Health System scheme: the case of a southern social European region. *Nurs Res* 2018; **67(1)**: 26–34.
19. Doherty E, O'Neill C. Estimating the health-care usage associated with osteoarthritis and rheumatoid arthritis in an older adult population in Ireland. *J Public Health* 2014; **36(3)**: 504–510.
20. König H-H, Lehnert T, Brenner H, et al. Health service use and costs associated with excess weight in older adults in Germany. *Age Ageing* 2015; **44(4)**: 616–623.
21. Cheung JTK, Yu R, Wu Z, et al. Geriatric syndromes, multimorbidity, and disability overlap and increase healthcare use among older Chinese. *BMC Geriatr* 2018; **18(1)**: 147.
22. Jordan K, Porcheret M, Croft P. Quality of morbidity coding in general practice computerized medical records: a systematic review. *Fam Pract* 2004; **21(4)**: 396–412.
23. Robertson J, McElduff P, Pearson S-A, et al. The health services burden of heart failure: an analysis using linked population health data-sets. *BMC Health Serv Res* 2012; **12**: 103.
24. Bottle A, Goudie R, Bell D, et al. Use of hospital services by age and comorbidity after an index heart failure admission in England: an observational study. *BMJ Open* 2016; **6(6)**: e010669.
25. Bottle A, Honeyford K, Chowdhury F, et al. *Factors associated with hospital emergency readmission and mortality rates in patients with heart failure or chronic obstructive pulmonary disease: a national observational study*. Southampton: National Institute for Health Research Journals Library, 2018.
26. Park LG, Schopfer DW, Zhang N, et al. Participation in cardiac rehabilitation among patients with heart failure. *J Card Fail* 2017; **23(5)**: 427–431.
27. Foebel AD, Hirdes JP, Heckman GA, et al. A profile of older community-dwelling home care clients with heart failure in Ontario. *Chronic Dis Can* 2011; **31(2)**: 49–57.
28. British Heart Foundation. *The National Audit of Cardiac Rehabilitation (NACR) quality and outcomes report 2018*. 2018. <https://www.bhf.org.uk/informationsupport/publications/statistics/national-audit-of-cardiac-rehabilitation-quality-and-outcomes-report-2018> [accessed 19 May 2020].
29. GP Patient Survey. Surveys and reports. 2019. <https://www.gp-patient.co.uk/surveysandreports> [accessed 19 May 2020].
30. British Heart Foundation. *Integrated Care: best practice*. 2016. <https://www.bhf.org.uk/informationsupport/publications/healthcare-and-innovations/integrated-care-best-practice> [accessed 19 May 2020].