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High prevalence of undetected heart failure in long-term care residents: findings from the Heart Failure in Care Homes (HFinCH) study

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Aims Diagnosis of heart failure in older people in long-term care is challenging because of co-morbidities, cognitive deficit, polypharmacy, immobility, and poor access to services. This study aimed to ascertain heart failure prevalence and clinical management in this population.

Methods and results A total of 405 residents, aged 65–100 years, in 33 UK care facilities were prospectively enrolled between April 2009 and June 2010. The presence of heart failure was determined using European Society of Cardiology guidelines, modified where necessary for immobility. Evaluation of symptoms and signs, functional capacity, and quality of life, portable on-site echocardiography, and medical record review were completed in 399 cases. The point prevalence of heart failure was 22.8% [$n = 91$, 95% confidence interval (CI) 18.8–27.2%]; of these, 62.7% ($n = 57$, 95% CI 59.6–66.5%) had heart failure with preserved ejection fraction and 37.3% had left ventricular systolic dysfunction ($n = 34$, 95% CI 34.8–40.5%). A total of 76% ($n = 61$) of previous diagnoses of heart failure were not confirmed, and up to 90% ($n = 82$) of study cases were new. No symptoms or signs were reliable predictors of heart failure.

Conclusion Heart failure was diagnosed in almost a quarter of residents: the prevalence was substantially higher than in other populations. The majority of heart failure cases were undiagnosed, while three-quarters of previously recorded cases were misdiagnosed. Common symptoms and signs appear to have little clinical utility in this population. Early, accurate differential diagnosis is key to the effective management of heart failure; this may be failing in long-term care facilities.

Trial registration ISRCTN19781227

Keywords Heart failure with preserved ejection fraction (HFpEF) • Diagnosis • Prevalence • Older people • Long-term care

Introduction

Heart failure (HF) has a progressive, negative impact upon quality of life, morbidity, and mortality, which may be improved substantially by accurate diagnosis and management. Although the prevalence of HF is highest in older people, [1] diagnosis and management are likely to be least comprehensive in long-term care.[2–5] In this setting, where access to health services may be limited, acute care often takes precedence over chronic care and preventative needs.[6] In practice, HF symptoms are often non-

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specific, physical signs may be difficult to elicit,[7–12] and, for unknown reasons, the prevalence of cardiovascular co-morbidities may be lower in older people.[13] As long-term care residents are often unable to attend outside clinics or diagnostic facilities, the lack of availability of echocardiography in this setting further complicates diagnosis and management.[14–17] Internationally, the most relevant studies suggest a prevalence of 10–42% in long-term care,[9,18,19] 6.7% in the general population,[20] and 46% in older people presenting to hospital with HF symptoms.[11] While data on undiagnosed HF are inherently difficult to obtain, current evidence suggests that an accurate diagnosis may be missed in up to half of cases.[18,21–24] Despite the higher prevalence of HF in older people, there is a paucity of research that examines either assessment and diagnostic practices or care provision for this debilitating disease. The relative prevalence of HF with reduced ejection fraction [left ventricular systolic dysfunction (LVSD) or HFrEF] and preserved ejection fraction (HFpEF) is unknown, though HFpEF may account for > 50% of HF hospitalizations in the elderly.[25–28] The aim of this study was to establish the overall prevalence of HF (and by type) in long-term care facilities using on-site echocardiography and a review of treatment for existing diagnoses of HF.

Methods

Study population

Residents from long-term care facilities (UK residential and nursing homes) in Teesside, North East England, aged ≥65 years without terminal disease and who were permanently resident were eligible to participate. Study data were collected over a 14-month period from April 2009. Initial and process consent was sought directly from the resident, or from their relative (or a consultee) when a resident lacked the capacity to provide informed consent. Capacity to consent was determined by the Mini Mental State Examination (MMSE)[29] and process consent using the abbreviated mental tests score (AMTS)[30] prior to assessments. Anonymized demographic details (date of birth, gender, and ethnicity) of all eligible residents (including non-participants) were extracted.

Investigation

Participants underwent a diagnostic assessment within each facility, including MMSE,[29] demographic information, medication, and past medical history, quality of life assessment (EuroQol: EQ-5D and EQ-VAS),[31] physical examination, electrocardiography, echocardiography,[32] and blood sampling. Portable echocardiograms (Vivid-i, application software version 6.2.0, system software 2.1.16, 3RS probe) were performed by a British Society of Echocardiography (BSE)-accredited physiologist according to European Society of Cardiology (ESC) guidelines,[19,25] and electrocardiograms (ECGs; GE MAC 1600, cardiosoft version 6.5) by a trained technician. Full echocardiograms, including colour Doppler, were performed, and images were stored for off-line assessment. Linear and M-mode cardiac chamber measurements were obtained from the parasternal long and short axis view in accordance with American Society of Cardiology (ASC) recommendations.[33] All assessments were conducted by the study team; echocardiography, ECG, and physical assessment findings were blinded from each other; findings were reviewed by a consultant cardiologist (J.J.M.) who made the definitive diagnosis of HF (LVSD or HFpEF). Findings were subsequently reviewed by a second HF specialist (A.F.) who was blinded to the diagnosis (with 100% agreement). On completion of the study 12.5% (50) of echocardiograms were randomly selected and independently reported by a BSE-accredited cardiac physiologist (not involved in the study) to test the reliability and validity of the findings (with 100% agreement for significant left ventricular dysfunction and valve disease).

Differential definitions of heart failure

Definitions of HF were based on ESC guidelines available at the time of the study,[19,25] modified for the potential impact of both cognitive impairment and immobility resulting from co-morbidities. Symptoms and signs compatible with HF were defined as: (i) breathlessness, graded as New York Heart Association (NYHA) class II, III, or IV; (ii) moderate oedema (up to the knees bilaterally); or (iii) mild oedema (confined to the ankles) + one other clinical sign (see below); (iv) mild oedema and taking at least furosemide 40 mg (or equivalent) per day; or (v) two or more other signs [raised jugular venous pressure (JVP), lung crackles, respiratory rate >20/min, third heart sound].

Left ventricular systolic dysfunction was assessed: using the 'eyeball' method as normal, or mildly, moderately, or severely impaired; by left ventricular ejection fraction (LVEF) calculated by Simpson's rule; and by wall motion index using the ASC recommendations.[33] Doppler and tissue Doppler measurements of the longitudinal function of the heart were used to determine left ventricular diastolic dysfunction (LVDD). Measurements of the ratio of early transmitral flow velocity and early mitral annular velocity (E/E') were recorded at both the septum and lateral wall.

All residents with clinical features and either an LVEF of ≤50% or whose left ventricular systolic function was assessed by 'eyeball' to be mildly, moderately, or severely impaired were classified as having HF due to LVSD. HFpEF was diagnosed in accordance with ESC guidelines[19] using clinical, echocardiographic, and brain natriuretic peptide (BNP) measurements. Patients with clinical features of HF whose LVEF was >50% with an E/E' >15, or those with an equivocal E/E' (8–15) but BNP >200 pg/mL or N-terminal proBNP (NT-proBNP) >220 pg/mL were diagnosed as having HFpEF.

Study endpoints

Point prevalence was measured according to the clinical diagnosis of HF, and differentiated as LVSD, LVSD-HF, or HFpEF. Symptom and sign profiles (including MMSE, AMTS, and NYHA class), co-morbidities and prescribed medications, quality of life (EQ-5D and EQ-VAS),[31] and characteristics of care provision and diagnostic agreement in general practice and care facility records were reported for those with and without HF.

Data analysis

All calculations were performed using SPSS version 19. Continuous data are expressed as mean, range, and standard deviation (SD) (unless otherwise stated) and binary data as proportions. A value of $P < 0.05$ was considered significant for the purpose of hypothesis generation. Comparisons between groups were made using Student's *t*-test for continuous data and Fisher's exact test for proportions. Residents with incomplete echocardiographic assessment were excluded from the analysis.

Ethical approval

The study protocol received prior local research management and governance and national ethics approvals, and the study complies with the Declaration of Helsinki. Informed consent was obtained from all subjects or guardians.

Results

Study population

Thirty-three care facilities (with a total of 1701 beds) agreed to participate in the study; two declined. Study participants were registered with 23 general practices (including 93 primary care physicians).

Data were collected on non-participating residents; 529 residents (of the total 1701) were judged by care facility managers to be ineligible predominantly due to concerns over the balance of risks and benefits of participating. Of the remaining 1172 eligible residents, consent for participation was obtained for 405 (35%). The primary reason for non-participation was relatives declining on behalf of residents due to similar concerns. Portable echocardiography was not possible in six participants; 399 participants with complete data are reported.

Participant age ranged from 65 to 100 years (mean 84 years); the majority (54%) were ≥85 years. Participants were almost exclusively white British (99%) and the majority were female (74%). Eligible non-participants and participants showed similar baseline demographic characteristics (see *Table 1*), demonstrating no discrimination on the basis of age, gender, or ethnicity. Baseline characteristics of participants are shown in *Table 2*.

Study diagnosis

The point prevalence of HF was 22.8% [$n = 91$, 95% confidence interval (CI) 18.8–27.2%]; of these, 62.7% ($n = 57$, 95% CI 59.6–66.5%) had HFpEF and 37.3% had LVSD ($n = 34$, 95% CI 34.8–40.5%). A further three patients had LVSD without clinical signs of HF. In total, 34 (8.5%, 95% CI 6.0–11.7%) were diagnosed with LVSD, categorized as: mild, 19 (56%); moderate, 9 (27%); or severe, 6 (18%). Participants with and without LVSD were broadly similar in terms of age and sex (*Table 2*).

Participants with LVSD were more likely to have orthopnoea, a raised JVP, lung crackles, abnormal ECG, and mitral regurgitation (see *Table 3* for a complete list of clinical symptoms and signs). HFpEF additionally featured raised levels of peripheral oedema. The number qualifying for HFpEF according to ESC criteria[19] of E/E' (8–15) and BNP >200 pg/mL (or NT-proBNP >220 pg/mL) was 11 residents (19%); the remainder ($n = 46$) had an E/E' of >15.

The NYHA classification was not a reliable indicator of systolic dysfunction; participants with an assessment of NYHA class IV were classified as having mild or moderate LVSD, while those with NYHA class I had mild, moderate, or severe LVSD. Study assessment of NYHA classification was not possible in 101 participants (25%) due to immobility; the remainder were ambulant. A total of 129 (32%) residents had an elevated respiratory rate (>20 breaths/min), and 183 (49%) had peripheral oedema (mild or moderate); 59 (15%) residents had both, and, of these, four residents also had a raised BNP (>400 pg/mL). Of the 59 symptomatic residents with an elevated respiratory rate and peripheral oedema, 20 (34%) had HF, of which 5 had an existing record of HF and15 were newly diagnosed. Of the four residents with these signs plus a raised BNP, three had HF, of which one was newly diagnosed.

The acceptability of the diagnostic assessment by residents was high: four (1%) residents reported they would decline a request to repeat parts of the assessments, two found the echocardiogram procedure uncomfortable, and two reported they would decline further blood tests. There were only four unsuccessful venepuncture attempts in the 405 participants.

Comparison of study and recorded diagnoses

Medical records did not specify the type or severity of HF in 99% of cases. Up to 50% of confirmed LVSD was previously diagnosed and noted in primary care, but only 12% was recorded in care facility notes. HFpEF was previously undiagnosed in ~90% of cases (*Table 4*). Of 71 cases recorded either in general practice notes or in a HF register, 17 (24%) were confirmed as either LVSD or HFpEF.

Study diagnosis, recorded co-morbidity, and clinical care

According to general practice records, the three most common co-morbidities were hypertension (48%), osteoarthritis (36%), and cognitive impairment (30%) (*Table 5*). Only eight (2%) participants had no record of any co-morbidity; none of these had HF.

Table 1 Care facility residents: comparison of participants and non-participants

Characteristics		Participants ($n = 399$)	Non-participants ($n = 767$)
Age (years)	65–74	46 (11.5%)	83 (10.8%)
	75–84	136 (34.1%)	294 (38.3%)
	85+	217 (54.4%)	390 (50.8%)
	Mean (SD, range)	84.2 (7.2, 65–100)	84.5 (7.6, 65–106)
Gender	Male	105 (26.3%)	198 (25.8%)
	Female	294 (73.7%)	569 (74.1%)
Ethnicity	White British	393 (98.5%)	767 (100%)
	White European	6 (1.5%)	0 (0%)
	Other	0 (0%)	0 (0%)

Table 2 Characteristics of participants by (study-determined) heart failure status

Characteristics		No HF (A), $n = 308$	LVSD (B), $n = 34$ (%)[a]	HFpEF (C), $n = 57$	*P*-value (A vs. B)	*P*-value (A vs. C)
Age (years)	65–74	42 (13.6%)	4 (11.8%)	0 (0%)	0.829[g]	0.004[g]
	75–84	109 (35.4%)	10 (29.4%)	17 (29.8%)		
	85+	157 (51.0%)	20 (58.8%)	40 (70.2%)		
	Mean[b]	83.5 (7.3, 65–99)	84.3 (6.6, 70–98)	87.6 (5.6, 75–100)		
Gender	Male	82 (26.6%)	13 (38.2%)	10 (17.5%)	0.077	0.068
	Female	226 (73.4%)	21 (61.8%)	47 (82.5%)		
Ethnicity	White British	303 (98.4%)	34 (100%)	56 (98.2%)	0.584[g]	0.606[g]
	White European	5 (1.6%)	0 (0%)	1 (1.8%)		
Care facility type[c]	Nursing	94 (30.5%)	9 (26.5%)	17 (29.8%)	0.314[g]	0.635[g]
	Residential	202 (65.6%)	22 (64.7%)	39 (68.4%)		
	Dementia	12 (3.9%)	3 (8.8%)	1 (1.8%)		
MMSE score[d]	0	36 (11.7%)	4 (11.8%)	5 (8.8%)	0.358[g]	0.746[g]
	1–23	174 (56.5%)	15 (44.1%)	31 (54.4%)		
	≥24	98 (31.8%)	15 (44.1%)	21 (36.8%)		
MMSE description	Alert	287 (93.2)	34 (100%)	54 (94.7%)	0.304[g]	0.905[g]
	Drowsy	20 (6.5%)	0 (0%)	3 (5.3%)		
	Coma	1 (0.3%)	0 (0%)	0 (0%)		
BMI[e]	Mean[b]	25.5 (5.4, 11–45)	26.2 (4.8, 18–36)	25.3 (4.6, 17–35)	0.535	0.961
EQ-5D	Mean[b]	0.42 (0.36, −0.54 to 1)	0.57 (0.26, 0.08–1)	0.47 (0.35, −0.18 to 1)	0.920	0.972
EQ-VAS[f]	Mean[b]	61.2 (19.1, 10–100)	67.8 (18, 50–100)	65.2 (14.9, 40–90)	0.881	0.622

BMI, body mass index; EQ, EuroQuol; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; LVSD, left ventricular systolic dysfunction; MMSE. Mini Mental State Examination; VAS, visual analogue scale.
[a]For tabulation purposes, three cases of LVSD without clinical signs of heart failure are included
[b]Mean, standard deviation, range
[c]Residential homes are registered to provide personal and social care for people no longer able to live independently; nursing homes provide these services in addition to medical and nursing care; nursing homes additionally include specialist mental healthcare. Some facilities provide a mixture of levels of care.
[d]A score of ≤23 required study consent by 'consultee declaration'.
[e]BMI available for 384 (96%) residents.
[f]VAS score available for 120 (30%) residents.
[g]Fisher's exact test (all other *P*-values show Pearson χ^2).

Participants had a mean of three co-morbidities (range 1–7, SD 1.4) (*Table 5*). The number of co-morbidities was not significantly different between those with and without HF ($P = 0.641$). Participants with LVSD were more likely to have a previous myocardial infarction or atrial fibrillation and to have been prescribed beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, diuretics, and warfarin (*Table 5*). Nearly 50% of these patients were receiving an ACE inhibitor or beta-blocker. Of 80 patients with any pre-existing record of HF, 36% were receiving an ACE inhibitor and 43% beta-blockers (*Table 6*).

Discussion

In our large, institution-based study of older people, we report that HF was diagnosed in almost a quarter of residents, two-thirds of whom had HFpEF. The prevalence of HF was substantially higher than in community populations. Most cases of HF were previously undiagnosed, and three-quarters of previously recorded cases were not confirmed. Symptoms and signs typically associated with HF such as leg oedema and breathlessness appear to have little clinical utility in this population. In summary, these findings indicate a HF and HFpEF burden that is substantially higher than previously thought.

Previous studies

Four studies have previously estimated the prevalence of HF in long-term care, varying from 23% to 42%.[18,24,34,35] These studies were small (100–150 residents), with the exception of one large US study (nearly 3000 residents).[28] Participants' mean age and gender distributions were similar to those of the cohort in this study, but definitions of HF and methods of diagnosis varied. Most studies relied on medical records to identify HF, with no details about operational definitions; only one prevalence study[16] used echocardiography to assess and define the presence of LVSD. For comparison, the prevalence of undifferentiated HF based on medical records (a HF register) in our study was 32%.

Recent evidence suggests potential prognostic benefits of ACE inhibitors for patients with HFpEF.[36] However, findings from this study indicate a tendency towards the use of diuretics for this group. The high incidence of HFpEF detected suggests the need for further research in this population, in order to establish clear

Table 3 Heart failure-related characteristics of participants by (study-determined) heart failure status

	No HF (A), $n = 308$	LVSD (B), $n = 34$	HFpEF (C), $n = 57$	*P*-value (A vs. B)	*P*-value (A vs. C)
Symptoms					
Orthopnea	36 (11.7%)	10 (29.4%)	17 (29.8%)	0.027[a]	0.003
Signs and echo findings					
Raised JVP[b]	25 (8.1%)	7 (20.6%)	10 (17.5%)	0.054[a]	0.058
Lung crackles[c]	52 (16.9%)	12 (35.3%)	19 (33.3%)	0.031[a]	0.012
Oedema[d]	125 (40.6%)	19 (55.9%)	39 (68.4%)	0.487	0.001
Systolic BP[e]	131 (±22)	131 (±26)	135 (±25)	0.896	0.141
Diastolic BP[f]	72 (±10)	71 (±13)	68 (±10)	0.213	0.643
Heart rate	72 (±12)	75 (±13)	74 (±13)	0.630	0.541
Respiratory rate[g]	18 (±4)	19 (±4)	18 (±4)	0.293	0.374
Abnormal ECG	153 (49.7%)	29 (85.3%)	35 (61.4%)	<0.001	0.157
Abnormal diastolic function	85 (27.6%)	14 (41.2%)	56 (98.2%)	0.334	<0.001
Ejection fraction % [h]	63.9 (±8.0)	39.0 (±7.1)	56.0 (±2.2)	0.191	0.825
Severe aortic regurgitation[i]	0 (0%)	0 (0%)	0 (0%)		
Severe aortic stenosis	3 (1.0%)	2 (5.9%)	2 (3.5%)	0.113[a]	0.263[a]
Severe mitral regurgitation[j]	2 (0.6%)	1 (2.9%)	1 (1.8%)	<0.001	0.004
Severe mitral stenosis[k]	0 (0%)	0 (0%)	1 (1.8%)		0.001

BP, blood pressure; ECG, electorcardiogram; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; JVP, jugular venous presure; LVSD, left ventricular systolic dysfunction.
[a]Fisher's exact test (all other *P*-values show Pearson χ^2).
[b]JVP measurement was available for 384 (96.2%) residents.
[c]Lung assessment was available for 398 (99.7%) residents.
[d]Oedema assessment was available for 397 (99.4%) residents.
[e]Systolic BP measurement was available for 398 (99.7%) residents.
[f]Diastolic BP measurement was available for 395 (98.9%) residents.
[g]Respiratory rate was available for 398 (99.7%) residents.
[h]Ejection fraction % was available for 17 (4%) residents.
[i]Aortic regurgitation measurement was available for 366 (91.7%) residents.
[j]Mitral regurgitation measurement was available for 385 (96.5%) residents.
[k]Mitral stenosis measurement was available for 396 (99.2%) residents. All other measurements were available for the full cohort ($n = 399$).

Table 4 Comparison of study findings from medical and health care records

Study		General practice notes	General practice HF register	Care facility notes
LVSD ($n = 34$)	Confirmed[a]	15 (44.1%)	16 (47.1%)	4 (11.8%)
	New[b]	19 (55.9%)	18 (52.9%)	30 (88.2%)
	Not confirmed[c]	24	47	13
HFpEF ($n = 57$)	Confirmed	3 (5.3%)	6 (10.5%)	3 (5.3%)
	New	54 (94.7%)	51 (89.5%)	54 (94.7%)
	Not confirmed	36	57	14

HF, heart failure; HFpEF, heart failure with preserved ejection fraction; LVSD, left ventricular systolic dysfunction.
[a]Study finding and health record agree.
[b]LVSD found in study but not in health record.
[c]LVSD found in health record but not confirmed by study.

guidelines for treatment;[36,37] this is borne out in the latest ESC guidelines.[38]

Implications of study findings

The findings of this study have implications for practice internationally and challenge the current focus on diagnosis and treatment of undifferentiated HF in this population: high levels of misdiagnosis, missed diagnosis, and the lack of evidence-based treatment found in this study might be explained in part by this lack of differentiation. In this study, HF was diagnosed in almost a quarter (22.8%) of participants. The prevalence of LVSD was lower than anticipated, while rates of asymptomatic LVSD reflect international data.[20] However, the study found high rates of HFpEF: this is the first known prevalence study to report HFpEF and LVSD as

Table 5 Co-morbidities and drug prescriptions by study-determined heart failure status

Characteristics	No HF (A), *n* = 308	LVSD (B), *n* = 34	HFpEF (C), *n* = 57	*P*-value (A vs. B)	*P*-value (A vs. C)
Co-morbidities					
Myocardial infarction	21 (6.8%)	7 (20.6%)	4 (7.0%)	0.012*	0.507*
Ischaemic heart disease	54 (17.5%)	6 (17.6%)	14 (24.6%)	0.549*	0.143*
Hypertension	151 (49.0%)	16 (47.1%)	26 (45.6%)	0.508*	0.380*
Atrial fibrillation	45 (14.6%)	14 (41.2%)	8 (14.0%)	<0.001*	0.351*
Valvular heart disease	9 (2.9%)	4 (11.8%)	3 (5.3%)	0.127*	0.364*
Mitral valvular heart disease	5 (1.6%)	1 (2.9%)	2 (3.5%)	0.513*	0.320*
Aortic valvular heart disease	5 (1.6%)	1 (2.9%)	2 (3.5%)	0.513*	0.320*
Diabetes	59 (19.2%)	7 (20.6%)	9 (15.8%)	0.464*	0.337*
COPD	25 (8.1%)	4 (11.8%)	11 (19.3%)	0.451*	0.016*
Osteoarthritis	105 (34.1%)	15 (44.1%)	22 (38.6%)	0.184*	0.355*
Cognitive impairment	102 (33.1%)	10 (29.4%)	9 (15.8%)	0.538*	0.006*
Prescribed drugs					
Beta-blocker	56 (18.2%)	16 (47.1%)	11 (19.3%)	<0.001*	0.460*
ACE inhibitor	58 (18.8%)	15 (44.1%)	15 (26.3%)	0.021	0.939
Angiotensin receptor blocker	18 (5.8%)	1 (2.9%)	5 (8.8%)	0.373*	0.248*
Calcium chanel blocker	56 (18.2%)	5 (14.7%)	17 (29.8%)	0.313*	0.030*
Diuretic	85 (27.6%)	19 (55.9%)	24 (42.1%)	0.002*	0.057*
Statin	117 (38.0%)	17 (50.0%)	27 (47.4%)	0.155*	0.154*
Digoxin	24 (7.8%)	5 (14.7%)	2 (3.5%)	0.111*	0.150*
Antiplatelet	159 (51.6%)	24 (70.6%)	24 (42.1%)	0.215*	0.099*
Spironolactone	7 (2.3%)	0 (0%)	1 (1.8%)	0.487*	0.680*
Bronchodilators	46 (14.9%)	7 (20.6%)	16 (28.1%)	0.370*	0.020*
Warfarin	8 (2.6%)	4 (11.8%)	1 (1.8%)	0.018*	0.423*
NSAIDs	25 (8.1%)	1 (2.9%)	7 (12.3%)	0.203*	0.174*

ACE, angiotensin-converting enzyme; COPD, chronic obstructive pulmonary disease; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; LVSD, left ventricular systolic dysfunction; NSAIDs, non-steroidal anti-inflammatory drugs.
*Fisher's Exact Test (all other *p* values show Pearson Chi-Square).

Table 6 Rates of angiotensin-converting enzyme, beta-blocker, and spironolactone prescribing in patients with left ventricular systolic dysfunction, categorized by study findings

Study		Any HF record[a]	ACE inhibitor[b]	Beta-blockers[b]	Spironolactone[b]
LVSD (*n* = 34)	Confirmed	19	10 (53%)	11 (58%)	0 (0%)
	New	15	5 (33%)	5 (33%)	0 (0%)
	Not confirmed	61	19 (31%)	23 (38%)	3 (5%)

ACE, angiotensin-converting enzyme; HF, heart failure; LVSD, left ventricular systolic dysfunction.
[a]A heart failure record, specified or unspecified in general practice notes, register, or care facility records.
[b]Any dose.

clearly defined subgroupings of HF in this population. Half of the HF cases diagnosed within the study were previously undiagnosed, while three-quarters of previously recorded cases appeared misdiagnosed (not confirmed by the study). Baseline demographic characteristics of participants and non-participants were almost identical and reflect other long-term care populations in different socio-economic groups and different countries with alternative service provision models.[18,24,34,35] Findings are therefore likely to be generalizable nationally and internationally. The cohort did not include patients from ethnic minorities; these patients are much less commonly represented in care home populations for cultural reasons. Half of study-determined cases of LVSD (17 of 34) and 6 of 57 cases of HFpEF were previously recorded as undifferentiated HF in general practice records. Previous studies have limited their examination of care provision to records held by healthcare professionals outside of long-term care facilities. Our

study supports international evidence that an accurate diagnosis may be missed in up to half of cases.[18,21–23] Difficulties diagnosing HF, organizing care across a wide range of care facilities, and allocating scarce health service resources can mean that important health needs of the older population in care are unmet. Based on these data, a review of current diagnostic processes within long-term care seems timely.

Strengths and limitations

Long-term care facilities proved a challenging environment, which led to some limitations for this research. As a condition of research access into care facilities, staff determined in part which residents were invited to participate. Thus participation within the study was filtered at three levels, by staff, by relatives, and by the residents themselves. Limited cognitive capacity was common, and a consultee declaration was required in 66% of participants. While 35% of eligible (non-excluded) residents participated, individual reasons for non-participation could not be determined within the selection process. A comparison of participants and non-participants reveals similarity in age, gender, and ethnicity. Study assessment tools, including the AMTS and EQ-5D, were carefully selected to avoid lengthy assessment times. A very high proportion (399/405, 98.5%) of recruited participants completed assessments, pointing to the acceptability of the assessments, including portable echocardiography, and the generalizability of findings.

There were difficulties assessing NYHA class and other symptoms and signs in this sedentary population; the lack of correlation between NYHA classification and LVSD severity, and between LVSD and HFpEF raises questions about its utility in the study population. Symptoms suggestive of HF such as oedema and dyspnoea were poor predictors of HF in this study. These were as common in participants without HF as in those with HF, and appear to have little diagnostic utility in this population. The routine introduction of portable echocardiography in care facilities might be essential to accurate diagnosis; this reflects the views of others about how best to achieve accurate diagnosis in older people.[12]

This study examined long-term care facility records which are used on a day to day basis (including prescriptions and co-morbidities) for this group and found them to be incomplete. Access to general practice and care facility records provided information about diagnoses and treatment but not the rationale behind decisions or relevant contraindications to medications; thus, the reasons for treatment decisions remain unknown.

Conclusion

In our large study of older people in long-term care, HF was diagnosed in almost a quarter of residents, two-thirds of whom had HFpEF. The prevalence of HF was substantially higher than in community populations. Symptoms and signs typically associated with HF such as leg oedema and breathlessness appear to have little clinical utility in this population. Findings suggest that this population is not routinely receiving evidence-based diagnosis; screening for HF was feasible and acceptable in this study. This challenges the current organization of diagnostic services for older people in care, which needs to be addressed at national and international levels.

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