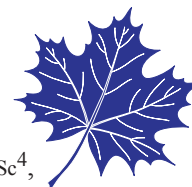# ORIGINAL RESEARCH

The Value of Admission Clinical Data for Diagnosing Heart Failure in Long-term Care

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ABSTRACT

Background

Heart failure (HF) is common in long-term care (LTC). Diagnostic uncertainty is important barrier to optimal HF management, stemming from inadequate health information transfer upon LTC admission. We determine the utility of admission clinical information to confirm a HF diagnosis in new LTC residents.

Methods

This was a prospective cohort study. From February 2004 to November 2006, information about new residents from 41 LTC homes in Ontario, Canada, was collected from residents and caregivers, and all available health records. A prior HF diagnosis was confirmed by consensus review of available data by two independent experts. Multivariate modelling was utilized to determine the utility of the admission clinical assessment in confirming a prior HF diagnosis.

Results

A total of 449 residents were included for analysis, aged 84.3±6.5 years, and 21.6% had a prior HF diagnosis. The most useful clinical item for diagnosing HF was a "history of HF". The final model included "history of HF' (OR [odds ratio] 13.66, 95% CI 6.61–28.24), "fluid on the lungs" (OR 2.01, 95% CI 1.04–3.89), "orthopnea" (OR 1.76, 95% CI 0.93–3.33), "taking β-blocker" (OR 2.09, 95% CI 1.10–3.94), "taking loop diuretics" (OR 2.11, 95% CI 1.12–3.98), and "history of coronary artery disease" (OR 2.83, 95% CI 1.42–5.64).

Conclusion

Elements of the clinical assessment for new LTC residents can help confirm a prior HF diagnosis. An admission history of HF is highly predictive.

Key words: heart failure, elderly, nursing home, long-term care, diagnosis, transition

INTRODUCTION

Heart failure (HF) predominantly affects seniors, many of whom are frail and disabled.[1-4] According to a recent systematic review, the prevalence of HF in long-term care (LTC) homes, which provide 24-hour nursing care to frail persons no longer able to reside in the community, reaches 20%.[5,6] The one-year mortality of HF in LTC reaches 40%, a rate 50% higher than among residents without HF.[7-9] HF accounts for approximately 20% of transfers of LTC residents to hospital, and it is considered that many admissions and resulting complications could be prevented with better HF management in LTC.[7,10-16]

Older persons with HF are less likely to be prescribed recommended HF therapies, despite evidence that these can be beneficial even among frail seniors.[17,18] An important barrier to appropriate prescribing of HF medications to frail seniors is diagnostic uncertainty.[19,20] The diagnosis, treatment, and prognosis of HF in older adults is often complicated by geriatric syndromes including frailty and psychogeriatric disorders.[17,19] Frail older HF patients, particularly those with difficulty completing activities of daily living, often manifest atypical signs and symptoms, leading to diagnostic delays, inappropriate prescribing, functional decline, and increased health care utilization.[19,21] Frail persons may have

difficulty providing accurate information to health providers.[22] Furthermore, when an older person is admitted to LTC, the transfer of health information from sending organizations is often inadequate.[22] Such poor transitions have been associated with suboptimal care and an increased risk of hospitalization and complications.[23] Ensuring the adequacy of diagnostic information upon LTC admission is crucial for optimal HF management.

The objective of this paper is to determine the utility of the admission clinical assessment for LTC residents in confirming a prior HF diagnosis.

METHODS

The Geriatric Outcomes and Longitudinal Decline in Heart Failure (GOLD-HF) study took place in South-Central Ontario from February 2004 to November 2006, and included Hamilton (25 LTC homes), Cambridge (seven homes), and Kitchener-Waterloo (nine homes). The GOLD-HF study was a prospective longitudinal study designed to compare over a one-year period the clinical course of newly admitted LTC residents with HF to those without HF. This study complies with the Declaration of Helsinki, was approved by the Research Ethics Board of McMaster University, and informed consent was obtained from all subjects or guardians.

Participants

Newly admitted and consecutive LTC residents aged 65 years or over were considered for inclusion. Excluded were residents with advanced malignant or non-malignant illness and expected to die within 6 weeks; those admitted from another LTC home (unless they had been residing there less than 6 weeks); those admitted to LTC for temporary respite to primary caregivers and expected to return to the community; and those for whom informed consent could not be obtained. Staff at participating homes sought permission from new residents or substitute decision-makers for referral to study nurses, who were then allowed to formally approach potential participants for consent. The period of 6 weeks for inclusion into the study was required by LTC homes to complete routine admission procedures prior to resident recruitment.

Data Collection

Baseline Assessment
A trained research nurse assessed all participants and reviewed the LTC home chart. For patients with communication difficulties or cognitive impairment, history was obtained from family caregivers. Baseline information collection included demographic data and medical history, HF signs and symptoms, and the most recent diagnostic investigations. Medical history information included the following disease diagnoses: pulmonary disease, coronary artery disease, valvular heart disease, hypertension, atrial fibrillation, hyperlipidemia, peripheral vascular disease (PVD), cerebrovascular events, diabetes mellitus, dementia, arthritis, osteoporosis and/or fragility fractures, cancer, renal insufficiency, and mood disorders. Prior smoking exposure and baseline function and cognition were also recorded. Prescribed medications were recorded and a medication count of regularly taken medications was created. Specific note was made of baseline use of angiotensin converting enzyme inhibitors (ACEi), angiotensin receptor blockers (ARB), beta-adrenergic receptor blockers (β-blockers), spironolactone, digoxin, loop diuretics, anti-platelets, anticoagulants, calcium channel blockers, antidepressants, and major and minor tranquilizers. Residents underwent a targeted physical examination. Assessment of functional, cognitive, and neuropsychiatric status, based on a review of the LTC chart and interview with the resident's primary caregiver or nurse, was performed using the Barthel Index (BI),[24] the Minimum Data Set Cognitive Scale,[25] the Cohen-Mansfield Agitation Inventory,[26] and Neuropsychiatric Inventory.[27]

Ascertaining a Prior Heart Failure Diagnosis
In order to ascertain a prior HF diagnosis, the research nurse obtained consent from participants (or substitute decision-makers) to search for medical records from previous physicians, hospitalizations, and diagnostic procedures, information generally not readily available to admitting LTC homes.[16,22] All data thus gathered were reviewed independently by two experts (GAH, RSM), who categorized the diagnosis of HF as true, possible, nor not present; disagreements resolved through discussion. Of 546 resident charts reviewed, there were 75 cases in which reviewers disagreed and 12 cases in which both reviewers were initially uncertain (Weighted Kappa = 0.73); all cases were resolved by discussion. The diagnosis of HF was based on accepted diagnostic criteria.[18,28] The presence of other diagnoses was also verified from review of this information.

Statistical Considerations

Baseline characteristics were summarized using mean and standard deviation for continuous measures, frequency, and percentage for categorical measures, and compared using t-test and Chi-square test, respectively. Unconditional estimates of sensitivity, specificity, positive predictive value, negative predictive value, and c-statistic were calculated for an admission "history of HF", "history of fluid on the lungs", symptoms and signs of HF, baseline physical findings, and calculated creatinine clearance.[29] Other indicators considered were co-morbidities, including hypertension, coronary artery disease (CAD), diabetes mellitus, atrial fibrillation, and renal insufficiency (defined as a calculated creatinine clearance < 60 mls/min), and use of HF medications (loop diuretics, ACEi, β-blockers, and digoxin). Multiple logistic regression was used to identify the strongest predictors of a prior HF diagnosis. Multi-collinearity was considered and

determined not to be significant, with estimates of the Pearson correlation less than 0.7 and variance inflation factors less than 2.5. Stepwise elimination was used to develop the final model, with remaining variables significant at the 5% level. Model fit was assessed using the likelihood ratio test, comparing the full and reduced models, and was found not to be significant. The integrated discriminant improvement (IDI) index was determined by sequentially adding variables in order of most to least informative c-statistic using the SAS ROCPLUS macro.[30,31] Variables were included in the final model if inclusion resulted in significant improvement at the 5% level. All analyses were conducted in SAS version 9.1 (SAS Institute Inc., Cary, NC).

RESULTS

The study enrolled 546 residents, and analysis will focus on 449 residents for whom creatinine clearance could be estimated. Mean age was 84.3±6.5 years and 66% were women, and a prior HF diagnosis was confirmed in 97 (21.6%) residents. Table 1 presents baseline characteristics of the sample. Almost half were admitted from hospital, with HF patients more likely to have been so. Participants had multiple medical co-morbidities, were prescribed multiple medications, and had significant functional and cognitive deficits. Residents with prior HF were older, more likely to have hypertension, CAD and atrial fibrillation, and had more acute care visits prior to LTC admission, than those with no prior HF. Results of an echocardiogram were available for 69 (71%) of residents with prior HF, 67% of whom had a left ventricular ejection fraction greater than 40% (preserved ejection fraction).

Table 2 presents data from the admission clinical assessment. A "history of HF" and symptoms and signs of HF were more common in patients with prior HF. However, some were also common in residents without HF, such as peripheral edema, which was reported by almost 60% of residents without HF. Among residents without prior HF, 17.9% claimed such a history. There were no statistically significant differences in the prevalence of physical findings of peripheral edema and auscultatory rales between both groups. Jugular venous pressures (JVP) were generally in the normal range and third heart sounds infrequent, suggesting that most residents are clinically stable following LTC admission.

Table 3 presents diagnostic properties of elements from the admission clinical assessment pertinent to HF. The most useful item is "history of HF". Elements pertaining to dyspnea have more modest sensitivities and specificities; specificity generally rises while sensitivity falls with increasing dyspnea severity. Orthopnea and paroxysmal nocturnal dyspnea (PND) were relatively specific, though not very sensitive. In contrast, "history of peripheral edema" was sensitive, but non-specific. There are notable differences between the properties of elements derived from the LTC chart and those obtained from the resident/caregiver interview. For histories of peripheral edema and varying degrees of dyspnea, the sensitivity of chart-derived information is uniformly lower, and the specificity higher, than that of interview-derived information. However, differences are less marked for elements suggestive of severe HF, such as PND, orthopnea, or dyspnea at rest or when performing basic activities of daily living. With respect to physical findings, both auscultatory rales and peripheral edema had poor sensitivity and positive predictive value, and modest specificity and negative predictive values. The utility of the JVP and ausculton for a third heart sound was limited in this sample. Table 4 presents the utility of cardiovascular co-morbidities and admission medications with respect to a prior HF diagnosis. The absence of cardiovascular morbidities was associated with good to very good negative predictive values, particularly a history of CAD. The sensitivity and specificity of individual prescribed medications were modest, other than for digoxin, which appears to be specific for a prior HF diagnosis.

Logistic regression models were derived to determine which combination of elements from the admission assessment was most predictive of a prior HF diagnosis. Results are shown in Table 4. The final model includes histories of "HF", "fluid on the lungs", orthopnea, CAD, and the use of β-blockers and furosemide. The c-statistic was 0.910; the IDI method arrived at the same final model.

DISCUSSION

This study confirms the high prevalence of HF in LTC and the complexity of residents with this condition. Ensuring an accurate HF diagnosis during the transition of residents into LTC is crucial for optimal management of this condition. This study provides important information on the value of the admission assessment of new LTC residents in confirming a prior HF diagnosis. Our findings are consistent with other literature showing that features of HF can be non-specific in frail seniors.[19,21,32] For example, dyspnea, a cardinal symptom of HF, is only reported for 38.5% to 62.4% residents with prior HF.

We observed differences in the sensitivity and specificity of elements of the admission assessment depending on whether information was obtained from the resident chart or from resident/caregiver interview. Direct history was more sensitive but less specific than chart information for peripheral edema, orthopnea, and dyspnea, though differences were less marked for more severe symptoms such as resting dyspnea. These suggest discrepancy in the importance ascribed to HF symptoms by residents and by LTC staff recording observations in resident charts. Symptoms are experienced subjectively by patients, and thus LTC staff charting may be inherently sensitive to symptom identification than resident reporting. These data are consistent with a recently reported communication gap[33] between LTC staff and residents, either leading to under-reporting of mild symptoms by residents, or to staff erroneously dismissing milder symptoms as "normal aging". These data reinforce the critical importance of a thorough

history, including collection of collateral information, in order to accurately assess frail seniors with HF.[19]

That a "history of HF" is predictive of a prior HF diagnosis may seem self-evident, but it is an important finding given the uncertainty surrounding the accuracy of health information available to clinicians about new LTC residents. There are a number of explanations for this finding. Older persons with HF are often hospitalized repeatedly, experience functional decline, and ultimately discharged to LTC. [34-36] In our study, almost 60% of participants were admitted from acute care. It is therefore likely that because most new LTC residents with HF had a recent hospitalization, available clinical information was more reliable. Furthermore, all LTC residents in Ontario undergo standardized assessment using the RAI (Home Care) instrument prior to admission.[37] The RAI family of instruments have been shown to have a high positive predictive value for HF.[38]

Our data suggests that the idiom "fluid on the lungs" may be useful to explain HF to lay persons (www.heartfailure.org/eng_site/hf_lungs.asp). While the low sensitivity implies that the idiom is not universally used, the high specificity suggests that it is an effective descriptor. Specifically, using this idiom when interviewing a LTC resident/caregiver improves the predictive value of the assessment.

TABLE 1.
Baseline characteristics of LTC residents

Characteristic	No prior HF N = 352 (%)	Prior HF N = 97 (%)	p value
Age (in years)	83.8±6.5	85.9± 6.3	0.0048
Male	115 (32.7)	36 (37.1)	0.4122
Admitted from			0.0394
Hospital	160 (45.5)	58 (59.8)	
Home	130 (36.9)	28 (28.9)	
Retirement home/senior's residence	62 (17.6)	11 (11.3)	
No. of hospitalizations or ED visits in year prior to admission to LTC	1.3±1.2	1.9±1.5	0.0014
Cardiovascular history			
Hypertension	252 (71.6)	83 (85.6)	0.0051
Diabetes mellitus	87 (24.7)	28 (28.9)	0. 4070
Hyperlipidemia	132 (37.5)	43 (44.3)	0.2220
CAD	142 (40.5)	79 (81.4)	<0.0001
PVD	46 (13.1)	18 (18.6)	0.1744
CVD	165 (46.9)	50 (51.5)	0.4148
Atrial fibrillation	81 (23.0)	55 (56.7)	<0.0001
Echocardiogram available	109 (31.0)	69 (71.1)	<0.0001
LVEF > 50%	100 (91.7)	29 (29.9)	
LVEF 40%–50%	8 (7.3)	17 (17.5)	
LVEF 25%–40%	1 (0.9)	14 (14.4)	
LVEF <25%	0	5 (5.2)	
Co-morbidities			
Pulmonary disease	126 (35.9)	49 (51.0)	0.0071
Renal insufficiency[a]	47 (13.4)	37 (38.1)	<0.0001
Venous thromboembolic disease	27 (7.7)	15 (15.6)	0.0182
Mood disorder	141 (40.1)	33 (34.0)	0.2799
Anxiety disorder	73 (20.7)	22 (12.7)	0.6784
Dementia	236 (67.0)	48 (49.5)	0.0015
Parkinson's disease or related disorder	39 (11.1)	6 (6.2)	0.1553
Arthritis	235 (66.8)	73 (75.3)	0.1104
Osteoporosis or fragility fracture	199 (56.5)	49 (50.5)	0.2912
History of cancer	77 (21.9)	27 (27.8)	0.2180
Functional and neuropsychiatric measures			
MDS-Cog	3.6±2.6	2.9±2.6	0.0235
Barthel Index	10.9±5.4	10.7±5.3	0.7796
Cohen Mansfield Agitation Inventory	37.1±2.5	33.6±9.8	0.0040
Neuropsychiatric Inventory	7.5±11.7	5.5±9.9	0.1238

TABLE 1.
Continued

Characteristic	No prior HF N = 352 (%)	Prior HF N = 97 (%)	p value
Pharmacotherapy			
Total number of regularly scheduled medications	7.5±3.4	9.5±3.3	<0.0001
Angiotensin Converting Enzyme inhibitor	110 (31.3)	45 (46.4)	0.0055
Angiotensin receptor blocker	23 (6.5)	14 (14.4)	0.0122
β-blocker	79 (22.4)	46 (47.4)	<0.0001
Digoxin	24 (6.8)	24 (24.7)	<0.0001
Furosemide	83 (23.6)	64 (66.0)	<0.0001
Spironolactone	16 (4.5)	13 (13.4)	0.0017
Nitrates	72 (20.5)	52 (53.6)	<0.0001
Calcium channel blocker	75 (21.3)	21 (21.6)	0.9419
Vasodilators	2 (0.6)	3 (3.1)	0.0669
Antiplatelet agent	161 (45.7)	56 (57.7)	0.0364
Warfarin	46 (13.1)	36 (37.1)	<0.0001
Lipid-lowering agent[b]	86 (24.4)	32 (33.0)	0.0900

[a] Renal insufficiency is define as a calculated creatinine clearance < 60 mls/min, according to the Cockcroft-Gault equation.

[b] All residents on lipid lowering agents were receiving HMG-CoA reductase inhibitors, and one resident was also receiving treatment with a fibrate.

HF = heart failure; LTC = long-term care; ED = emergency department; CAD = coronary artery disease (history of myocardial infarction, angina/unstable angina, or history of coronary revascularization); PVD = peripheral vascular disease (history of intermittent claudication, revascularization, or abdominal aortic aneurysm); CVD = cerebrovascular disease (history of transient ischemic attack, stroke, or revascularization procedure); LVEF = left ventricular ejection fraction

TABLE 2.
Heart failure history, symptoms, and signs elicited at the baseline assessment either from
the resident/caregiver interview or from the LTC home chart review

Element of the LTC Admission Clinical Assessment	No HF (N=352)	HF (N=97)	p value
History of			
Heart failure	63 (17.9%)	85 (87.6%)	<0.0001
Fluid on the lungs	37 (10.5%)	49 (50.5%)	<0.0001
Peripheral edema	209 (59.4%)	82 (84.5%)	<0.0001
Orthopnea	63 (17.9%)	44 (45.4%)	<0.0001
Paroxysmal nocturnal dyspnea	34 (9.7%)	30 (30.9%)	<0.0001
Dyspnea on moderate activity	123 (35.0%)	59 (60.8%)	<0.0001
Dyspnea compared to peers	54 (15.4%)	37 (38.1%)	<0.0001
Dyspnea walking on a level surface	91 (25.9%)	59 (60.8%)	<0.0001
Dyspnea with activities of daily living	56 (16.0%)	49 (50.5%)	<0.0001
Dyspnea at rest	36 (10.3%)	35 (36.1%)	<0.0001
Physical findings by research nurse of			
Peripheral edema[a]	109/336 (32.4%)	34/85 (40.0%)	0.1886
Auscultatory rales	64/328 (19.5%)	26/91 (28.6%)	0.0626
Third heart sound	7/338 (2.1%)	4/89 (4.5%)	0.2516
Jugular venous elevation	2.5±0.8 cm (N=287)	2.6±1.2 cm (N=78)	0.5311

[a] Not all residents underwent a complete physical examination by the research nurses due to refusal to do so, limited cooperation, significantly limited bed mobility or inability to transfer, resulting in missing data.

TABLE 3.
Properties of individual elements of the admission clinical assessment to predict the diagnosis of HF

Element	From the Chart		From Resident History		Chart or Resident History				
	Sn	Sp	Sn	Sp	Sn	Sp	PPV	NPV	c-statistic
Admission assessment history of:									
HF	0.856	0.875	0.412	0.903	0.876	0.821	0.574	0.960	0.849
Fluid on the lungs	0.268	0.986	0.381	0.901	0.505	0.895	0.570	0.868	0.700
Peripheral edema	0.443	0.761	0.794	0.443	0.845	0.406	0.282	0.905	0.626
Orthopnea	0.175	0.977	0.381	0.827	0.454	0.821	0.411	0.845	0.637
PND	0.134	0.991	0.258	0.906	0.309	0.903	0.469	0.826	0.606
Dyspnea on moderate activity	0.021	0.974	0.608	0.664	0.608	0.650	0.324	0.857	0.629
Dyspnea compared to peers	0.010	0.989	0.381	0.855	0.381	0.846	0.407	0.832	0.614
Dyspnea walking on the level	0.278	0.926	0.526	0.766	0.608	0.741	0.393	0.872	0.674
Dyspnea with ADLs	0.237	0.937	0.402	0.889	0.505	0.840	0.467	0.860	0.673
Dyspnea at rest	0.216	0.957	0.227	0.915	0.361	0.897	0.493	0.836	0.629
Cardiovascular comorbidities:									
Coronary Artery Disease	0.763	0.644	0.660	0.735	0.814	0.595	0.357	0.921	0.705
Atrial Fibrillation	0.546	0.795	0.216	0.915	0.567	0.770	0.404	0.866	0.668
Hypertension	0.722	0.347	0.670	0.446	0.856	0.284	0.248	0.877	0.570
Diabetes mellitus	0.278	0.770	0.237	0.773	0.289	0.753	0.243	0.793	0.521
Physical findings by research nurse of:[a]									
Rales on auscultation	N/A	N/A	N/A	N/A	0.286	0.805	0.289	0.802	0.545
Peripheral edema	N/A	N/A	N/A	N/A	0.400	0.676	0.238	0.817	0.538
Third heart sound	N/A	N/A	N/A	N/A	0.876	0.040	0.204	0.636	0.511
Jugular venous elevation	N/A	N/A	N/A	N/A	0.051	0.983	0.444	0.792	0.517
Admission HF medications:									
Furosemide	N/A	N/A	N/A	N/A	0.660	0.764	0.435	0.891	0.712
ACE inhibitor	N/A	N/A	N/A	N/A	0.464	0.688	0.290	0.823	0.576
β-Blocker	N/A	N/A	N/A	N/A	0.474	0.776	0.368	0.843	0.625
Digoxin	N/A	N/A	N/A	N/A	0.247	0.932	0.500	0.818	0.590

[a] Not all residents underwent a complete physical examination by the research nurses due to refusal to do so, limited cooperation, significantly limited bed mobility or inability to transfer.

HF = heart failure; PND = paroxysmal nocturnal dyspnea; sn = sensitivity; sp = specificity; PPV = positive predictive value; NPV = negative predictive value; ADLs = activities of daily living; ACEi = angiotensin converting enzyme inhibitor; N/A = not applicable

Our data are consistent with other studies in older patients. Our findings that orthopnea and PND are specific but not very sensitive are similar to those from several community-based epidemiologic studies in the U.S. and Europe.[39-42] A systematic review of studies of the utility of signs and symptoms for detecting HF in primary care showed sensitivities of 29–47% and 44%, and specificities of 73–98% and 89%, for PND and orthopnea, respectively.[39] In contrast, our study found lower specificities for histories of peripheral edema and dyspnea, likely reflecting the non-specific presentation of HF in LTC residents. Physical findings of HF were infrequent in this sample and unhelpful for confirming a prior HF diagnosis, possibly reflecting the relative clinical stability of new LTC residents. These results do not negate the importance of these physical examination maneuvers when assessing acutely unwell residents.[43,44]

Cardiovascular co-morbidities were common in the entire sample. Not surprisingly, CAD and hypertension were relatively sensitive for a prior HF diagnosis,[18] though only CAD was included in the final model. Admission HF medications had poor to modest sensitivity for prior HF, consistent with their underuse in older patients.[45] The absence of HF medications from the admission drug profile makes a prior HF diagnosis less likely.

Our study has a number of strengths and limitations. Data were collected prospectively, and we obtained substantial clinical information from multiple sources to facilitate the confirmation of a prior HF diagnosis by two independent reviewers. This information is not readily available in usual practice. Though our procedures may have missed a small proportion of residents with mild HF who might never have been hospitalized, it is likely that the majority of those with prior HF were identified. The prevalence of HF in our sample

TABLE 4.
Results of the multivariate analysis to predict the diagnosis of HF based on admission clinical characteristics,
cardiovascular co-morbidities, and medication profile

Clinical Characteristic	Full Model		Reduced Model				
	AOR (95% CI)	p value	AOR (95% CI)	p value	c-statistic	IDI	p value
Admission assessment history of:							
HF	11.65 (4.55, 29.83)		13.66 (6.61, 28.24)	<0.0001	0.910	0.02	0.0682
Fluid on the lungs	1.96 (0.83, 4.65)	0.1254	2.01 (1.04, 3.89)	0.0373			
Peripheral edema	0.87 (0.30, 2.57)	0.8042					
Orthopnea	1.72 (0.69, 4.27)	0.2443	1.76 (0.93,3.33)	0.0834			
PND	1.03 (0.36, 2.92)	0.9599					
Dyspnea on moderate activity	0.62 (0.21, 1.84)	0.3920					
Dyspnea compared to peers	0.26 (0.07, 0.90)	0.0337					
Dyspnea walking on the level	3.17 (1.01, 9.90)	0.0475					
Dyspnea with ADLs	3.15 (1.07, 9.31)	0.0377					
Dyspnea at rest	0.72 (0.26, 2.02)	0.5336					
Cardiovascular comorbidities:							
Coronary Artery Disease	2.83 (1.12, 7.15)	0.0282	2.83 (1.42, 5.64)	0.0216			
Atrial Fibrillation	1.20 (0.50, 2.91)	0.6809					
Hypertension	0.85 (0.27, 2.66)	0.7752					
Diabetes mellitus	0.83 (0.33, 2.09)	0.6979					
Physical findings:[a]							
Rales on auscultation	0.88 (0.46, 1.69)	0.6988					
Peripheral edema	1.00 (0.54, 1.85)	0.9989					
Third heart sounds	1.19 (0.20, 7.01)	0.8445					
Jugular venous elevation	0.76 (0.08, 7.31)	0.8116					
Admission HF medications:							
Furosmide	3.70 (1.52, 9.02)	0.0040	2.11 (1.12, 3.98)	0.0216			
ACE inhibitor	1.20 (0.54, 2.64)	0.6575					
β-blocker	2.60 (1.15, 5.85)	0.0216	2.09 (1.10, 3.94)	0.0234			
Digoxin	1.41 (0.43, 4.59)	0.5716					

[a] Not all residents underwent a complete physical examination by the research nurses due to refusal to do so, limited cooperation, significantly limited bed mobility or inability to transfer.

AOR = adjusted odds ratio; CI = confidence interval; HF = heart failure; PND = paroxysmal nocturnal dyspnea; ADLS = activities of daily living; IDI = integrated discrimination improvement index

is consistent with that of a recent systematic review.[5] We relied on residents/caregivers to accurately recall their medical history, and LTC staff to identify and accurately document symptoms and signs among residents for whom they cared, limitations that reflect the clinical conditions under which Canadian LTC clinicians operate. Since the completion of this study, the indications for aldosterone antagonists in the care of HF with reduced ejection fraction have expanded.[18] While it is possible that this has translated into greater usage of this class of medications in the LTC setting, it is not clear whether this would improve upon the diagnostic accuracy of HF in LTC, given the limited utility of other HF medications in this regard. Finally, the average accrual rate for this study was lower than expected.[46] Recruitment required that potential participants be first contacted by LTC staff within six weeks of admission, a period of turmoil during which clinical and administrative priorities take precedent over

research studies. Recruitment difficulties were compounded by frequent turnover of LTC staff. Finally, nine LTC homes underwent significant expansion and were unable to participate in our study, but also diverted all new admissions from other participating homes for extended periods. Despite these concerns, clinical characteristics of residents enrolled in this study are similar to those from other studies,[7,9] providing reassurance as to the representativeness of the sample.

CONCLUSION

In summary, HF is prevalent LTC. Correctly diagnosing HF is crucial to ensure that affected residents receive optimal management. Our data suggest that the most useful indicator of a prior HF diagnosis in new LTC residents include histories of HF, fluid on the lungs, orthopnea, CAD, and use of loop diuretics and β-blockers. The transfer of health information during

the transition to LTC is problematic, and clinicians must rely on limited information upon which to formulate a diagnosis of HF. Our findings reinforce the importance of a thorough history, including collateral information from family caregivers, when assessing frail seniors upon admission to LTC.

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CONFLICT OF INTEREST DISCLOSURES

The authors declare that no conflicts of interest exist.

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