

Risk of Hospitalization in Long-Term Care Residents Living with Heart Failure: a Retrospective Cohort Study



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ABSTRACT

Background

Older adults living with heart failure (HF) in long-term care (LTC) experience frequent hospitalization. Using routinely available clinical information, we examined resident-level factors that precipitate hospitalization within 90 days of admission to LTC.

Methods

This was a retrospective cohort study of older adults diagnosed with HF, who were admitted to LTC in Ontario, Canada, between 2011 and 2013. Multivariate logistic regression models using generalized estimating equations were developed to determine predictors of hospitalization in residents with HF.

Results

Entry to LTC from a hospital was the strongest predictor of future hospitalization (OR: 8.1, 95% CI: 7.1–9.3), followed by a score of three or greater on the Changes in Health, End-stage Signs and Symptoms scale, a measure of moderate to severe medical instability (OR 4.2, 95% CI: 3.1–5.9). Other variables that increased the likelihood of hospitalization included being flagged as a high risk for falls, two or more physician visits, and increased monitoring for acute medical illness within 14 days of admission.

Conclusion

Our findings highlight that health instability and transitions from acute to LTC will increase the likelihood of transitioning back into the hospital setting. The identified predisposing factors suggest the need for targeted prevention strategies for those in high-risk groups.

Key words: heart failure, older adults, transitions of care, hospitalization, readmission, long-term care, nursing homes

INTRODUCTION

Heart failure (HF) is the primary cause of over 43,000 hospital visits per year, costing the Canadian acute care sector an estimated \$425.6 million.⁽¹⁾ Overall, 86% of HF-related hospitalizations are experienced by older adults aged 65 years and over.⁽²⁾ With age-adjusted mortality rates from cardiovascular disease declining and the population of older adults increasing,⁽³⁾ the projected burden of HF hospitalizations is expected to dramatically increase over the next few decades.⁽⁴⁾

Long-term care (LTC) plays a critical role in the care continuum of older adults with HF, who are often admitted following the loss of functional and cognitive independence.^(5,6) An estimated 15–21% of LTC residents live with HF,^(7,8) though this prevalence is expected to rise with 50,000 new cases diagnosed across the country per year.⁽⁹⁾ The risk of hospitalization significantly increases when older adults are admitted to LTC, with some researchers calling this phenomenon “the revolving door of rehospitalization from nursing homes”.⁽¹⁰⁾ In an observational study of over 15,000 Medicare beneficiaries in the United States, a third of residents with HF were hospitalized within 30 days of admission to LTC, and over 75% within a year of the admission to LTC.⁽¹¹⁾ This pattern is also evident in Ontario, Canada, where up to a third of newly admitted LTC residents with HF are transferred to hospitals within a year.⁽⁸⁾ There is growing consensus that a significant number of hospitalizations from LTC are preventable⁽¹²⁾ and costly,⁽¹³⁾ and can increase the likelihood of medical errors related to poor care coordination.⁽¹⁰⁾

Evidence-based guidelines for HF management have called for early identification and monitoring of residents at risk as one of many strategies to reduce hospital transfers from LTC.^(14–17) While there is a ubiquity of studies evaluating various interventions aimed at addressing this outcome

in LTC,^(18–22) little is known of the patient-level factors that predispose the transfer of residents with HF to hospital settings. There are several gaps in the existing research. One is the reliance on smaller samples that may not represent the overall LTC resident population living with HF. To our knowledge, only two Canadian studies examined individual factors associated with hospitalizations among newly admitted residents with HF.^(8,23) However, the authors of the first study sampled residents in three medium-sized urban centers in Southwestern Ontario, limiting the generalizability of the results at a provincial level.⁽⁸⁾ A recent study in three Canadian provinces showed the importance of health instability and frailty as critical drivers of acute care transfers among newly admitted LTC residents.⁽²³⁾ Secondly, information from surveys and medical chart audits is often used to examine the association between hospitalization and HF-management practices (e.g., treatment with angiotensin-converting enzyme (ACE) inhibitors or use of advanced directives).^(8,24,25) There is value in using information derived from routinely collected clinical assessments that capture the resident care journey, from the point of admission to discharge from the LTC setting. Creating a risk profile based on routinely available data sources may have wide applications for future hospitalization prevention strategies in clinical practice and at a health system level.^(7,26–28) Lastly, while predictors of 30-day outcomes and transitions have been extensively examined in older LTC residents with HF,^(29–31) examination of predictors over longer periods has been limited.

Therefore, the objective of this study is to follow a cohort of LTC residents in Ontario living with HF to determine the factors that predict their hospitalization within 90-days of their entry into LTC.

METHODS

We used a population-based, retrospective cohort study to examine predictors of hospitalization among adults aged 65 or older who were admitted to LTC homes in Ontario, between January 1st, 2011 and December 31st, 2013. Residents were included if they had an HF diagnosis as identified by ICD-10 codes beginning with ‘150’ or in the disease diagnoses section of their admission assessment. These included left ventricular, diastolic, and systolic heart failure. Hospitalization within 90 days was identified on the follow-up assessment that was completed 90 days after admission. We excluded residents with a ‘palliative’ designation as indicated in the assessment, or those who lacked a follow-up assessment due to death or early discharge. Palliative residents (n= 4) were excluded *a priori* from the study, as evidence shows that they experience disproportionately higher rates of transfer to the acute care in the last six months of life⁽³²⁾ compared to the general LTC population living with HF,⁽⁸⁾ which may bias our estimates. Ethical clearance for this study was obtained from the University of Waterloo’s Office of Research Ethics (ORE #19945).

Data Source

This study used data from the Continuing Care Reporting System (CCRS) maintained by the Canadian Institute for Health Information (CIHI). The CCRS data are based on the Resident Assessment Instrument 2.0 (RAI 2.0), routinely used to assess LTC residents in Ontario. Data were acquired through a data-sharing agreement between the University of Waterloo and CIHI. The RAI 2.0 provides a comprehensive assessment of residents’ physical, mental, and functional needs, as well as various dimensions of service delivery and utilization. It is completed by LTC staff overseeing the care of the resident at fixed intervals: at admission, every 90 days, and at discharge.^(33,34)

Theoretical Framework for Variable Selection

The Behavioral Model of Health Care Utilization provides a useful framework for examining the individual and contextual variables that predict hospitalization in LTC.⁽³⁵⁾ The model explores the relationship between predisposing, enabling, and need for care factors related to health-care utilization.⁽³⁵⁾ It has been applied extensively to structure and interpret the results of studies evaluating health-care use across different population groups,⁽³⁶⁾ and more specifically, acute-care use in older adults.⁽³⁷⁾ Adapting this model into a conceptual framework for our study objective (Figure 1), we hypothesized that hospitalization is dependent on a resident’s propensity for care utilization or their predisposing factors (e.g., age, gender, whether they are living alone), their ability to access care, or enabling factors (e.g., availability of services in LTC), and their need-for-care factors (e.g., perceived acuity of illness by resident or health professional).⁽³⁵⁾

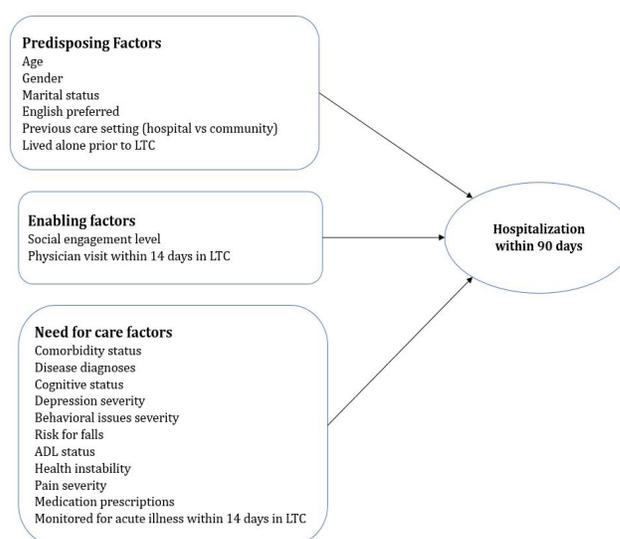


FIGURE 1. A conceptual model of factors associated with hospitalization in residents living with HF

Independent Variables

The selection of the independent risk factors was guided by prior literature that examined factors associated with hospitalization or readmission of older adults living with HF^(5,8,11,38–40) and residents living in LTC.^(18,26,41–47) Based on the Behavioral Model, a number of items from the RAI 2.0 were placed into three categories: enabling, predisposing, and need for care.⁽³⁵⁾ Predisposing care variables included: gender, age, marital status, previous care setting, and living status prior to LTC admission. Need-for-care variables included: number of comorbidities, common diagnoses, cardiovascular history, number of medications, and whether a resident was monitored for acute illness within 14 days of admission (defined as receiving specialized nursing care for a sudden or severe medical exacerbation).

To examine the association of hospitalization with residents' physical, mental, and social status at admission, items on the RAI 2.0 were combined into summary scales across various health domains. These variables fell under the need-for-care category and included: the Aggressive Behaviour Scale (ABS), a 12-point measure of the frequency and level of aggressive behavior;⁽⁴⁸⁾ the Activities of Daily Living Hierarchy Scale (ADL), a 6-point measure of the stage of functional disability;⁽⁴⁹⁾ the Changes in Health, End-stage, Signs and Symptoms scale (CHESS), a 5-point measure of medical instability, previously shown to be predictive of mortality;^(27,50) the Depression Rating Scale (DRS), a 7-point measure indicative of possible depression symptoms;⁽⁵¹⁾ the Cognitive Performance Scale (CPS), a 6-point index of impaired cognitive performance;⁽⁵²⁾ the Pressure Ulcer Risk Scale (PURS), an 8-point scale that is predictive of a resident's risk of developing a pressure ulcer;⁽⁵³⁾ and the Pain Scale (PS), a 3-point validated instrument assessing pain levels in LTC.⁽⁵⁴⁾

A select number of Clinical Assessment Protocols (CAPs) from the RAI 2.0 were also included as need-for-care variables and potential predictors of hospitalization. The CAPs were designed to assist clinicians with identifying residents at risk of poor outcomes on various domains of health and well-being, and can be used to guide care planning.⁽⁵⁵⁾ When a CAP is triggered, the assessor is alerted of specific clinical issues that could be amenable to early interventions.⁽⁵⁶⁾ For this study, CAPs items capturing the risk of falls and inappropriate medication were included, as they were both shown to increase the risk of hospitalizations and emergency department visits.^(43–46,57)

Finally, enabling care variables included scores on the Index of Social Engagement, a 6-point measure of the level of engagement in the social life of LTC home,⁽⁵⁸⁾ and whether a resident received a physician visit within 14 days of admission. These variables were hypothesized to play a protective role in preventing the need for hospitalization.

Outcome Measure

Our outcome of interest was whether a resident was hospitalized at least once within 90 days of admission to LTC, as captured by the RAI 2.0 assessments.

Statistical Analysis

We summarized the baseline demographic and clinical information of residents with HF using means and standard deviations for continuous measures, and frequencies and percentages for categorical measures. Predictors of hospitalization among residents with HF were identified through logistic regression analysis, using generalized estimating equations (GEE). Bivariate analyses were first conducted to identify variables that were significant at a probability of $p < .05$ for consideration in the multivariate modeling. Next, multivariate GEE models were developed, controlling for clustering or similarities in resident characteristics due to LTC facility level factors. In our sample, two residents living with HF in one facility may receive similar type of care, which may result in similarities in some variables. Therefore, we controlled for this using the LTC facility code as the clustering variable.⁽⁵⁹⁾ Using stepwise regression, variables identified from the bivariate analysis were individually added to the model and retained if they showed statistical significance. The effect size of each independent variable was evaluated using odds ratios (ORs) and 95% confidence intervals (CIs). The goodness of fit of the model was examined using the Akaike Information Criterion (AIC), where the model with the optimal value—that is to say, the lowest value—was selected.⁽⁶⁰⁾ All statistical analyses were performed using SAS, Version 9.2 (SAS Institute Inc., Cary, NC).

RESULTS

Resident Characteristics at Admission

There were 48,601 residents admitted to LTC in Ontario between 2011 and 2013; of these, 12.3% ($n=5,977$) were diagnosed with HF. Table 1 and Table 2 show the baseline characteristics and clinical scores of residents at admission to LTC. Residents with HF were predominantly female, widowed and/or single, 85 years and older, and more frequently admitted from the community vs. the hospital (56.3% vs. 43%). They also had a high number of comorbidities (6.5 ± 2.4) and polypharmacy (11.9 ± 4.6 medications), commonly defined by a cut-off of 5 or more daily prescription medications.⁽⁶¹⁾ One in four were diagnosed with dementia at admission, while one in five were diagnosed with depression. While residents experienced moderate to high levels of social engagement at admission to LTC, 20% were found to be socially withdrawn. Use of antipsychotics and antidepressant medications was found to be common in the population (23.3% and 41.8%, respectively). They also showed significant functional limitations, with 69.9% of the residents receiving scores of 3 and above on the ADL Hierarchy Scale. Though 50.9% of the residents showed low levels of health instability (as indicated by a CHESS score of 3 or less), 6.6% experienced moderate to high levels of instability. Seventy-four per cent were at risk of developing pressure ulcer sores at admission and reported

TABLE 1.

Demographic and clinical characteristics of LTC residents living with HF

| <i>Clinical Characteristic</i> | <i>HF</i> <i>(n=5,977)</i> | |
|--------------------------------------|-------------------------------|------------|
| | <i>%</i> | <i>(n)</i> |
| Female | 67.9 | 4072 |
| Age | | |
| 65-74 years | 6.1 | 364 |
| 75-84 years | 30.6 | 1835 |
| 85+ years | 63.4 | 3802 |
| Married | 25.1 | 1505 |
| Admitted from hospital | 43 | 2579 |
| Admitted from community | 56.3 | 3376 |
| Preferred language is English | 81.9 | 4912 |
| Cardiovascular history | | |
| Hypertension | 65.8 | 3946 |
| Deep vein thrombosis | 1.6 | 96 |
| Arteriosclerotic heart disease | 21.8 | 1307 |
| Cardiac dysrhythmias | 16.2 | 972 |
| Other cardiovascular diseases | 23.5 | 1409 |
| Diseases | | |
| Diabetes mellitus | 31.1 | 1864 |
| Arthritis | 45.9 | 2753 |
| Alzheimer's | 10.8 | 648 |
| Dementia | 41.8 | 2507 |
| Depression | 22.4 | 1343 |
| Cancer | 11 | 660 |
| Renal failure | 17.8 | 1067 |
| Risk of falls | 18.4 | 1100 |
| Risk of bowel incontinence | 21.9 | 1309 |
| Risk of inappropriate medication use | 15.7 | 938 |
| Symptoms | | |
| Edema | 21.9 | 1313 |
| Shortness of breath | 17.4 | 1043 |
| Syncope | 0.22 | 13 |
| Unsteady gait | 45.7 | 2741 |
| Chest pain | 1.74 | 104 |
| Psychotropic Medications | | |
| Anti-psychotics | 23.3 | 1397 |
| Anti-depressants | 41.8 | 2507 |
| Anti-anxiety | 14.4 | 864 |
| Service utilization | | |
| Monitored for acute illness | 37.2 | 2231 |
| Number of physician visits | | |
| 0 | 17.8 | 1067 |
| 1 | 52.7 | 3160 |
| 2 | 22.6 | 1355 |
| 3 ≥ | 6.9 | 414 |

LTC = long-term care; HF = heart failure.

TABLE 2.

Clinical scale scores among residents with HF

| <i>Scale</i> | <i>HF</i> <i>(n=5,977)</i> | |
|--------------------------------------|-------------------------------|------------|
| | <i>%</i> | <i>(n)</i> |
| Cognitive Performance Scale | | |
| 0 | 19.4 | 1,165 |
| 1-2 | 41.6 | 2,494 |
| 3-4 | 31.0 | 1,856 |
| 5-6 | 8.1 | 483 |
| ADL Hierarchy | | |
| 0 | 6.3 | 376 |
| 1-2 | 24.2 | 1,446 |
| 3-4 | 42.7 | 2,553 |
| 5-6 | 26.8 | 1,602 |
| Depression Rating Scale | | |
| 0 | 42.6 | 2,543 |
| 1-2 | 32.7 | 1,955 |
| 3+ | 24.7 | 1,478 |
| CHESS | | |
| 0 | 42.4 | 2,536 |
| 1-2 | 50.9 | 3,044 |
| 3+ | 6.6 | 397 |
| Aggressive Behavior Scale | | |
| 0 | 67.1 | 4,012 |
| 1-4 | 27.6 | 1,652 |
| 5+ | 5.2 | 313 |
| Social Engagement Scale ^a | | |
| 0-1 | 19.6 | 1,171 |
| 2-4 | 55.3 | 3,302 |
| 5-6 | 25.2 | 1,504 |
| Pain Scale | | |
| 0 | 52.7 | 3,148 |
| 1-2 | 44.5 | 2,660 |
| 3 | 2.8 | 169 |
| Pressure Ulcer Scale | | |
| 0.1667 in | 25.9 | 1,547 |
| 1-2 | 41.9 | 2504 |
| 3-4 | 27.8 | 1,661 |
| 5-6 | 4.4 | 265 |

^aExcept for the Social Engagement Scale, a score of zero on the clinical scales indicate 'intact', while higher scores indicate greater severity of the condition. Higher scores on the Social Engagement Scale indicate greater engagement in social activity and interaction. HF = heart failure; ADL = activities of daily living; CHESS = Changes in Health, End-stage Signs and Symptoms scale.

living with moderate to high levels of pain (47%). Over a third of residents were monitored for acute illness (37.2%), and a majority had at least one physician visit (82.2%) within the first 14 days of admission.

Predictors of Hospitalization (bivariate analysis)

The rate of hospitalization within 90 days of admission to LTC among residents with HF was 36.2%. In the bivariate analysis, the strongest predisposing factor was admission into LTC from the hospital setting, increasing the likelihood of subsequent hospitalization by 8.5 times (95% CI = 7.49–9.54). Living alone prior to admission to LTC was also found to increase risk of hospitalization by 1.35 times (95% CI = 1.17–1.56). On the other hand, admission to the LTC from the community was found to be 8.33-fold protective at the bivariate level (95% CI = 7.1–9.1). Enabling factors such as high levels of social engagement were found to significantly reduce the odds of hospitalization by 1.56 times (95% CI = 1.96–1.27). Even though physician visits within 14 days of admission were initially hypothesized to be protective, residents receiving two and three or more visits were found to have higher likelihood of hospitalization, with ORs of 1.58 and 1.99, respectively. A number of need-for-care factors were found to be independently associated with subsequent hospital admission. These included being monitored for acute illness within 14 days of admission, being flagged as high risk for falls and for inappropriate medication use, medium to high levels of functional impairment, and exhibiting symptoms of depression. Within this category, high levels of health instability as measured by CHESS was found to have the strongest relationship with hospitalization (O.R.: 6.87; 95% CI = 5.43–8.69). Detailed bivariate results and respective ORs are available in Table 3.

Predictors of Hospitalization (multivariate analysis)

Figure 2 shows a summary of the final logistic regression model using GEE. At the multivariate level, residents who were previously admitted to LTC from a hospital setting remained at the highest risk for hospital transfers (OR: 8.09, 95% CI: 7.05–9.29). This was followed by those who showed moderate to high levels of medical instability at admission, with a CHESS score of 3 or greater (O.R 4.24, 95% CI: 3.07–5.85). Residents monitored for acute illness within 14 days of LTC admission were about 1.5 times more likely to be hospitalized (O.R 1.45, 95% CI: 1.26–1.67). Furthermore, compared to residents who had no physician visits within 14 days of admission, there was a slight incremental risk of hospitalization with every additional number of visits received. Residents identified at high risk of falls were approximately twice as likely to be hospitalized than those with no falls risk (95% CI: 1.47–2.50). Predisposing and enabling factors, such as admission to LTC from the community and high levels of social engagement (both significant at the bivariate analysis), were not statistically significant in the final multivariate

regression model. For further information on the values of the regression results, please refer to Table 4.

DISCUSSION

In our study, one in three residents living with HF in Ontario was hospitalized within 90 days of admission into LTC. Residents entering LTC from a hospital were at greatest risk of subsequent readmission, emphasizing the importance of this care transition as a predisposing factor for future hospitalization. Our results are confirmed by other large scale studies of skilled nursing facilities in the United States that found that previous hospitalizations were strong predictors for readmission within 30 days and 180 days of admission to LTC.^(8,23,47) This risk factor is particularly notable, given that 43% individuals living with HF entered LTC from a hospital setting. Prior hospitalizations and admission to LTC from a hospital setting may reflect the complexities of the residents' health status. Complex comorbidities, polypharmacy, issues in cognition, and ADL limitations are more prevalent in older adults hospitalized with HF, compared to those who are not.^(5,8,11,38,39) A large Canadian cross-sectional study showed that HF affected at least 20% of hospitalized patients awaiting transfer to LTC, and that rates of health instability were 2 to 3 times higher than those of similar patients in home care.⁽⁶²⁾ These findings suggest these patients may be at a disadvantaged health trajectory prior to LTC admission.

Once in LTC, health instability can result in further complexity when caring for LTC residents. A minority of residents was found to have moderate to high health instability based on their CHESS scores; however, these residents had the second highest odds of hospitalization. There are several possible explanations for why residents with high CHESS scores were at greater risk of hospitalization. The CHESS scale considers recent declines in functional and cognitive capacity, edema, shortness of breath, vomiting, weight loss and reduced food or fluid intake, and end-stage disease.^(50,63) Therefore, it can reflect health instability related to a combination of potentially reversible conditions (e.g., HF) and irreversible conditions (e.g., frailty).⁽¹⁷⁾ Early identification and optimal management of HF in residents experiencing health instability can help prevent further exacerbations and thus maintain their functional capacity and quality of life, or alternatively, appropriate end-of-life measures can be put in place.⁽²³⁾

Initiatives to reduce readmission and improve care transitions for older adults living with HF are increasingly examining the role of early physician follow-up and monitoring for potential exacerbations.^(40,31) Our results showed that 37% of residents with HF were being actively monitored for acute illness at admission to LTC. While this factor indicated need for care in our adaptation of the Behavioral model, we expected that receiving medical attention from the point of entry into LTC would reduce the likelihood of hospitalization; yet, our results showed this was not the case. The majority of our sample received at least one physician visit within

TABLE 3.
Bivariate logistic regression analysis examining admission characteristics that predict hospitalization in LTC residents living with HF in Ontario (n=5,300)

| <i>Clinical Characteristic</i> | <i>Odds Ratio (SE)</i> | <i>95% Confidence Interval</i> | <i>p value</i> |
|--|------------------------|--------------------------------|----------------|
| Age, 85+ years | 0.78 (0.11) | 0.63–0.97 | .03 |
| Female | 1.49 (0.67) | 0.40–5.57 | .55 |
| Married | 1.11 (0.061) | 0.99–1.26 | .08 |
| English | 0.92 (0.14) | 0.69–1.21 | .53 |
| Admitted from hospital | 8.45 (0.06) | 7.49–9.54 | <.0001 |
| Admitted from community | 0.12 (0.06) | 0.11–0.14 | <.0001 |
| Lived alone | 1.35 (0.07) | 1.17–1.56 | <.0001 |
| Cardiovascular history | | | |
| Chest pain | 1.31 (0.21) | 0.86–1.99 | .2 |
| Dizziness | 1.29 (0.14) | 0.99–1.69 | .061 |
| Edema | 1.39 (0.06) | 1.22–1.57 | <.0001 |
| Syncope | 0.79 (0.60) | 0.24–2.6 | .69 |
| Unsteady gait | 1.26 (0.05) | 1.14–1.41 | <.0001 |
| Number of Medications | | | |
| 1-3 | 5.43 (0.76) | 1.26–23.41 | .02 |
| 4-5 | 3.89 (0.75) | 0.89–16.98 | .07 |
| 7+ | 4.42 (0.75) | 1.02–19.13 | .05 |
| Comorbidities, 7+ | 0.62 (1.41) | 0.04–9.93 | .74 |
| Anti-depressant | 1.26 (0.05) | 1.13–1.40 | <.0001 |
| Anti-anxiety | 1.17 (0.076) | 1.01–1.35 | .04 |
| Anti-psychotic | 1.19 (0.06) | 1.05–1.34 | .0068 |
| Number of physician visits, 2 | 1.58 (0.09) | 1.33–1.87 | <.0001 |
| Number of Physician visits, 3± | 1.99 (0.12) | 1.58–2.52 | <.0001 |
| Monitored for acute illness | 2.06 (0.06) | 1.85–2.30 | <.0001 |
| Medium risk for falls | 1.39 (0.8) | 1.18–1.62 | <.0001 |
| High risk for falls | 1.93(0.10) | 1.56–2.38 | <.0001 |
| Risk of bowel incontinence | 1.78(0.11) | 1.45–2.9 | <.0001 |
| Risk of inappropriate medication use | 2.36 (0.08) | 2.03–2.74 | <.0001 |
| Cognitive performance scale^a | | | |
| 1-2 | 1.07 (0.07) | 0.92–1.24 | .38 |
| 3-4 | 1.19 (0.08) | 1.02–1.38 | .03 |
| 5-6 | 1.06 (0.11) | 0.85–1.32 | .63 |
| ADL scale^a | | | |
| 0.1667 in | 1.25 (0.14) | 0.96–1.63 | .09 |
| 3-4 | 1.89 (0.13) | 1.47–2.43 | <.0001 |
| 5-6 | 2.76 (0.13) | 2.13–3.57 | <.0001 |
| Depression Rating Scale^a | | | |
| 1-2 | 1.40 (0.06) | 1.24–1.59 | <.0001 |
| 3+ | 1.52 (0.07) | 1.33–1.73 | <.0001 |
| CHESS scale^a | | | |
| 1-2 | 1.76 (0.058) | 1.57–1.97 | <.0001 |
| 3 or greater | 6.87 (0.12) | 5.43–8.69 | <.0001 |
| ABS scale | | | |
| 1-4 | 1.19 (0.06) | 1.06–1.35 | .003 |
| 5+ | 1.07 (0.12) | 0.84–1.36 | .57 |
| Social engagement scale | | | |
| 1-2 | 0.92 (0.11) | 0.74–1.14 | .43 |
| 3-4 | 0.79 (0.11) | 0.65–0.98 | .03 |
| 5-6 | 0.64 (0.11) | 0.51–0.79 | <.0001 |

TABLE 3.
Continued

| Clinical Characteristic | Odds Ratio (SE) | 95% Confidence Interval | p value |
|-----------------------------------|-----------------|-------------------------|---------|
| Pain scale | | | |
| 1-2 ^a | 1.27 (0.05) | 1.14–1.41 | <.0001 |
| 3 | 1.64 (0.16) | 1.19–2.24 | .0019 |
| Pressure ulcer scale ^a | | | |
| 1-2 | 1.91 (0.07) | 1.65–2.20 | <.0001 |
| 3-4 | 2.92 (0.78) | 2.51–3.40 | <.0001 |
| 5+ | 4.07 (0.14) | 3.11–5.33 | <.0001 |

^aWith the exception of the social engagement scale, score of zero on the clinical scales indicate 'intact' while higher scores indicate greater severity of the condition

LTC= long-term care; HF= heart failure; SE = standard error; ADL= activities of daily living; CHES= Changes in Health, End-stage Signs and Symptoms scale; ABS= aggressive behaviour scale.

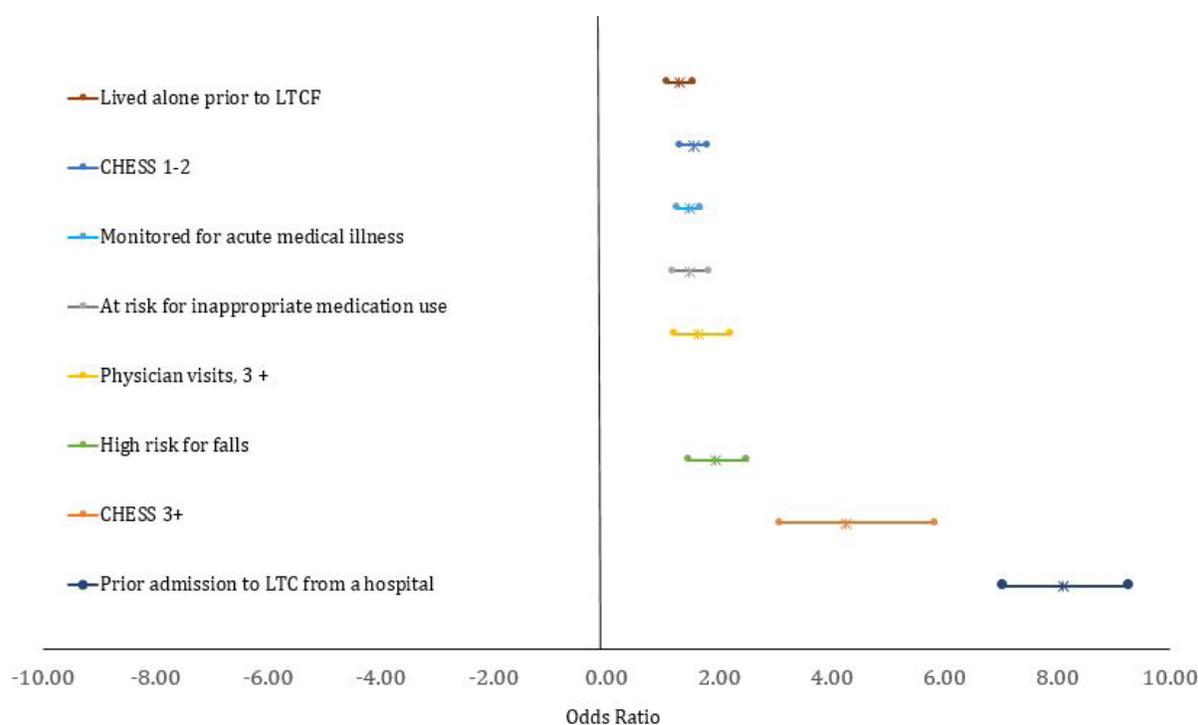


FIGURE 2. Forest plot showing results of multivariate logistic regression analysis of factors that increased risk of hospitalization of residents with HF within the 90-day follow-up

14 days of LTC admission (82.2%), yet this was also found to predispose hospitalization. While not all HF hospitalizations are preventable,⁽⁶⁴⁾ guideline-based management can improve outcomes for LTC residents with HF.⁽¹⁷⁾ However, barriers to optimal HF care include inadequate knowledge about the detection and management of HF residents among all LTC clinical staff, including personal support workers, ineffective interprofessional education, and lack of access to specialists.^(65–67)

Despite the availability of clinical decision-making support tools for assessing the clinical appropriateness of hospitalization

in LTC,^(47,68) they are not widely implemented across Ontario.⁽⁶⁹⁾ Indeed, in our study and many others examining hospitalization in older adults living with HF, a major limitation is the lack of distinction of avoidable admission from those that are unavoidable.^(11,38,70) While our analysis did not include contextual care factors (e.g., implementation of advanced directives and prescription of HF-pharmacotherapy), others have found them to be significantly preventative of hospitalizations in residents with HF.^(8,25,71) The nature of the RAI MDS data also limited our ability to characterize the cause, timings, and frequency of the hospitalizations, potentially confounding our

TABLE 4.

Multivariate logistic regression results predicting hospitalization within 90 days of admission to LTC among residents living with HF in Ontario^a (n=5,300)

| <i>Clinical characteristic</i> | <i>Odds Ratio (SE)</i> | <i>95% Confidence Interval</i> | <i>p value</i> |
|--|------------------------|--------------------------------|----------------|
| CHESS score, 1-2 | 1.53 (0.08) | (1.31–1.79) | <.0001 |
| CHESS score, 3 or greater | 4.24 (0.16) | (3.07–5.85) | <.0001 |
| Risk of inappropriate medication use | 1.47 (0.11) | (1.18–1.82) | .0005 |
| Medium risk of falls | 1.24 (0.10) | (1.00–1.50) | .0487 |
| High risk of falls | 1.92 (0.14) | (1.47–2.50) | <.0001 |
| Monitored for acute illness | 1.45 (0.07) | (1.26–1.67) | <.0001 |
| Number of physician visits, 1 | 1.31 (0.094) | (1.09–1.58) | .0042 |
| Number of physician visits, 2 | 1.43 (0.10) | (1.16–1.77) | .0010 |
| Number of physician visits, 3 or greater | 1.63 (0.15) | (1.21–2.20) | .0013 |
| Antidepressant use | 1.16 (0.07) | (1.01–1.33) | .0343 |
| Admitted from hospital | 8.09 (0.07) | (7.05–9.30) | <.0001 |
| Lived alone prior to LTC admission | 1.29 (0.09) | (1.08–1.54) | 0.0055 |

^aTo understand the relative predictive accuracy of the model, we ran a standard logistic regression model to obtain a c-statistic. The model had a c-statistic of 0.809, suggesting high sensitivity for accurately predicting hospitalization in residents living with HF.

LTC = long-term care; HF = heart failure; SE = standard error; CHESS = Changes in Health, End-stage Signs and Symptoms scale (ranges from 0 to 6, with higher scores indicating greater health instability).

results. Evaluating the outcome in shorter time intervals, such as 30- and 60 days following admission, as part of sensitivity analysis, would be helpful in determining risk factors and vulnerabilities across the disease trajectory in LTC.

CONCLUSION

Previous research on factors associated with hospitalization among LTC residents living with HF has focused on clinical markers and HF-specific processes of care. Few studies have used routinely collected administrative data to characterize factors that precipitate hospital transfers in this population from the point of admission. The results of this study expand the focus from a disease-specific lens in understanding hospitalization from LTC through suggesting multiple areas of focus, including functional, cognitive, and health instability factors, as well as early service utilization patterns in residents with HF. With reducing hospital readmissions in chronic conditions such as HF highlighted as a provincial priority,⁽⁷²⁾ there exist substantial opportunities to apply existing assessment tools, such as the RAI tools, which are embedded across the health system in order to promote more individualized and proactive care.⁽²⁷⁾ Creating risk profiles using interoperable and widely available tools can be a crucial step towards proactively managing residents at risk of transfers and for improving informational continuity during care transitions.

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CONFLICT OF INTEREST DISCLOSURES

The authors declare that no conflicts of interest exist.

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