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Do premorbid characteristics of home care clients predict delayed discharges in acute care hospitals: a retrospective cohort study in Ontario and British Columbia, Canada

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ABSTRACT

Background Improved identification of patients with complex needs early during hospitalisation may help target individuals at risk of delayed discharge with interventions to prevent iatrogenic complications, reduce length of stay and increase the likelihood of a successful discharge home.

Methods In this retrospective cohort study, we linked home care assessment records based on the Resident Assessment Instrument for Home Care (RAI-HC) of 210 931 hospitalised patients with their Discharge Abstract Database records. We then undertook multivariable logistic regression analyses to identify preadmission predictive factors for delayed discharge from hospital.

Results Characteristics that predicted delayed discharge included advanced age (OR: 2.72, 95% CI 2.55 to 2.90), social vulnerability (OR: 1.27, 95% CI 1.08 to 1.49), Parkinsonism (OR: 1.34, 95% CI 1.28 to 1.41) Alzheimer's disease and related dementias (OR: 1.27, 95% CI 1.23 to 1.31), need for long-term care facility services (OR: 2.08, 95% CI 1.96 to 2.21), difficulty in performing activities of daily living and instrumental activities of daily living, falls (OR: 1.16, 95% CI 1.12 to 1.19) and problematic behaviours such as wandering (OR: 1.29, 95% CI 1.22 to 1.38).

Conclusion Predicting delayed discharge prior to or on admission is possible. Characteristics associated with delayed discharge and inability to return home are easily identified using existing interRAI home care assessments, which can then facilitate the targeting of pre-emptive interventions immediately on hospital admission.

Strengths and limitations of this study

- ► To the best of our knowledge, this is the first study to use premorbid data from comprehensive home care assessments to predict transitional outcomes (ie, alternate level of care, delayed discharge) in acute care hospitals.
- ► We used about 7 years (2009–2015) of linked clinical and administrative data to follow 210 931 home care patients with episodes of care involving acute hospitalisation, with no loss to follow-up.
- ► Due to the widespread international use of interRAI assessment instruments, there is great potential for applicability to home care and acute care settings in other regions.
- ► Limitations include inconsistent eligibility criteria and operationalisation of the alternate level of care (ALC) concept, lack of standardisation in assessing ALC and delays in discharge across Canada.

BACKGROUND

Healthcare systems around the world grapple with delayed discharges from acute hospitals.[1 2] Delayed discharge (or the term alternate level of care (ALC)) refers to patients who have completed their care episode, but remain in an acute care facility because no other care setting is available.[3–5] Approximately 85% of all ALC patients are 65 years or older.[6 7] Many of these patients are frail older adults requiring restorative care (rehabilitative process focused on assisting patients to regain independence, psychosocial functioning and improved quality of life at their own pace),[4 8 9] however whose prolonged stays in acute care hospitals further increase their risk of hospital-acquired iatrogenic complications like delirium,[10] deconditioning and functional decline.[4 5 11–16] Cognitive impairment is a particularly important factor, both as a potential cause and as a consequence of delayed discharge.[8 9 13 17–19] More so, such acute episodes and hospitalisations are considered important stressors that could lead to disability in older adults.[20]

In Canada, about 43% of patients with delayed discharges are eventually placed in long-term care facilities (LTC), 27% are discharged home, 13% go to rehabilitation facilities and about 12% die while

waiting in hospitals.[19] Characteristics of patients with a delayed discharge designation have been described, many of which are often present prior to the hospitalisation, including functional impairment, complex health needs, cognitive impairment, falls, behavioural challenges, morbid obesity, social vulnerability and advanced aged.[4 8 18 21 22] By identifying these characteristics early in the course of a hospital stay, patients at risk of delayed discharge could receive targeted and pre-emptive interventions such as specific Elder Friendly interventions like Hospital Elder Life Program,[23] physiotherapy or geriatric assessment.[24–27] Realising the existing limited capacity in providing geriatric care within a fragmented healthcare system,[28] it has become more imperative to be deliberate about deploying scarce resources. Proactive case-finding and multifaceted interventions must become the first point of call instead of waiting till after complications arise, as may be the norm in different places.[28 29]

Provinces in Canada manage and regulate healthcare services for older adults through regional or local health authorities at the local level. These authorities are known as Local Health Integration Networks and Regional Health Authorities in Ontario and British Columbia, respectively. They oversee the delivery of home and community care services, as well as facility-based long-term care. They also regulate mandated assessments, evaluate needs and eligibility of clients and contract care delivery services to home care agencies or LTCs.[30] Case managers or placement coordinators who are either stationed in the community or at hospitals evaluate the needs of potential home care or long-term care clients and coordinate their referrals accordingly.[30]

One group of patients at increased risk for hospitalisation and vulnerable to delayed discharge is long-stay home care clients, who are often frail with complex health needs and comorbid illnesses.[31–33] Long-stay home care clients are those who usually require 60 days or more of supportive or maintenance level care.[30] In Canada and many other countries, these home care clients are assessed using standardised instruments such as the interRAI Home Care (interRAI HC) to identify and respond to their complex needs and priorities.[34]

Improving the transition between community and the acute care sector includes making this information available to hospitals early during a hospitalisation, thus facilitating the targeting of interventions to mitigate the risk of delayed discharge. Our study aimed to identify premorbid demographic and clinical characteristics of long-stay home care clients that were associated with delayed discharge after admission to the acute care setting.

METHODS

Data source

In this retrospective study, we linked records from two data sets maintained by the Canadian Institute of Health Information, the acute care Discharge Abstract Database (DAD) and the Home Care Reporting System.[35 36] The Home Care Reporting System is based on the earlier version of the interRAI HC known as the Resident Assessment Instrument for Home Care (RAI-HC), which is a validated standardised clinical assessment tool used to identify the strengths, preferences and needs of persons receiving home care.[30–32] In addition to over 300 individual data elements, the RAI-HC assessment includes algorithms to trigger care planning interventions in 20 domain areas and clinical outcome scales[33] such as the Changes in Health, End-Stage Disease, and Signs and Symptoms (CHESS) Scale to measure health instability,[34 35] the Cognitive Performance Scale (CPS) to measure cognitive function,[36] a Pain Scale measuring the frequency and severity of pain,[37] measures of functional status including Activities of Daily Living Hierarchy (ADLH) Instrumental Activities of Daily Living (IADL) difficulty scales[38 39] and a Frailty Index.[40 41] In addition, the RAI-HC provides data for a decision-support algorithm to inform the allocation of home care and long-term care services known as the Method for Assigning Priority Levels (MAPLe).[42]

Patient and public involvement

Patients or the public were not involved or invited to comment on the study design and were not consulted to develop any patient-centred outcomes or interpret the results. Patients or the public were not involved in writing or editing of this document for readability or accuracy.

Sample and procedure

We identified RAI-HC assessments done for clients from Ontario and British Columbia between January 2009 and March 2015. The assessments are completed during a client's admission to a home care programme and usually reassessed every 6 months, during revisions to care plan and as needed based on client type, needs and outcomes.[30]

These home care records were matched using health card numbers and hospital admission identifiers and only those patients and episodes whose most recent hospital admission occurred within 6 months after RAI-HC assessment were retained. This time frame was chosen to reflect the period for which assessments are meant to inform clinical responses to patients' needs before reassessment. About 42% of the patients were assessed within 30 days of acute hospital admission, and about 58% were assessed within 31 or more days of acute hospital admission. The mean and median intervals between assessments and index acute hospital admission were 57 days and 41 days, respectively. For patients with multiple admissions, we retained only data from the first hospitalisation after the RAI-HC assessment. Through this approach, we identified 210 931 unique long-stay home care patients.

Outcome

We used ALC designation as a proxy for delayed discharge in this analysis and from hereon we use the term ALC when referring to delayed discharge. The primary outcome of our study was the designation of ALC status indicating that the patient has been declared 'medically discharged'

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but remained in hospital awaiting actual discharge to another destination that provides a more appropriate level of care.[3–5] A primary care team member or the most appropriate clinical staff assesses and documents ALC status as any additional day/days a patient occupies a bed in that facility when they no longer require acute levels of resource intensity in a hospital.[37] This ALC designation is recorded in the hospital DAD abstract as the number of ALC days with one being the minimum. During the acute care episode, the need and appropriateness of ALC are constantly assessed on designation and final documentation is completed on discharge when a more appropriate discharge destination has been secured. In this study, ALC status was coded as Yes (1 or more ALC days) or No (0 ALC days).

Independent variables

We selected potential predictors of ALC based on a comprehensive literature review and expert input from clinician coauthors. The candidate variables included demographic characteristics (eg, age, marital status, gender), selected diagnoses, health conditions (eg, history of falls, pain, health instability, behaviour) caregiver characteristics, resource utilisation and medication use. We also created a social resource composite variable based on a count of social resources identified in the RAI-HC, including marital status, caregiver availability, caregiver living status, spousal caregiver and absence of caregiver distress. Each resource is assigned a value of 1 and combined in a cumulative manner to reflect the number of resources a patient has. The count of social resources is represented in a scale format as low (0–2) to high (3–5). The Assessment Gap (interval between RAI-HC assessment and index hospital admission) is also included and is coded as a binary variable (0–30 days; 31+ days). RAI-HC scales and outputs included as independent variables were CPS, MAPLe, CHESS, Pain scale, ADLH scale, IADL scale and the Frailty Index.

Analysis

We conducted descriptive analyses to explore potential associations between the candidate independent variables and ALC status. Differences between groups were statistically tested using χ^2 for nominal or ordinal and t-test for continuous measures. CIs and level of statistical significance were computed at the 95% level (alpha=0.05). We used univariate logistic regression models with a priori specifications including a 99% significance level ($p<0.01$) to identify variables considered for the multivariate model. The final multivariable logistic regression model was specified after several model-fit procedures were applied and robustness was examined with indicators like the Akaike information criterion and Area Under the ROC Curve (AUC). All analyses were performed using SAS V.9.4.[38]

RESULTS

The mean age of the sample of home care clients hospitalised within 6 months of a RAI-HC assessment was 78 years (SD 12.8). Patients later designated as ALC had an average age of 82 years (SD 10.3) compared with 77 years for those not designated ALC (SD 13.5).

Table 1 shows the sociodemographic and caregiver characteristics of home care clients admitted to hospital. ALC patients were less likely to be married (36%) compared with non-ALC patients (42%). Caregivers of ALC patients were more likely to be distressed (31%) or unable to continue care (17%) compared with non-ALC patients (22% and 12%, respectively). ALC patients were less likely to have a primary caregiver who was a spouse (31%) or to live with their caregiver (50%) compared with non-ALC patients (36% and 56%, respectively).

The associations of ALC status and diagnoses are shown in table 2. Those designated as ALC were more likely to have Alzheimer's disease and related dementias (ADRD) and Parkinsonism than those without an ALC designation.

Table 3 compares ALC and non-ALC patients based on their preadmission RAI HC scales and outputs. ALC patients had considerably higher rates of preadmission ADL impairment, cognitive loss and frailty (prefrail and frail) than non-ALC patients, as well as fewer social resources. Additionally, ALC patients were much more likely to be in the two highest MAPLe priority levels than non-ALC patients.

Table 4 shows the discharge disposition (the location where patient was discharged to or destination status of patient on discharge) of home care clients during their hospital stay. The rate of discharge to continuing care facilities (including long-term care) was more than five times greater for ALC patients compared with non-ALC patients (56% and 10%, respectively), and only 27% of ALC patients were discharged home compared with 68% of non-ALC patients. About 6% of ALC patients went home with no supports compared with 33% of non-ALC patients. Death rates were comparable for the two groups.

Table 5 presents the preadmission risk factors for ALC designation as well as protective factors. Advancing age, Parkinsonism, ADRD, multiple sclerosis and morbid obesity were all associated with greater odds for ALC designation. Higher preadmission MAPLe priority levels were associated with greater ALC risk. Preadmission health instability based on the CHESS score showed a modest curvilinear relationship with ALC risk, with the lowest ALC risks associated with either the lowest or the highest CHESS scores. Those with intermediate instability were at greater risk of ALC than those who were most stable and most unstable. A more proximal or shorter assessment gap (interval between a RAI-HC assessment and index hospital admission) was also predictive of ALC. Preadmission IADL and ADLH capacity were also predictive of ALC status. Other preadmission risk factors included wandering, falls, fear of falling, neglect and any behavioural challenges.

Table 1 Demographic and caregiver characteristics of home care clients designated as alc and non-ALC patients in acute care, 2009–2015

	ALL home care clients % (n)	ALC % (n)	Non-ALC % (n)	P values* (p≤0.01)
Age				
<65	14.1 (29 687)	6.6 (3316)	16.5 (26 371)	<0.0001
65–74	15.4 (32 459)	11.9 (6017)	16.5 (26 442)	
75–84	33 (69 645)	35 (17 734)	32.4 (51 911)	
85–94	33.5 (70 706)	41.2 (20 864)	31.1 (49 842)	
95+	4 (8434)	5.3 (2703)	3.6 (5731)	
Sex				
Male	41.4 (87 290)	39.8 (20 172)	41.8 (67 118)	<0.0001
Female	58.6 (123 637)	60.2 (30 461)	58.1 (93 176)	
Marital status				
Married	40.4 (85 149)	36.2 (18 313)	41.7 (66 836)	<0.0001
Not married	60 (125 782)	63.8 (32 321)	58.3 (93 461)	
Primary caregiver				
Lives with client	54.3 (114 557)	49.9 (25 261)	55.7 (89 296)	<0.0001
Is unable to continue	12.9 (27 201)	16.7 (8465)	11.7 (18 736)	<0.0001
Caregiver distressed	24.1 (50 847)	30.7 (15 550)	22 (35 297)	<0.0001
Is a spouse	34.6 (71 175)	31.1 (15 426)	35.7 (55 749)	<0.0001
Living arrangement at referral				
Lived alone	33.7 (70 628)	36.1 (18 137)	33 (52 491)	<0.0001
Did not live alone	66.3 (138 776)	63.9 (32 044)	67 (106 732)	

Note: alternate level of care (ALC) is proxy for delayed discharge.
*P value of X^2 test.

Protective factors that *decreased* one's likelihood of ALC designation were social factors included in the social resource summary scale (OR=0.83, CI 0.81 to 0.85) and having a primary language other than English or French (OR=0.81; CI 0.79 to 0.84). Patients with more complex medical needs indicated by preadmission renal failure, shortness of breath, surgical wounds, receiving oxygen, catheter, tube feeding and physician or clinic visits were less likely to be designated ALC. The Frailty Index did not reach the threshold for inclusion in the final model; however, the retained scales and algorithms represent many key facets of frailty. The AUC for the final model was 0.67.

DISCUSSION

Using existing readily available information collected in home care settings, we identified key patient characteristics associated with delayed discharge. These characteristics were known at the time of admission, well in advance

Table 2 Diagnoses of home care clients designated as ALC and non-ALC patients in acute care, 2009–2015

	All home care clients % (n)	ALC % (n)	Non-ALC % (n)	P values* (p≤0.01)
Clinical characteristics				
ADRD†	22.2 (46 868)	33 (16 704)	18.8 (30 164)	<0.0001
Parkinsonism	4.3 (9038)	6.1 (3075)	3.7 (5963)	<0.0001
Diabetes	28.4 (59 839)	26.4 (13 362)	29 (46 477)	<0.0001
Cancer‡	19.9 (41 961)	14.7 (7422)	21.6 (34 539)	<0.0001
Congestive heart failure	16.6 (34 945)	15 (7606)	17.1 (27 339)	<0.0001
COPD§	21.8 (45 910)	4.4 (9348)	17.3 (36 562)	<0.0001
Renal failure	10.7 (22 471)	9.1 (4630)	11.1 (17 841)	<0.0001

Note: alternate level of care (ALC) is proxy for delayed discharge.
*P value of X^2 test.
†Alzheimer's disease and related dementias.
‡Not including skin cancer.
§Chronic obstructive pulmonary disease.

Table 3 Clinical scales scores of home care clients designated ALC and non-ALC patients in acute care, 2009–2015

	All home care clients % (n)	ALC % (n)	Non-ALC % (n)	P values* (p≤0.01)
ADL hierarchy				
Independent (0)	50.1 (105 678)	42 (21 286)	52.7 (84 392)	<0.0001
Some difficulty (1+)	49.9 (105 248)	58 (29 348)	47.4 (75 900)	
CHESS†				
Stable	18.4 (38 844)	16.1 (8144)	19.2 (30 700)	<0.0001
Minimal instability	27.8 (58 695)	27.2 (13 751)	28 (44 944)	
Low instability	28.7 (60 443)	30.2 (15 312)	28.2 (45 131)	
Moderate instability	18.6 (39 305)	19 (9638)	18.5 (29 667)	
High instability	6 (12 718)	7.1 (3593)	5.7 (9125)	
Very high instability	0.4 (926)	0.4 (196)	0.5 (730)	
Cognitive Performance Scale				
Intact	50 (105 410)	36.7 (18 580)	54.2 (86 830)	<0.0001
Minimal impairment	35 (73 741)	41.3 (20 922)	33 (52 819)	
Moderate impairment	10.5 (22 032)	15.8 (7980)	8.8 (14 052)	
Severe impairment	4.6 (9748)	6.2 (3152)	4.1 (6596)	
Frailty Index				
Robust	33.5 (70 664)	26 (13 147)	35.9 (57 517)	<0.0001
Prefrail	45.2 (95 247)	47.9 (24 226)	44.3 (71 021)	
Frail	21.3 (45 020)	26.2 (13 261)	19.8 (31 759)	
MAPLe‡				
Low need	11.3 (23 814)	5.3 (2705)	13.2 (21 109)	<0.0001
Mild need	7.8 (16 450)	5.6 (2833)	8.5 (13 617)	
Moderate need	33.7 (70 993)	30 (15 183)	34.8 (55 810)	
High need	32.8 (69 153)	36.4 (18 453)	31.6 (50 700)	
Very high need	14.5 (30 521)	22.6 (11 460)	11.9 (19 061)	
Count of social resources§				
Low (0–2)	57.9 (119 081)	61.3 (30 358)	56.8 (88 723)	<0.0001
High (3–5)	42.1 (86 624)	38.7 (19 175)	43.2 (67 449)	

Note: alternate level of care (ALC) is proxy for delayed discharge.
*P value of X^2 test.
†Changes in Health, End-Stage Disease, and Signs and Symptoms.
‡Method for Assigning Priority Levels.
§Count of social resources present, including marital status, caregiver availability, caregiver living status, spousal caregiver and absence of caregiver distress.

Table 4 Distribution of selected postacute discharge disposition of home care clients designated ALC and non-ALC patients in acute care, fiscal 2009–2015*

	All home care clients % (n)	ALC % (n)	Non-ALC % (n)	P values* (p≤0.01)
Continuing care†	21.5 (45 310)	56.4 (28 570)	10.4 (16 740)	<0.0001
Home with support‡	31.8 (67 086)	21.6 (10 944)	35.0 (56 142)	<0.0001
Home without support§	26.4 (55 647)	5.6 (2854)	32.9 (52 793)	<0.0001
Died in hospital	14.5 (30 670)	12.3 (6224)	15.2 (24 446)	<0.0001

Note: alternate level of care (ALC) is proxy for delayed discharge.
*X^2 test for distribution of outcome.
†May include continuing care beds or chronic complex bed in hospitals, or residential facilities such as nursing homes or long-term care facilities.
‡Discharged home with support services from home care agency.
§Discharged home with no support services from home care agency required.

Table 5 ORs for being designated ALC in acute-care using RAI-HC premorbid characteristics, 2009–2015

Variables	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)
Age		
65–74 versus <65	1.81 (1.73 to 1.89)	1.67 (1.59 to 1.75)
75–84 versus <65	2.72 (2.61 to 2.83)	2.21 (2.12 to 2.31)
85–94 versus <65	3.33 (3.20 to 3.46)	2.53 (2.42 to 2.64)
≥95 versus <65	3.75 (3.54 to 3.98)	2.72 (2.55 to 2.90)
Primary language		
Other versus English/French	0.97 (0.94 to 0.99)	0.81 (0.79 to 0.84)
Social resource†		
High (3–5) versus low (0–2)	0.83 (0.81 to 0.85)	0.83 (0.81 to 0.85)
MAPLe		
Mild versus low	1.62 (1.53 to 1.72)	1.28 (1.21 to 1.37)
Moderate versus low	2.12 (2.03 to 2.22)	1.43 (1.36 to 1.51)
High versus low	2.84 (2.72 to 2.97)	1.67 (1.58 to 1.76)
Very high versus low	4.69 (4.48 to 4.91)	2.08 (1.96 to 2.21)
CHESS scale		
Minimal instability versus stable	1.15 (1.12 to 1.19)	1.11 (1.07 to 1.14)
Low instability versus stable	1.28 (1.24 to 1.32)	1.18 (1.13 to 1.22)
Moderate instability versus stable	1.23 (1.18 to 1.27)	1.23 (1.18 to 1.3)
High instability versus stable	1.48 (1.42 to 1.55)	1.28 (1.21 to 1.35)
Very high instability versus stable	1.01 (0.86 to 1.19)	1.11 (0.94 to 1.32)
Activities of daily living (ADL) hierarchy		
Some difficulty versus independent	1.53 (1.50 to 1.56)	1.16 (1.12 to 1.19)
Instrumental Activities of Daily Living (IADL) Scale		
Low versus no difficulty	1.52 (1.36 to 1.69)	1.21 (1.08 to 1.36)
Mild versus no difficulty	1.85 (1.68 to 2.03)	1.22 (1.1 to 1.35)
Moderate versus no difficulty	3.13 (2.78 to 3.53)	1.3 (1.14 to 1.48)
High versus no difficulty	2.27 (2.08 to 2.49)	1.29 (1.16 to 1.43)
Very high versus no difficulty	2.81 (2.57 to 3.07)	1.31 (1.19 to 1.45)
Severe versus no difficulty	3.92 (3.58 to 4.29)	1.27 (1.14 to 1.41)
Mental health		
Any negative behaviour change	2.10 (2.03 to 2.17)	1.25 (1.2 to 1.3)
Neglected/abused	1.60 (1.39 to 1.84)	1.27 (1.08 to 1.49)
Mobility		
Wandering	2.61 (2.47 to 2.75)	1.29 (1.22 to 1.38)
Afraid of falling	1.28 (1.26 to 1.31)	1.10 (1.07 to 1.12)
Falls	1.45 (1.42 to 1.48)	1.17 (1.14 to 1.19)
Caregiver's perspective of client		
Able to increase functional independence	0.71 (0.68 to 0.73)	0.85 (0.82 to 0.88)
Diseases and health conditions		
ADRD‡	2.12 (2.08 to 2.17)	1.27 (1.23 to 1.31)
Parkinsonism	1.67 (1.60 to 1.75)	1.34 (1.28 to 1.41)
Congestive heart failure	0.86 (0.84 to 0.88)	0.84 (0.81 to 0.86)
Cancer§	0.63 (0.61 to 0.64)	0.84 (0.82 to 0.87)
Multiple sclerosis	0.76 (0.69 to 0.85)	1.15 (1.02 to 1.29)
Renal failure	0.80 (0.78 to 0.83)	0.86 (0.83 to 0.90)
Morbid obesity	0.82 (0.78 to 0.86)	1.18 (1.12 to 1.25)
Shortness of breath	0.74 (0.72 to 0.75)	0.76 (0.74 to 0.78)
Surgical wound	0.43 (0.40 to 0.46)	0.71 (0.66 to 0.75)
Treatment and therapies		
Tube feeding	0.38 (0.34 to 0.43)	0.60 (0.53 to 0.68)
Physician/clinic visit	0.78 (0.77 to 080)	0.88 (0.86 to 0.9)
Oxygen	0.62 (0.59 to 0.65)	0.79 (0.75 to 0.82)
Catheter	0.71 (0.67 to 0.75)	0.79 (0.75 to 0.84)
Time between assessment and admission		
Assessment Gap 0–30 days versus 31+ days	1.14 (1.12 to 1.17)	1.08 (1.06 to 1.10)

Model area under the ROC curve: 0.67.
Note: alternate level of care (ALC) is proxy for delayed discharge.
*ORs were adjusted for all the covariates in this model.
†Count of social resources, including marital status, caregiver availability, caregiver living status, spousal caregiver, and absence of caregiver distress.
‡Alzheimer's disease and related dementias.
§Not including skin cancer.

of the time when delayed discharge was designated. They include older age, limited social support, decreased functional status and diagnoses related to cognitive decline such as dementia. These factors may help us easily identify at-risk patients or suggest interventions that may improve the efficiency of care or decrease the use of alternate levels of care.

Our findings support moving towards a more integrated, collaborative approach to healthcare. For older adults, this means that care models and tools should take into account the complete health trajectory to prioritise pertinent premorbid assets and liabilities. Premorbid assessments can help to achieve a more comprehensive and multidimensional view to arrive at realistic prognosis and targeted interventions early in the acute hospital

stay. Previously completed home care assessments could help by identifying pre-existing risk factors that are often missed, showing a trajectory of change in patient needs, and helping the care team respond to needs requiring immediate attention during the acute episode. It has been well recognised that prehospital functional status or vulnerability is a significant predictor of hospitalisation associated disability.[39] The role of premorbid evidence to support better prognostication and prevention of negative outcomes in older adults is also well documented.[20] For example, in patients who had a stroke, the availability of such reliable and standardised premorbid assessments was found to be essential for realistic goal setting and better rehabilitative support.[40] If frail older adults patients are to return to an optimal prehospitalisation functional state and achieve functional recovery posthospitalisation, acute care must take into account the prehospital functional history.[41]

Clinical variables from previously completed interRAI assessments were useful for predicting delayed discharge in subsequent admissions to acute hospitals. This means that home care agencies and hospitals need to work together to ensure that assessment information is shared with hospitals in a timely manner to allow them to use it to support discharge planning at the time of admission rather than waiting until delays in discharge surface. This would ensure proactive planning instead of relying on current reactive practices. This will necessitate dealing with some privacy issues and information technology considerations to share the data, but both those are manageable. For example, in some jurisdictions (Belgium, New Zealand), interRAI assessment information is integrated into the electronic medical records to facilitate smooth, timely transmission of data.

Despite the value of in-hospital assessments, a fuller longitudinal picture of a patient's trajectory of progress or decline would come from periodic reassessments over time independent of care setting. Patients with chronic illnesses and functional limitations are often frail, and usually subject to frequent movements between providers and care settings.[42] Clinical data that could provide important insights to inform treatment plans of such patients are ignored or lost in transition. In other cases, pertinent details are not communicated, and patients are unnecessarily subjected to a series of redundant assessments and tests. The findings from this study therefore show the urgent need for acute care hospitals to incorporate premorbid assessments such as the RAI-HC in care planning.

Identified characteristics associated with delayed discharge invariably affect long-term disposition of patients through different mechanisms. These characteristics can be viewed as markers of older adults whose problems are not adequately addressed prior to and during hospitalisation and are therefore at greater risk for further decline with delayed discharge. Advanced age is obviously not modifiable, but it could easily and quickly identify a population with complex needs. Age is often associated with cognitive decline, limited social support and decreased mobility as well as limited physiological reserve among other factors that may result in delaying a discharge or an inability to return home.[43–45]

Patients of advanced age (85 years and above) had higher odds of experiencing delayed discharge during hospitalisation compared with those aged less than 65 years. Age was highly predictive of long-stay (≥30 days) delays in discharge in the Ontario mental health system[46] and also associated with longer hospital stays.[47–49] However, age alone is not an adequate screener for ALC risk. Previous studies that investigated delayed discharges also support our findings that caregiver characteristics (social support or vulnerability) are important variables even after clinical factors had been accounted for.[18 50] Our results showed that having optimal social resources (eg, being married, caregiver availability, caregiver residing with client, spousal caregiver and caregiver not distressed) made delays in discharge less likely (OR=0.83; CI 0.81 to 0.85). This is consistent with other studies.[46 47 51 52] These findings also show that clients who reported neglect or abuse, experiences that reflect social vulnerability, had higher odds (OR=1.27) of delayed discharge.

Inadequate social support leaves the sick, and especially frail older adults vulnerable to adverse outcomes.[53 54] Likewise, Lim *et al* concluded that social issues accounted for most delays and discharge limiting factors (final events that often resulted in the delay in discharge).[5] The finding that having a primary language apart from English or French (OR=0.81; CI 0.79 to 0.84) is associated with a decreased likelihood of delayed discharge is also an important factor to consider in care planning especially with the influx of older immigrant populations. Cultural factors may result in more family supports being available to them, but the role of language barriers and current health inequity may be of concern.[55 56]

Recent accounts suggest that patients discharged to long-term care homes were more likely to experience delayed discharge and were also associated with caregiver distress and caregiver unavailability.[13] This manifestation of inadequate formal and informal caregiver capacity further protracts the waiting period in delayed discharge beds. The lack of standardisation in the allocation of personal support workers, for instance, may contribute to delays in care coordination for hospital patients awaiting discharge to go home.[57]

Other variables that affect delayed discharge status include MAPLe, which is a widely used algorithm that reflects complex needs associated with caregiver distress and risk of admission to LTC. Behaviour symptoms may also pose as barriers to discharge home and potentially discharge to LTC. Impaired functional ability,[4 8 58 59] problematic behavioural symptoms,[60] clinical conditions,[5 8] cognitive decline[51 61 62] and clinical instability[4 13 63] have been shown to contribute to delayed discharge days and long hospital stays. Variables that are associated with increased clinical acuity predictive of need for acute hospital services (eg, tube feeding, oxygen, CHESS) also

influence delays in discharge coordination. Our findings showed that diagnoses such as ADRD and Parkinsonism lead to delayed discharges, in agreement with previous studies that revealed neurological and mental conditions to be closely related to delayed discharges.[3 4 6 17 52 64 65] Frailty as measured by the Frailty Index was useful at the bivariate level to predict delayed discharge, but this composite measure was no longer significant after controlling for other related clinical scales that measure the subdomains of frailty (eg, CHESS, MAPLe, ADLH and IADL).

Timely access to information about patients' current versus premorbid states affords all parties (formal and informal caregivers) engaged in the coordinating process sufficient time to engage in collaborative care planning and optimise resource allocation.[13 66–68] Also, recognising that most cases of complicated transitions are marked by inadequate facilitation of home environment optimisation, lack of informal support and strong social networks among others,[13] assessment data on premorbid status from the RAI-HC provides extensive evidence that would otherwise be relatively difficult to obtain in acute hospitals.

This paper used a multivariable logistic regression model to predict delayed discharge with moderate predictive validity based on AUC. This could be improved in several ways, including using assessments much more proximate to the time of admission and creating a decision-support algorithm based on those covariates using machine learning tools like decision-tree analyses. Making timely use of interRAI HC assessment data to predict delayed discharge status in hospitalised home care clients is another return on investment of having already paid for doing the assessment. It is not only useful within home care settings, but this paper shows it can also be valuable to inform decision making in other sectors of the health system.

This study has some notable strengths including a representative sample size with a complete record of their assessment journey at home and during hospitalisation, and the potential generalisability of the results beyond the Canadian home care and acute care settings. The comprehensive picture obtained from an integrated assessment enabled this study to use a novel approach to investigate how premorbid data in community settings can predict transitional outcomes in acute care hospitals.

However, an important limitation is the inconsistent definition and hence the possible differences in operationalising the ALC concept across provinces in Canada. Some of these differences have been attributed to inconsistent documentation,[69] and uncertainties surrounding what constitutes an eligible ALC designation.[70] The results could therefore be biased by some misclassification errors. Also, due to constraints in the available data, we were unable to show the number of patients who experienced delays in discharge while awaiting transfer to rehabilitation or who died in hospital while waiting.

Future studies should investigate delays in discharge that negatively affect patient requiring access to rehabilitative and palliative or hospice services. The literature would also benefit from a future study using a multistate transition model approach to investigate the intricate relationship between the various circumstances of admission, diagnoses and the impact of the acute care episode on the outcome.

CONCLUSION

This study demonstrates that standardised assessments in an at-risk group done prior to hospital admission may be very useful in care planning for patients admitted to acute care. Patients can benefit when we leverage integrated health information systems based on standardised assessment instruments. Quality of care along the continuum of care can happen when we identify and respond to patients' needs in a timely manner.

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