

# Factors Associated with Alternate Level of Care Status Designation: a Case-Control Study and Model to Optimize Care Trajectories\*



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## ABSTRACT

### Background

As health-care demand is growing, our health-care system will require the optimization of the care trajectories. Patients with an alternate level of care (ALC) status could be a target for flow optimization. We aimed to characterize ALC patients and risk factors for ALC status, and to propose an integrated model to analyze the trajectory of ALC patients and discuss solutions to reduce their burden.

### Methods

A case-control design was used to compare 60 ALC and 60 non-ALC patients admitted to the geriatric unit of the Centre hospitalier de l'Université de Montréal in 2021, collecting medical and sociodemographic data. Based on our model, univariate statistical analyses were computed to compare groups and identify risk factors for ALC status.

### Results

ALC patients were less independent (22% performed five to six activities of daily living vs. 43%,  $p = .03$ ). Both groups were comparable in terms of mobility and neurocognitive disorders. ALC patients were more likely to receive a new diagnosis of a neurocognitive disorder or new behavioural or psychological symptoms (37% vs. 15%,  $p = .008$ ). Up to 25% of ALC patients were admitted despite presenting no active medical condition (vs. 3% of non-ALC patients,  $p = .002$ ).

### Conclusions

The optimization of the care trajectory of ALC patients is mainly based on pre-hospital and post-hospital factors. A proportion of ALC admissions might be avoidable

with additional investment in home care resources and relocation procedures. Fluidity of ALC trajectory may benefit from improved orientation at discharge procedures. Full optimization of ALC trajectories requires a systemic understanding of the health-care system.

**Key words:** alternate level of care; ALC; care trajectory; long-term care; resources allocation; flow optimization; health-care system; older adults

## INTRODUCTION

Care trajectories of older adults are complex and involve many care settings in a continuum, from pre-hospital resources to acute hospital care and post-acute resources.<sup>(1,2)</sup> Alternate level of care (ALC) status was created to account for the lack of fluidity between care settings. By definition, ALC patients occupy beds while their clinical state is stable and no longer requires the intensity of services or resources provided by that care setting.<sup>(3)</sup>

Health-care demand and associated costs are growing.<sup>(4,5)</sup> As the population is aging, our health-care system will face increased needs and will require the optimization of the care trajectories. During the COVID-19 pandemic, due to a rapid and large influx of patients, ALC patients became an increased focus of attention to relieve acute health-care centres.<sup>(3,6)</sup> Yet as the pandemic crisis recedes, optimizing the trajectory of ALC patients can have benefits for patients themselves, caregivers, and the health-care system as a whole.<sup>(7,8)</sup>

Beyond ALC status designation, there is a need to compare the trajectories of ALC and non-ALC patients to determine opportunities to prevent, optimize, and reduce

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both the number and duration of ALC status. Figure 1A presents an integrated model which structures the stages and delays in the trajectory of ALC patients, and divides potential factors for ALC designation into three steps within the care trajectory: pre-hospital variables, hospital-related delays, and post-hospital-related delays. The proposed model allows for the analysis and mapping of potential solutions to reduce the burden of ALC status on patients and care settings.

In this exploratory study, our primary objective was to identify older adult characteristics and risk factors associated with ALC status by examining sociodemographic characteristics, pre-hospital living environment and social support, acute in-hospital care management delays, and post-acute care. Our secondary objectives were to determine whether some of these stays are avoidable or predictable and to examine length of stay, comparing ALC to non-ALC patients, in order to propose avenues to optimize care trajectories.

**METHODS**

**Study Design and Population**

A case-control design was used to compare patients with ALC designation during their hospital stay to those without ALC designation. All patients admitted to the geriatric acute care unit of the Centre hospitalier de l'Université de Montréal (CHUM) in 2021 and alive at discharge were considered for inclusion. We randomly sampled 60 hospitalizations with ALC status, and 60 hospitalizations without. The study was approved by the CHUM's ethics committee.

**Measurements and Variables**

Data were extracted from electronic medical records. Three of the authors (ML, MD, and VWJC) extracted data and disagreements were resolved by consensus. Documents used included medical, allied health, and nursing records.

We collected the following demographic characteristics: age, sex, ethnicity, education, marital status, principal social support, home services, and functional status. The following variables were also extracted: previous cognitive impairment or mobility disorder, the context of emergency visit (mode of arrival, person who sought the consultation [intrinsic: participant; extrinsic: caregivers or health-care workers], reason for consultation), admitting diagnosis, complications, delays before each component of stabilization (medical, mobility, and cognitive stability), and determination of orientation at discharge. The presence of prior neurocognitive disorder (NCD) was categorized according to the presence of major neurocognitive disorder and behavioural and psychological symptoms of dementia (BPSD): no major neurocognitive disorders (MNCD) or mild cognitive impairment vs. MNCD vs. de novo MNCD or BPSD. For activities of daily living (ADLs), a modified Katz scale was used (1 point for independent bathing, dressing, toileting, continence, and feeding), with the following modification for transfers: 1 point if using no aids, a cane, or a rollator; half a point if using a walker; and no point if using a wheelchair or bedbound. For instrumental activities of daily living (IADLs), 1 point was given if entirely independent for each of these activities: cooking, medication, finances, shopping, and driving. Finally, we extracted whether the emergency physician or the emergency geriatric team (geriatrician, social worker, or specialized nurse) recorded a potential compromise of discharge to the patient's previous environment in their initial assessment.

**Outcomes**

We examined patients' characteristics and risk factors for ALC status among ALC patients and compared them to the non-ALC group. We also examined the total hospital length of stay and the delays before management by medical and multidisciplinary teams.

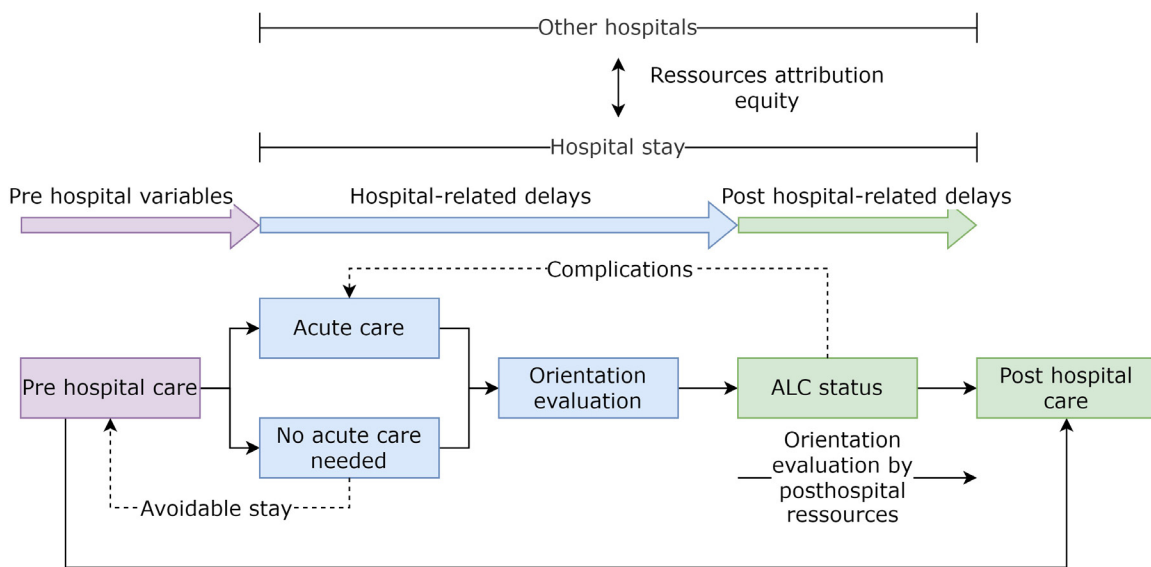


FIGURE 1A. Integrated model: overall care trajectory of alternate level of care patients  
ALC = alternate level of care.

## Statistical Analysis

We described the ALC population based on its demographic and medical characteristics. To compare characteristics and in-hospital delays between ALC and non-ALC patients, we used univariate *t*-tests, Wilcoxon rank-sum tests, and Pearson's Chi-squared tests as appropriate. Risk factors examined were categorized as pre-hospitalization variables, inpatient complications, outcomes at discharge, and potentially modifiable factors. With a total sample size of 120 participants, our study was powered ( $\beta = 0.8$ ) to detect a difference in proportion of 25%, with a dual-sided  $\alpha = 0.05$ . Analyses were performed using R 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

## RESULTS

### Descriptive Statistics of ALC Patients

ALC patients were mostly White ( $n=47$ , 78%), female ( $n=38$ , 63%) with a mean age of 87 years old, single or widowed ( $n=43$ , 71%), and of lower education level (high school completed;  $n=27$ , 45%). More than half of ALC patients were supported by their family members ( $n=36$ , 61%), and a majority lived at home ( $n=41$ , 68%). They were mainly dependent for IADLs (mean score 0.7) and 32% ( $n=19$ ) received daily care or caregiver respite. One ALC patient out of five ( $n=11$ , 18%) was awaiting admission to a nursing home from the community. Previous mobility disorder was frequent as almost half used a walker, a rollator, or a wheelchair ( $n=29$ , 48%). Prior neurocognitive disorder was frequent among ALC patients ( $n=27$ , 45%). Full characteristics are presented in Table 1.

### Differences Between ALC and Non-ALC Patient Pre-Hospital Characteristics

Univariate analysis of characteristics demonstrates that ALC patients were older (87 vs. 84 years old,  $p = .005$ ) and less likely to have completed a high school degree (45% vs. 71%,  $p = .014$ ). ALC patients were less independent for ADLs, as fewer performed five or more ADLs (22% vs. 43%,  $p = .03$ ). Both groups were comparable in terms of previous mobility and neurocognitive disorders, but ALC patients were more likely to receive a new diagnosis of a neurocognitive disorder or new BPSD (37% vs. 15%,  $p = .008$ ). Full results are presented in Table 1.

### Hospital Trajectory and In-Hospital Modifiable Factors

Table 2 presents details on emergency visits, delays before medical and multidisciplinary team management, and orientation at discharge. Three out of four ALC patients were brought to the emergency by paramedics ( $n=44$ , 76%), and the decision to consult was often extrinsic to the patient ( $n=42$ , 72%).

Up to 25% of ALC patients (vs. 3% of non-ALC patients,  $p = .002$ ) were admitted despite presenting no active medical issue. ER physicians anticipated an issue of discharge

orientation in 38% of ALC patients (vs. 8.5% non-ALC group,  $p < .001$ ). The same was found among the emergency geriatric team (geriatrician, social worker, or specialized nurse), with 52% of ALC patients compared to 6.7% for non-ALC ( $p < .001$ ).

The average stay in the ER was 1.2 days, with no difference between groups (1.3 vs. 1.2 days,  $p = .7$ ). Delays before medical stabilization and return to baseline mobility were similar. Delays before cognitive stabilization differed between the two groups (six vs. three days,  $p = .03$ ), as well as delays before discharge orientation determination (18 vs. eight days,  $p < .01$ ).

The total length of stay was longer for ALC patients (31 vs. 12 days,  $p < .001$ ). At discharge, ALC patients were less likely to return home (7% vs. 63% for non-ALC patients) and were more likely to be admitted to a long-term care facility (66% vs. 3.3%,  $p < .001$ ). As for complications, delirium rates were similar, but ALC patients sustained more falls than non-ALC patients (20% vs. 2%,  $p = .003$ ).

## DISCUSSION

We examined the characteristics of ALC patients compared to a control group of participants hospitalized in geriatric acute care unit. As our study population comprises older patients with multimorbidity and a complex care trajectory, several risk factors for ALC designation were identified, occurring before, during, and after hospital stay.<sup>(9-11)</sup> Figure 1B presents our integrated model with the most important findings.

### Pre-Hospital Variables

From the first assessments in the emergency room (ER), physicians and allied professionals were able to predict an issue of orientation at discharge in many ALC cases by foreseeing that the return to their previous living environment was compromised. A quarter of ALC patients were admitted to an acute care unit without any active medical problems, suggesting that a proportion of admissions could potentially be avoided if the pre-hospital resources were sufficient or intensified. Our findings that ALC patients had a greater prevalence of ADL impairment suggest that additional investment in home care resources or management of relocation procedures from home are possible solutions that could alleviate the number of admissions without active medical conditions.<sup>(12)</sup> Costa and Hirdes also have highlighted the importance of adequate community resources to reduce the burden of ALC patients waiting for long-term care (LTC) facilities.<sup>(13)</sup>

Twice as many ALC patients received a new diagnosis of neurocognitive disorder or BPSD during their hospital stay. Overall, up to 82% of ALC patients were identified as having known or new NCD or BPSD, compared to 62% for non-ALC patients. Our results are consistent with the current literature showing that seniors with NCD are at greater risk of being designated with ALC status,<sup>(14)</sup> have longer hospital stays, and sustain more complications, including falls, than seniors without NCD.<sup>(15,16)</sup> Because the determination of orientation

LAMARRE: FACTORS ASSOCIATED WITH ALTERNATE LEVEL OF CARE STATUS DESIGNATION

at discharge greatly depends on the patient’s functional profile and needs for services, a more resource- and time-intensive evaluation can be expected among patients with NCD and BPSD.<sup>(17,18)</sup> As previously discussed,<sup>(19)</sup> access to diagnosis and management of NCDs and BPSD might help to reduce the ALC burden.

**Hospital-Related Variables and Delays**

As expected, we found that patients with ALC status have longer lengths of stay than those without ALC.<sup>(11)</sup> Adverse

outcomes have previously been demonstrated for ALC patients,<sup>(7,20)</sup> and we observed a higher prevalence of falls during hospitalization among this group. Although many patients with anticipated orientation discharge issues were identified by emergency and geriatric teams at the initial consultation, ALC patients remained with prolonged stays. Time to medical stabilization and to mobility stability did not appear to influence ALC status; longer delays before cognitive stabilization of ALC group might be attributable to the excess of new cognitive diagnoses. The longest delay within the

TABLE 1.  
Demographic characteristics and risk factors for ALC status compared to non-ALC group

<i>Demographic Characteristics and Risk Factors</i>	<i>ALC Patients (n=60)<sup>a</sup></i>	<i>Non-ALC Patients (n=60)<sup>a</sup></i>	<i>p value<sup>b</sup></i>
<b>Demographic Characteristics</b>			
Age, mean (yrs)	87	84	.005
Sex, female (%)	38 (63%)	42 (70%)	.6
Education, high school completed (%)	22 (45%)	35 (71%)	.01
<b>Living Environment</b>			
Private residence	41 (68%)	43 (72%)	.2
Residence for independent seniors	8 (13%)	12 (20%)	
Long-term care facilities	11 (18%)	5 (8.3%)	
<b>Main Support</b>			
Spouse	11 (19%)	19 (32%)	.3
Family member	36 (61%)	29 (48%)	
Community-based services	7 (12%)	4 (6.7%)	
Friends or neighbors	5 (8.5%)	8 (13%)	
<b>Home Services</b>			
None	37 (62%)	44 (73%)	.3
Weekly bathing	4 (6.7%)	4 (6.7%)	
Daily care and/or respite	19 (32%)	12 (20%)	
Awaiting transfer to long-term care facility	11 (18%)	4 (6.7%)	.10
<b>Functional Abilities</b>			
<b>ADLs Score</b>			
0 - 2.4	23 (38%)	20 (33%)	.03
2.5 - 4	24 (40%)	14 (23%)	
5 - 6	13 (22%)	26 (43%)	
<b>Mobility</b>			
Walker, rollator, or wheelchair	29 (48%)	28 (47%)	>0.9
No aid or cane	31 (52%)	32 (53%)	
<b>Medical Conditions</b>			
<b>Neurocognitive Disorder</b>			
No or mild cognitive impairment	11 (18%)	23 (38%)	.008
Previously diagnosed major neurocognitive disorder	27 (45%)	28 (47%)	
De novo MNCD or BPSD diagnosis	22 (37%)	9 (15%)	
Previously evaluated by a geriatrician	31 (52%)	26 (43%)	.5
No active medical condition	15 (25%)	2 (3.3%)	.002

<sup>a</sup>Mean (SD); n (%).

<sup>b</sup>Wilcoxon rank sum test; Pearson’s Chi-squared test.

ALC = alternate level of care; ADLs = activities of daily living; MNCD = major neurocognitive disorders; BPSD = behavioral and psychological symptoms of dementia.

acute hospital setting was related to the determination of discharge destination. In addition to the presence of NCD or BPSD,<sup>(17,18)</sup> we found that this delay was mainly influenced by post-hospital factors—in particular, the assessment by the social services and the nursing home attribution system. We were unable to identify any significant difference that could serve as a target during the hospital stay itself. An emergent avenue could be to avoid the hospital stay; there has been enthusiasm around the concept of “hospital at home”, where patients presenting with predetermined medical conditions receive required care at home, avoiding hospital stays as much as possible.<sup>(21)</sup>

### Post-Hospital Delays

As for post-hospital factors, we identified that 93% of ALC patients did not return directly to their previous living environment following their stay; 18% needed post-acute care, and 66% were transferred to LTC facilities. Consequently, to improve the fluidity in the trajectory of ALC patients,

solutions regarding post-acute care and LTC facilities should be prioritized. Increasing the availability and widening the goals of community resources and home services might also be an opportunity to reduce the burden on both acute care and LTC facilities. The patient’s access to community services shouldn’t be a barrier to hospital discharge.<sup>(22)</sup>

### Strengths and Limitations

Strengths of our study include the proposal of a comprehensive and integrated model with potential solutions pertaining to ALC status which considers the broader care trajectory. To our knowledge, no previous study has integrated and anchored ALC data in a care trajectory model. We also included and examined extensive clinical data which wasn’t presented in previous studies.<sup>(9,11,13)</sup>

Our study has a few important limitations that deserve mention. Our study population was limited to geriatric patients; comparisons among ALC and non-ALC patients thus included many older adults with functional impairment and frailty. Since

TABLE 2.  
In-hospital trajectory characteristics among ALC and non-ALC patients

<i>In-Hospital Trajectory Characteristics</i>	<i>ALC Patients (n=60)<sup>a</sup></i>	<i>Non-ALC Patients (n=60)<sup>a</sup></i>	<i>p value<sup>b</sup></i>
<i>Emergency</i>			
Means of arrival to emergency			.5
Paramedics	44 (76%)	37 (64%)	
Accompanied by a relative	9 (16%)	16 (28%)	
Decision to consult			.6
Patient	16 (28%)	21 (35%)	
Relative	26 (45%)	27 (45%)	
Living environment	10 (17%)	5 (8.3%)	
Delay between arrival and geriatrics consult (days)	0.3 (0.5)	0.6 (0.5)	.008
Length of stay in emergency department (days)	1.3 (0.8)	1.2 (0.7)	.7
<i>Hospitalization</i>			
Length of stay on ward (days)	31 (17)	12 (8)	<.001
Time before stabilization (days)			
Medical	8 (8)	8 (6)	.4
Cognitive	6 (8)	3 (5)	.03
Mobility	8 (9)	7 (7)	.7
Orientation	18 (12)	8 (6)	<.01
Number of complications	1.3 (1.5)	0.9 (1.3)	.08
Delirium	14 (23%)	13 (22%)	>.9
Fall	12 (20%)	1 (2%)	.003
<i>Discharge</i>			
Orientation at discharge			<.001
Home	4 (6.7%)	38 (63%)	
Post-acute care (transition)	11 (18%)	2 (3.3%)	
Residence for independent seniors	4 (6.7%)	15 (25%)	
Long-term care facilities	40 (66%)	2 (3.3%)	

<sup>a</sup>Mean (SD); n (%).

<sup>b</sup>Wilcoxon rank sum test; Pearson’s Chi-squared test

ALC = alternate level of care.



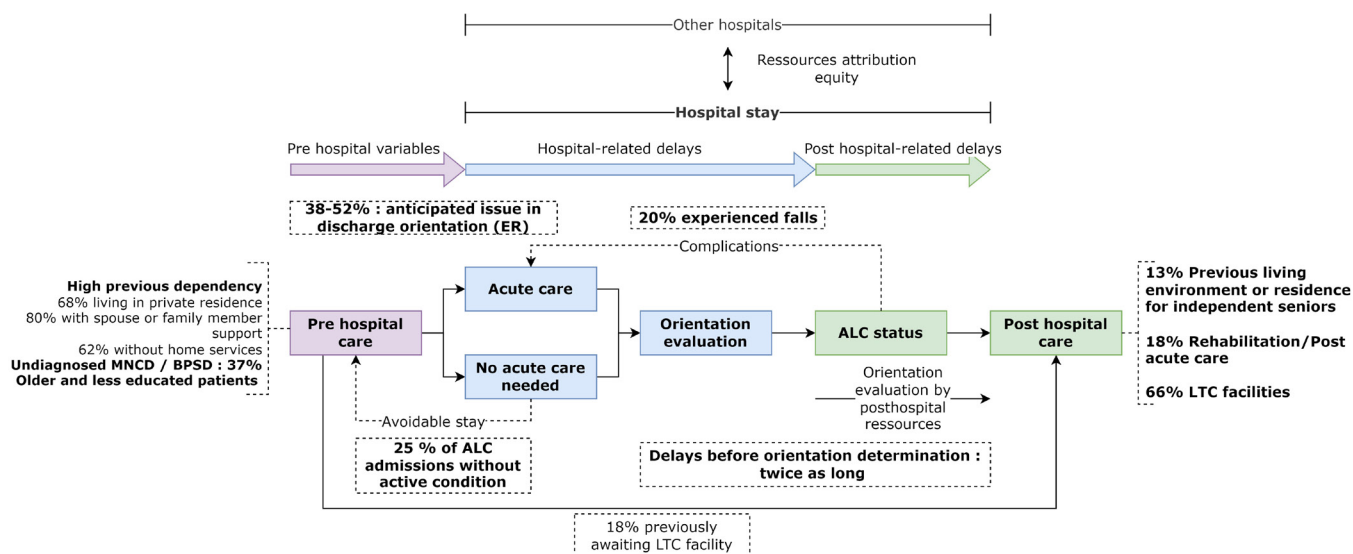


FIGURE 1B. Integrated model: care trajectory of alternate level of care patients with main study findings  
 ALC = alternate level of care; BPSD = behavioural and psychological symptoms of dementia; ER = emergency room; MNCD = major neurocognitive disorders; LTC = long-term care.

our study population may show less variability and enrolled participants, alive at discharge, from a single academic geriatric medicine unit, our findings may not generalize to all patients admitted to acute care settings. Due to small sample size, we only conducted descriptive and exploratory analyses; no multivariable analysis was performed.

**CONCLUSION**

The care trajectory of older adults is the result of interactions between many variables and resources. The optimization of these trajectories requires an understanding of the health-care system itself and the heterogeneity of older patients within it. However, rather than emphasizing the acute care stay itself, our model and findings suggest that solutions regarding ALC status should focus on modifiable factors which are mostly related to the pre- and post-hospital stay periods. Systemic thinking<sup>(23-25)</sup> is needed to understand and optimize the relation between every step of ALC patient flow.

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**CONFLICT OF INTEREST DISCLOSURES**

We have read and understood the *Canadian Geriatrics Journal's* policy on conflicts of interest disclosure and declare there are none.

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