Investing in Quality Improvement:

Economic Analysis of the Kipling Acres Convalescent Care Length of Stay Project

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Prepared by:
Andrew Mendlowitz
Ruth Croxford
Laura Maclagan
Dr. Wanrudee Isaranuwatchai

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The Problem

In 2012, the Ontario Long-Term Care Innovation Expert Panel proposed re-visioning the purpose of long-term care to recognize the demand for shorter-term stays for purposes of pose-acute care and respite care.[1] Among other things, they noted that the proposal would "free up hospital beds occupied by patients who do not need to be there".[1] It has been estimated that individuals who enter convalescent care typically spend almost a week in alternative level of care (ALC), where the average cost per day is reported to be around $1,100 CAD, before entering convalescent care.[2] Individuals in ALC no longer require the intensity of services provided in the acute care setting and are waiting for placement in a more appropriate setting. ALC has been widely considered to be an inefficient use of costly hospital resources that could otherwise be used for those with acute needs.[3] These ALC patients have created a sense of "gridlock" among hospitals and the health care system by occupying beds that could alternatively be used to immediately admit patients from the emergency department (ED).[4]

The Kipling Acres Convalescent Care Length of Stay Project

The Kipling Acres Convalescent Care Length of Stay project focuses on improving system resource utilization and efficiency by establishing a more effective, proactive and collaborative approach to convalescent care. The program is a quality improvement initiative with two focus areas: streamlining the application approval process and effective discharge planning with residents, families and community partners.[5] The project was originally implemented within the Convalescent Care Program (CCP) at the Kipling Acres assisted living facility as part of the IDEAS (Improving and Driving Excellence Across Sectors) Advanced Learning Program.*

During the course of IDEAS, Kipling Acres was able to improve the turnaround time for processing ALC patient applications for admission into convalescent care and enhance patient support throughout the admission and discharge process. The Kipling Acres team estimated that the improvements made to the review and admission processes had the potential to free up approximately 240 staff hours per year, which could then be redirected to resident care and services.[5] The improvements identified and tested during their IDEAS project have since been successfully implemented and integrated into the day to day operations at Kipling Acres. In addition, the team has started discussions of wider-scale adoption in other Long Term Care Homes that provide similar services throughout the city of Toronto.[6]

Potential Economic Impact of the Project

In this economic impact study, we examined the potential of the Kipling Acres Convalescent Care Length of Stay Project to reduce health care costs by (1) more efficient transfer of patients from acute care to convalescent care and (2) by caring for eligible individuals in the convalescent care setting rather than in inpatient rehabilitation.

*IDEAS is a comprehensive, evidence based quality improvement training program for Ontario's healthcare professionals. Funded by the Ontario Ministry of Health and Long-Term Care and delivered in partnership with The Institute for Health Policy, Management and Evaluation at the University of Toronto, Health Quality Ontario, and the Institute for Clinical Evaluative Sciences, along with the six medical schools in Ontario, IDEAS is designed for frontline clinicians and administrators to improve the quality of patient care. An essential component of the Advanced Learning Program is the team-based applied learning project. Over the five-month program, project teams identify an issue and develop, implement and report on a quality improvement project in their own organization or local health system.

This analysis examines costs only from the point of view of the Ministry of Health and Long-Term care, in its role as the funder of acute care, rehabilitation hospitals and long-term care facilities.

The Analysis: Methods, Results and Limitations

Methods

Using administrative databases, we performed a matched cohort study to estimate the potential cost-savings (see Appendix A for a list of data sources and an outline of the methods used to identify patients, Appendix B for the results of the cohort creation, and Appendix C for a comparison of convalescent care and inpatient rehabilitation recipients). Over six thousand (6,362) acute care patients who were discharged to convalescent care were matched to similar acute care patients who were discharged to inpatient rehabilitation. The members of each matched pair were compared to one another with respect to the number of ALC days during their preceding hospitalization, the amount of time spent in convalescent care/inpatient rehabilitation, and the cost of convalescent care and rehabilitation. The differences for each of the 6,362 pairs were averaged to estimate the average impact of transferring more patients more efficiently to convalescent care (see Appendix D for additional information on the matching and the matched comparisons).

Results

As each convalescent care patient included in the analysis was matched to an inpatient rehabilitation recipient on age, sex, reason for hospitalization, and comorbidities, we believe that the analysis included only patients who were candidates for treatment in either care setting. The analysis found that patients who were discharged to convalescent care spent an average of **8.5 days longer** in Alternate Level of Care (ALC) than those who were transferred to inpatient rehabilitation. We found that 82% of the patients who were discharged to convalescent care had ALC days prior to their discharge, compared with 42% of patients who were discharged to an inpatient rehabilitation setting. This suggests that by improving the efficiency of the transfer from acute care to convalescent care, the Kipling Acres project has the potential to achieve cost-savings estimated at **$3,800** per patient. [†] The analysis also found that the cost of rehabilitative care was, on average, **$11,100** less for those treated in the convalescent care setting when compared to those who were discharged to inpatient rehabilitation. (Appendix D)

Limitations

There are limitations of this analysis. There is no information on patient's functional outcomes (e.g., improvements in activities of daily living) following treatment in convalescent care. While the National Rehabilitation Reporting System (NRS) database reports the functional status of individuals receiving inpatient rehabilitation both at admission and discharge, there is no comparable information for individuals who receive rehabilitation care in the convalescent care setting. Therefore, we cannot comment on the cost-effectiveness of convalescent care from the point of view of patient outcomes. As well, the lack of information on functional status at the time of entry into rehabilitation/convalescent care prevents a more rigorous comparison between inpatient rehabilitation and convalescent care patients.

The Kipling Acres project also demonstrated success in reducing costs associated with patient intake once patients arrived at the facility.[6] We were unable to comment on the results of this achievement as it could not be tracked using administrative databases.

[†] Additional costs are based on the difference in average resource intensity weight associated with the usage of hospital resources between those who received convalescent care services and those who received inpatient rehabilitation. (See Appendix D for more information)

It is also important to note that this analysis examines costs only from the point of view of the Ministry of Health and Long-Term care, in its role as the funder of acute care, rehabilitation hospitals and long-term care facilities. We are not able to comment on the impact of the project on costs incurred by the patient and their caregivers.

Conclusions

These results bring to light the potential cost-savings that can be achieved by freeing hospital capacity through efficient discharge of patients into a convalescent care setting. Furthermore, compared to the cost of treating similar people undergoing inpatient rehabilitation, convalescent care is far less expensive. Therefore, if we assume that convalescent care can act as a substitute for inpatient rehabilitation for certain types of patients (assuming people treated in either setting require the same level of care before they can return home and that both types of post-discharge care are equally effective in preparing a patient to return home), convalescent care demonstrates the potential to be a more economically attractive solution, from the Ministry of Health's perspective, than inpatient rehabilitation.

Appendix A: Data Sources

Primary Data Sources:

The National Rehabilitation Reporting System (NRS) database[7]:

- Contains information on patients receiving inpatient rehabilitation services
- Includes individuals with limitations due to, among others, stroke, cardiac conditions, and orthopedic conditions
- Clients are expected to require time-limited services and expected to show improvements in functional status
- The database includes information on functional status (activities of daily living, etc.) at the time of admission and at discharge

The Continuing Care Reporting System – Long-Term Care (CCRS-LTC) database[8]:

- Records all assessments performed on residents who enter a long-term care facility
- Assessments are performed within 14 days of admission for residents expected to stay for at least 14 days, and then quarterly or if the resident's status changes
- The assessment records the type of bed occupied by the resident: we examined residents whose admission category was 'CONV' or 'CNVS' indicating convalescent care

Other Data Sources:

The Registered Persons Database[9]:

- Contains limited information on all individuals insured by the Ontario Health Insurance Plan (OHIP)
- This database was used to obtain patient sex and age, as well as place of residence
- Postal codes were linked to the Postal Code Conversion File to obtain neighborhood income quintile (a measure of socioeconomic status) and Local Health Integration Network (LHIN)

The Discharge Abstract Database (DAD)[10]:

- Contains information on all inpatient hospital discharges including reason for hospitalization, comorbidities, and length of time in ALC

The Ontario Health Insurance Plan (OHIP) Physician Claims database[11]:

- Records all payments made to physicians
- Each claim contains a diagnosis code – the diagnosis codes were used to characterize patients' health status prior to their hospital admission

The National Ambulatory Care Reporting System (NACRS) database[12]:

- Contains information on all visits to emergency departments in Ontario, including reason for emergency department visit and patient comorbidities

The Ontario Drug Benefit (ODB) database[13]:

- Documents all prescriptions covered by the Ministry of Health and Long-Term Care
- These include all prescriptions filled by individuals aged 65 years and older, as well as those filled by individuals who are on social assistance

Analytical Dataset Creation Algorithm:

1. Admissions to a convalescent care program in a long-term care home were identified using the CCRS-LTC database. Records were retained if the initial assessment indicated that the person occupied a convalescent care bed. We examined admissions between April 1, 2012 and May 11, 2016.

2. Admissions to inpatient rehabilitation between April 1, 2012 and March 31, 2016 were identified using the NRS database.

3. Data cleaning: individuals staying in rehabilitation or convalescent care were excluded from the analyses if we did not have a valid identifier for them (without a valid identified, we could not link their convalescent care or rehabilitation stay to other records) or if their most recent postal code indicated they were not living in Ontario. Furthermore, since the maximum length of stay in convalescent care is 90 days, individuals with longer convalescent care stays were excluded as they were assumed to be atypical or misclassified as convalescent care patients.

4. For each person admitted to rehabilitation or convalescent care, the Discharge Abstract Database was searched for an inpatient discharge occurring within 7 days prior to rehabilitation/convalescent care admission. In most (95%) cases, admission to rehabilitation/convalescent care was on the same day as hospital discharge. If there was more than one hospital discharge, the one closest in time to admission was selected. Only those patients who entered rehabilitation/convalescent care following hospital discharge were retained.

5. Some individuals were initially discharged to inpatient rehabilitation and then, within 7 days, transferred to a convalescent care program. Others were discharged from convalescent care and entered inpatient rehabilitation. Individuals who switched from one place of care to another without an intervening acute care stay were removed from both the dataset of convalescent care admissions and the dataset of rehabilitation admissions.

6. All individuals (rehabilitation and convalescent care) were characterized by age, sex, neighbourhood socioeconomic status, LHIN, and measures of comorbidity. Three measures of comorbidity were used. All three measures have been updated for use with the ICD-10 diagnosis classification system currently used in Canadian health care databases. These three measures include:
    a. The Charlson Comorbidity Index, which uses comorbidities recorded in hospital discharge records to produce a score summarizing the patient's health status. [14]
    b. A morbidity score proposed by Elixhauser, which is modified to use the ICD-10 diagnosis coding system based on comorbidities recorded in hospital discharge records. [15]
    c. The Johns Hopkins Adjusted Clinical Group (ACG®) system score [16], which uses diagnosis information from administrative records to assess each individual on 32 diagnosis clusters (Aggregated Diagnosis Groups). We used diagnosis information from hospital discharge, emergency department visits, and ambulatory care records using a two-year look-back period. The 32 ADGs, plus age and sex, were combined into a single morbidity score. [17]

7. Cost of rehabilitation care was estimated for all individuals. Due to the cost of prescription medications for inpatient rehabilitation patients being covered by a hospital's global budget, the costs of prescriptions filled for patients in convalescent care were obtained from the ODB database and were included in cost of care. Similarly, the cost of physician visits made to patients in convalescent care were obtained from the OHIP physician billing database and were included in cost of care.

8. Individuals who entered convalescent care were matched to those who entered inpatient rehabilitation on age, sex, Charlson comorbidity score (which captures comorbidities associated with the hospitalization that led to the rehabilitation stay), reason for hospital stay (case mix group), and medical history (ADG morbidity score).

9. Within each matched pair, the difference in the number of ALC days was calculated (number of ALC days for the patient discharged to convalescent care – number of ALC days for the patient discharged to a rehabilitation hospital).

10. For each matched pair, the difference in the total cost of rehabilitation was estimated (cost of rehabilitation for the patient cared for in a convalescent care setting – cost of rehabilitation for the patient care for in a rehabilitation hospital).

Appendix B: Cohort Creation Results

Cohort Creation: Using the algorithm from Appendix A, an antecedent hospital discharge was found for 70% of patients who entered convalescent care as compared to 92% of the patients admitted to rehabilitation.

Table 1: Convalescent care cohort selection results

Convalescent Care	**Number of Patients**
All admissions to a convalescent care bed April 1, 2010 and later	12, 247
Exclude if admission was before January 1, 2016 and the discharge date is missing, or if length of stay > 90 days	11,622
Exclude if invalid identifier	11,616
Exclude if address at time of admission is out of province	11,606
Exclude if there is no inpatient hospital discharge within 7 days prior to convalescent care admissions	8,018
Exclude if patient switched between convalescent care and inpatient Rehabilitation: 89 who went from Rehabilitation into convalescent care 540 who went from convalescent care into Rehabilitation	7,389

Table 2: Inpatient rehabilitation cohort selection results

Inpatient Rehabilitation	**Number of Patients**
All admissions to Rehabilitation April 1, 2010 and later	125,062
Exclude if admission was before January 1, 2016 and the discharge date is missing, or the length of stay is >110 days (the 99th percentile)	121,493
Exclude if invalid identifier	121,478
Exclude if address at the time of admission is our of province	121,349
Exclude atypical acute care patients: those with total number of ALC days recorded in the inpatient record preceding the Rehabilitation stay greater than 99th percentile of 28 days or total acute care length of stay greater than 99th percentile of 87 days.	108,601
Exclude if patient switched between convalescent care and inpatient Rehabilitation: 58 who went from convalescent care into Rehabilitation 1472 who went from Rehabilitation into convalescent care	107,071

Appendix C: Patient Demographics Comparison

A comparison of demographics is shown below in Table 3. Of these patients:

- The comparison shows rehabilitation patients are younger and more likely to be male
- Regional differences in availability of post-discharge care are apparent in the distribution of patients among the LHINs. For example, 20% of convalescent care patients were from the Hamilton LHIN in comparison to 9% of rehabilitation patients. Furthermore, only 5% of convalescent care patients were from the Toronto Central LHIN in comparison to 11% of rehabilitation patients.

Patients discharged to convalescent care often experienced ALC stays prior to discharge, whereas patients discharged to rehabilitation typically did not spend any time in ALC. Stays in convalescent care were much longer than stays in inpatient rehabilitation but despite this, the total cost was much lower. Because of this, there are a few striking differences between convalescent care patients and inpatient rehabilitation patients with respect to:

- Number of ALC days during antecedent hospitalization
- Number of days spent in post-discharge care
- Total costs observed

Table 3: Comparison of convalescent care and inpatient demographic before matching

	Convalescent care	**Inpatient Rehabilitation**
Age: median (IQR)	81 (72 – 87)	78 (67 – 85)
Sex: % female	70.9	56.4
Austin score based on Adjusted clinical group (ACG) in previous 2 years: median (IQR)	81 (69 – 92)	77 (64 – 89)
Income quintile: %		
• 1	25.7	21.8
• 2	22.6	21.2
• 3	20.1	19.1
• 4	17.0	19.4
• 5	14.7	18.6
Rural: %	10.4	8.1
RIO: median (IQR)	0 (0 – 8)	0 (0 – 10)
LHIN: (%)		
• Erie St. Clair	3.8	6.6
• South West	3.4	5.9
• Waterloo Wellington	3.9	3.8
• Hamilton Niagara Haldimand Brant	20.1	9.1
• Central West	4.2	4.8
• Mississauga Halton	6.1	9.2
• Toronto Central	4.9	11.3
• Central	14.0	13.4
• Central East	11.9	15.5
• South East	3.1	2.8
	8.7	10.6

• Champlain • North Simcoe Muskoka • North East • North West	7.9 6.3 1.9	2.6 3.5 1.3
Lives alone (as reported in the convalescent care/rehabilitation record): (%)	42.5	34.0
Preceding Hospitalization		
Admission to hospital: % non-elective	91.2	81.3
Charlson comorbidity index: % • 0 • 1 • 2 • 3 • 4+	 47.5 21.4 15.4 8.7 7.1	 37.3 24.3 14.7 13.3 10.4
Morbidity score based on Elixhauser conditions: median (IQR)	0 (0 – 6)	0 (0 – 7)
Most common CMGs • Ischemic event of central nervous system • Fixation/repair hip/femur • Hip replacement with trauma/complication • Unilateral knee replacement • Unilateral hip replacement • Fracture/Dislocation/Rupture of Pelvis/Sacrum/Coccyx • Reduction/Fixation/Repair of Ankle/Foot • Fracture of Shoulder/Upper Humerus	 0.5 8.9 2.2 0.6 1.4 5.8 4.7 3.4	 12.0 8.3 6.1 4.4 4.0 2.4 0.2 0.3
Total resource intensity weight (RIW) for hospital episode of care: median (IQR)	2.6 (1.6 – 4.1)	2.0 (1.3 – 3.2)
Total ALC days: median (IQR)	9 (4 – 15)	0 (0 – 3)
Any ALC days: %	82.0	42.3
Convalescent Care/Rehabilitation Stay		
Days in convalescent care/Rehabilitation	59 (36 – 82)	20 (13 – 30)
Dementia recorded in the rehabilitation/conv care record: %	7.9	6.7
Cost: median (IQR) Convalescent costs are not available for patients who had not been discharged by the end of the data period; rehabilitation costs are not available for patients admitted after Dec 31, 2014. Convalescent care costs were calculated as the sum of the per diem, prescription drugs (these are included in the cost of Rehabilitation), and physician visits.	$8,000 (5,000 – 10,800)	$12,700 (9,900 – 22,100)

Appendix D: Matching Results

Patients who were cared for in a convalescent care home were matched to patients cared for in inpatient rehabilitation (see analytical dataset creation algorithm in Appendix A). Patients were matched on:

- Age (± 5 years)
- Sex
- Charlson score (truncated at 5)
- Case mix group (CMG)
- Quintile of Adjusted Clinical group (ACG) score (capturing history of comorbidities in the previous 2 years)

Using these criteria, we were able to match 6,362 (86.1%) of the convalescent care patients to similar patients who were discharged to inpatient rehabilitation.

Matched pairs were then compared with respect to:

- Number ALC days during preceding hospitalization
- Time spent in convalescent care/rehabilitation
- Cost of convalescent care/rehabilitation

Table 4: Results of the matched comparison of convalescent stay patients and inpatient rehabilitation patients.

	Difference (convalescent stay – inpatient rehabilitation)*	
Measure	mean (95% confidence interval)	median (Interquartile range)
ALC days during preceding hospital stay	8.5 (8.2 – 8.7)	7 (0 – 13)
Total RIW for preceding hospital stay	0.67 (0.57 – 0.78)	0.46 (-0.45 – 1.83)
Length of stay (days) in convalescent care/rehabilitation	33.4 (32.7 – 34.2)	36 (12 – 58)
Cost of convalescent care/rehabilitation (rounded to the nearest $100)	**-$11,100 (-10,700 – -11,500)**	-$6,800 (-1,700 – -13,500)

*The table shows the difference in costs, calculated as (convalescent stay – inpatient rehabilitation). Bootstrapping was used to estimate 95% confidence intervals for the mean differences.

These results indicate that:

- On average, patients who were discharged to convalescent care experienced 8.5 more days in ALC than patients who were discharged to inpatient rehabilitation
- The Resource Intensity Weights (RIW) for acute care hospitalization of patients who are discharged to convalescent care were, on average, 0.67 higher than the RIWs for matched patients discharged to inpatient rehabilitation
    - Because convalescent care patients were matched to inpatient rehabilitation patients on most of the variables used to calculate RIW (age, CMG, and comorbidities recorded in the discharge record), differences in RIW reflect the burden of ALC stays

- Stays in convalescent care were, on average, over a month longer than stays in inpatient rehabilitation
- Despite longer stays in convalescent care, the total cost of post-acute discharge rehabilitation was, on average, $11,100 less expensive for patients treated in convalescent care than for those who received inpatient rehabilitation ranging from $10,700 to $11,500.

The estimated cost of additional ALC Days for those discharged to convalescent care services:

- Those discharged to convalescent care had, on average, an RIW that was 0.67 higher than that of matched patients discharged to inpatient rehabilitation
- This RIW difference was assumed to be largely attributed to their preceding hospital ALC stay
    - For the years 2010/11 – 2014/15, the average cost per RIW in Ontario was $5,690 with minimal year-to-year variation (Between 2010/11 and 2014/15, the average cost per RIW ranged from $5,631 to $5,746)10
    - The average cost associated with the additional ALC stay for those discharged to convalescent care is estimated to be $3,812 per patient (0.67*$5,690/RIW)
    - Therefore, there is the potential for considerable cost savings if discharge to convalescent care can be streamlined and become as efficient as discharge to inpatient rehabilitation

References

1. Why not now? A bold five-year strategy for innovating Ontario's system of care for older adults. Long Term Care Innovation Expert Panel. 2012 Mar. http://www.oltca.com/oltca/Documents/Reports/WhyNotNowFULL_March2012.pdf

2. Seniors in hospital beds costly for health system. CBC News: Health. 2011 Dec. http://www.cbc.ca/news/health/seniors-in-hospital-beds-costly-for-health-system-1.1069802

3. Sutherland JM, Crump RT. Exploring alternative level care (ALC) and the role of funding policies: an evolving evidence base for Canada. Ottawa: Canadian Health Services Research Foundation; 2011 Sep.

4. Born K, Laupacis A. Gridlock in Ontario's hospitals. Healthy Debate. 2011 Feb. http://healthydebate.ca/2011/02/_mailpress_mailing_list_healthydebate-news/hospital-gridlock

5. Juraschka E, Filice G. Kipling Acres Convalescent Care Length of Stay. IDEAS Ontario. 2015.

6. Croxford R, Juraschka E, Filice G, Isaranuwatchai W, Maclagan L, Mendlowitz A. Kipling Acres IDEAS Economic Analysis Team Meeting. 2016.

7. National Rehabilitation Reporting System (NRS). Canadian Institute for Health Information. 2017.

8. The Continuing Care Reporting System. Canadian Institute for Health Information. 2017.

9. The Registered Persons Database. Ministry of Health and Long Term Care. 2017.

10. Discharge Abstract Database. Canadian Institute for Health Information. 2017.

11. National Physician Database. Canadian Institute for Health Information. 2017.

12. National Ambulatory Care Reporting System. Canadian Institute for Health Information. 2017.

13. Ontario Drug Benefit database. Ministry of Health and Long Term Care. 2017.

14. Sundararajan V, Henderson T, Perry C, Muggivan A, Quan H, Ghali WA. New ICD-10 version of the Charlson comorbidity index predicted in-hospital mortality. J Clin Epidemiol. 2004; S7(12): 1288-94.

15. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Juthi J-C, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical Care 2005; 43(11): 1130-1139.

16. The Johns Hopkins ACG® System. The Johns Hopkins University. 2017. https://www.hopkinsacg.org/

17. Austin PC, van Walraven C. The mortality risk score and the ADG score. Two points-based scoring systems for the Johns Hopkins Aggregated Diagnosis Groups to predict mortality in a general adult population cohort in Ontario, Canada. Medical Care 2011; 49(10): 940 – 947.