All-Cause Readmission to Acute Care and Return to the Emergency Department

Health System Performance

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Institut canadien d'information sur la santé

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- **Irfan Dhalla**, MD, MSc, FRCPC, Staff Physician and Scientist, St. Michael's Hospital; Assistant Professor, University of Toronto; Medical Advisor, Toronto Central Community Care Access Centre; Adjunct Scientist, Institute for Clinical Evaluative Sciences

It should be noted that the analyses and conclusions in this report do not necessarily reflect the opinions of the affiliated organizations.

The leadership team that provided guidance and support in the development of this report is as follows:

- Jeremy Veillard, Vice President, Research and Analysis
- Kathleen Morris, Director, Health System Analysis and Emerging Issues
- Darren Gerson, Manager, Health Services Research
- Joanne Hader, Manager, Health Indicators

The project team responsible for the development of this report is as follows:

- Hani Abushomar, Senior Analyst
- Xi-Kuan Chen, Program Lead
- Michelle Costa, Senior Analyst
- Hong Ji, Senior Analyst
- Carrie Lee, Analyst
- Isac Lima, Senior Analyst
- Jacqueline Kurji, Senior Coordinator
- Cheng Qian, Program Lead
- Razia Sultana, Analyst

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Executive Summary

Unplanned readmissions to hospital have been identified as common,[1–4] costly[2, 5] and potentially avoidable.[6] Understanding the factors that contribute to unplanned readmissions can inform strategies to reduce unplanned readmission rates. This report presents pan-Canadian rates of all-cause, unplanned readmission to acute care within 30 days of discharge and rates of return to the emergency department (ED) within seven days of discharge for three jurisdictions (Alberta, Ontario and Yukon). It also examines patient, hospital and community factors associated with acute care readmissions and ED returns for four patient groups (medical, surgical, obstetric and pediatric).

Key Findings

- About 8.5% of acute care patients were readmitted to an acute care hospital within 30 days of their initial discharge.
- Nine percent of acute care patients in Alberta, Ontario and Yukon returned to the ED, with one-sixth of that group returning multiple times within seven days of their initial discharge. Readmission rates and costs were greatest for medical patients (patients initially hospitalized for medical care), followed by surgical patients. Medical and pediatric patients tended to be readmitted for the same or similar conditions upon readmission to acute care and return to the ED, while obstetric and surgical readmissions tended to be for unplanned follow-up care.
- For all patient groups except medical patients, the initial hospitalization was more expensive than the readmission. For example, surgical patients were readmitted for less-expensive follow-up care on average, including care for infection following a procedure.
- Almost 1 in 10 (9.3%) readmitted patients who were initially in hospital for a surgical procedure were readmitted because of an infection. The risk of readmission for medical and surgical patients increased with age, and male patients were at a higher risk of readmission than female ones. Patients with more comorbidities, as measured by the Charlson Index score, were also more likely to be readmitted.
- A patient's risk of readmission to acute care increased with an increasing number of acute care hospitalizations prior to the index hospitalization. A patient's risk of returning to the ED increased with an increasing number of ED visits prior to index.
- Both very long and very short patient lengths of stay in hospital were predictors of acute care readmission.

Hospital-level factors associated with readmissions included hospital length of stay and hospital size. Overall, after adjusting for case mix, age, sex, admission via the ED and number of acute care visits six months prior, hospitals with longer lengths of stay had lower readmission rates.

The community-level factors of rural patient residence and neighbourhood income quintile were also explored. Rural patients were more likely to return to the ED across patient groups, and acute care readmission rates were significantly greater for rural medical, surgical and obstetric patients. When examined at the aggregate level, patients in the lowest income quintile

demonstrated higher acute care readmission and ED return rates than patients in the highest income quintile. Variations in readmission and return rates across jurisdictions in Canada (with the exception of Nunavut) were modest.

Readmissions to acute care cost an estimated $1.8 billion (excluding physician fees for services). An additional $30.6 million was spent on acute care patients returning to the ED in the three jurisdictions studied.

While not all readmissions are avoidable, research suggests that between 9% and 59% of readmissions may be prevented. Strategies to reduce readmission that have been documented in the literature include improved patient education, improved discharge planning and scheduling follow-up appointments before discharge. After discharge, follow-up phone calls, patient hotlines and same-provider continuity may prove to be beneficial.

Introduction

Background

Unplanned hospital readmissions have been a focus of health service researchers and policy- and decision-makers since the early 1970s.[5] Growing attention has been given to this issue due to the burden of unplanned readmissions on patients and their family members, on the quality of health care services and on the health care system in general. Many studies have identified unplanned readmissions as common,[1–4] costly[2, 5] and potentially avoidable.[6, 7]

Much work has been done to investigate the rates and risk factors associated with unplanned readmissions in the United States.[2, 4, 5, 8] In 2009, an influential study reported that nearly one in five (19.6%) Medicare beneficiaries in the United States who were discharged from hospital were readmitted to hospital within 30 days of their index discharge.[2] Experts in the field consider this rate higher than what would be expected if these patients received care considered to be best practice. Identifying patients more likely to return to the hospital and creating mechanisms to improve their care before and after hospital discharge are important in reducing the rates of unplanned readmissions.

The overall cost associated with unplanned readmissions can be quite significant. The approximate total cost of Medicare for unplanned readmissions was estimated to be just more than $17 billion in 2004.[2] This represented approximately 17% of all the hospital payments received from Medicare.[2] It is believed that a portion of these expenses could be saved by reducing hospital readmissions.

While some readmissions are unavoidable due to onset of different conditions or health deterioration, some are preventable. Although consensus has not been reached on the proportion of readmissions that are preventable, studies indicate that 9% to 59% of all-cause unplanned readmissions may be prevented.[6, 9–13]

Several studies have investigated the factors associated with an increased risk of returning to the hospital shortly after a discharge.[4, 14, 15] Readmitted patients are generally known to be older,[16] to suffer from complications and comorbidities,[14, 17] to have received medical care as opposed to surgical care in the index discharge,[5] to be of low socio-economic status[18] and to have a history of an emergency department/acute care admission prior to the index discharge.[14, 17] Studies have also demonstrated that both long[14, 17] and short[19] index lengths of stay are indicators of future readmission.

Our Focus

This report presents all-cause unplanned readmission rates to acute care hospitals across every province and territory in Canada, as well as all-cause unplanned return to emergency department (ED) rates in Ontario, Alberta and Yukon. The rates are estimated for four different patient groups: medical, surgical, pediatric and obstetric. These patient groups are clinically different from each other and may be significantly different in terms of risk factors associated with unplanned readmissions.

Existing literature has focused on preventable readmissions,[4, 7, 20] that is, cases that could have been prevented with better clinical management before hospital discharge, improved case management, adequate follow-up care and discharge planning, and adequate home care services.[20–23] Identifying preventable readmissions requires a clear and measurable definition of preventability. However, a common definition of preventable readmission has not been established among researchers, as readmissions depend on things such as social supports and home care.

During the exploration of all-cause unplanned readmission in Canada, this report focuses on three components of readmission:

- **Patient effects:** Certain factors associated with the patient, such as age, sex, clinical condition and comorbidities, that may affect the likelihood of readmission and are often beyond the control of the hospital.
- **Hospital effects:** Hospital-specific length-of-stay pattern and hospital size effects on unplanned readmissions.
- **Community effects:** The availability of post-acute care that may prevent exacerbation of problems requiring additional hospital admissions. This is measured by examining differences in readmission patterns between rural and urban communities. Additionally, the impact of neighbourhood income quintile is explored in this component of readmissions.

In addition, this report also addresses hospital costs associated with caring for unplanned readmissions in Canada.

Methodology Note

The unit of analysis in this report is the episode of care. An episode of care refers to all adjoining inpatient hospitalizations and same-day surgery visits. Throughout this report, episodes will be referred to as “patients” or “hospitalizations.” All eligible episodes serve as index to determine if there is a following readmission to acute care within 30 days or a following return to the emergency department within 7 days. The latter outcome is measured using data from Alberta, Ontario and Yukon. In this context, the term “index” refers to the initial hospitalization. The approach used in this report is consistent with that used for other CIHI readmission indicators. When comparing these results with those in other published reports, it is important to examine the details of the methodology, which can be found in the appendix. Common differences among reported readmission results include

- Episodes versus discharges;
- Unplanned readmissions versus all readmitted patients;
- Time frames for readmission; and
- Clinical groups included in the analysis.

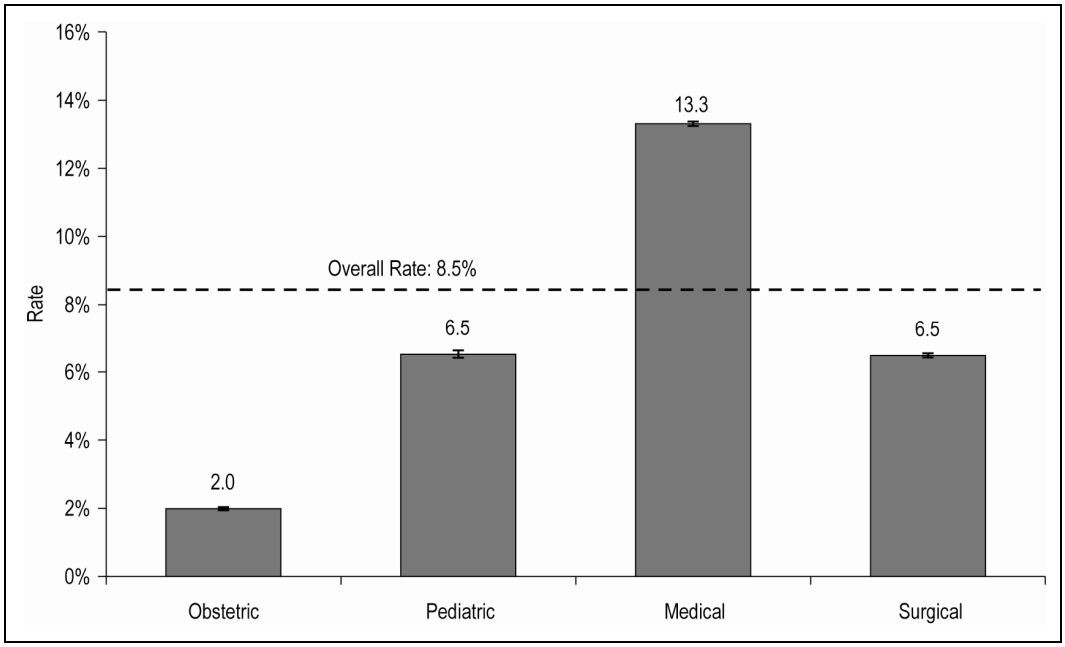
Part 1: Readmissions to Inpatient Acute Care

Just over 2.1 million acute inpatient hospitalizations occurred in Canada during the 11-month study period.[i, ii] Of this population, 41.6% (885,806) were medical patients, 31.4% (667,796) were surgical, 17.8% (378,951) were obstetric and 9.3% (197,080) were pediatric. More information about patient group characteristics can be found in the appendix.

A total of 181,551 patients were readmitted to acute inpatient care within a month of discharge, for a 30-day all-cause readmission rate of 8.5% in Canada. As found in previous studies,[14, 24] the medical patient group accounted for the greatest proportion of all readmissions (64.9%). Readmissions for the surgical patient group accounted for 23.9% of all readmissions, while 7.1% were for pediatric patients and 4.1% were for obstetric patients.

Medical patients had both the greatest absolute number of readmissions and the highest readmission rate among patient groups. In the medical patient group, 13.3% of patients had a readmission within 30 days of discharge, compared with 6.5% of patients in the surgical patient group. Only 2.0% of obstetric patients and 6.5% of pediatric patients were readmitted to acute inpatient care.

Figure 1: 30-Day All-Cause Unplanned Readmission Rates to Inpatient Acute Care



Note
Rates and 95% confidence intervals.
Sources
Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

i. The study period encompassed the months of April 2010 to February 2011 for index hospitalizations and the entire year of April 2010 to March 2011 for readmissions.
ii. Data for Quebec was from April 2009 to February 2010.

30-Day Acute Inpatient Readmissions for Mental Illness

Readmission rates reported here exclude readmissions for mental illness. This was done because data about mental illness is not captured consistently across the country. However, readmissions for mental illness were explored in CIHI's *Health Indicators 2011* report. In 2009–2010, about 12,618 patients with selected mental illnesses were readmitted to acute inpatient care, for a rate of 11.4%.[25]

Risk Factors for Readmission

Studies have identified several factors associated with readmission, many of which can be found in CIHI data, including age, sex, Charlson Index comorbidity score, rural residence, neighbourhood income, index admission through the ED, number of acute care visits six months prior to the index discharge and patient length of stay in hospital. Different models were fit to predict the risk of acute inpatient readmissions for each of the four patient groups. Table 1 presents the risk factors applied to each patient group.

Table 1: Risk Factors for Readmission, by Patient, Hospital and Community Effects

	Medical/Surgical	Obstetric	Pediatric
Patient Effects			
Age*	✓	✓	✓
Sex*	✓	✗	✓
Charlson Index Comorbidity Score*	✓	✗	✗
Admission via Emergency Department in Index*	✓	✓	✓
Patient Length-of-Stay Variance*	✓	✓	✓
Number of Acute Admissions Six Months Prior to Index*	✓	✓	✓
Clinical Conditions in Index	✓	✓	✓
Clinical Conditions in Readmission	✓	✓	✓
Hospital Effects			
Hospital Length-of-Stay Variance	✓	✓	✓
Hospital Size	✓	✓	✓
Community Effects			
Rural Residence*	✓	✓	✓
Neighbourhood Income Quintile*	✓	✓	✓

Note

* These risk factors were included in the multiple regression models. The odds ratios for these factors associated with readmission can be found in the appendix.

Source

Canadian Institute for Health Information.

Risk was reported as the odds of readmission to acute inpatient care within 30 days of discharge. Odds ratios and confidence intervals for each factor within each patient group are described in the appendix of this report. The following factors were found to be predictors of acute inpatient readmissions across patient groups:

- Number of acute care inpatient admissions six months prior to the index admission;
- Rural residence; and
- Index acute inpatient care admission through the ED.

The factors listed in Table 1 will be explored in more detail in the following sections.

Understanding Patient Effects

A number of patient characteristics were found to predict an inpatient readmission. Such characteristics include age, sex and clinical complexity. In medical and surgical hospitalizations, the risk of readmission increased with age, and male patients were at a higher risk of readmission than female ones. Patients with higher Charlson Index scores were more likely to be readmitted in the same patient groups. In this section, we focus on the clinical characteristics of readmitted patients to provide a deeper understanding of these patients.

Who Is Returning and Why Are They Returning?

Each hospitalization was categorized based on CIHI's Case Mix Group+ (CMG+) methodology. CMGs provide a method for aggregating large volumes of data into clinically homogenous groups. The five CMGs with the highest inpatient readmission volumes were determined for each of the medical, surgical, obstetric and pediatric patient groups. The two most frequent conditions for which patients were readmitted were examined.

Medical Patient Group

Among medical patients, those with chronic obstructive pulmonary disease (COPD) had the highest number of readmissions. Other conditions representing high readmission volumes included (in order from high volume to low volume) heart failure, pneumonia, digestive disorders and arrhythmia. These conditions also represented the highest-volume CMGs in the medical population, whether or not the patient was readmitted. COPD patients represented the highest volume of readmissions, and heart failure patients had the highest readmission rate. About one in five patients with an index condition of COPD (18.8%) and heart failure (21.0%) was readmitted to acute inpatient care within 30 days.

In each of the CMGs representing the highest volume of readmissions, the most frequent condition upon readmission was the same condition as the index case. For example, of the 18.8% (N = 10,517) of COPD patients who were readmitted, 56.3% were treated for COPD symptoms. Similarly, a very high proportion (42.2%) of all returning heart failure patients came back for treatment for the same condition. These results align with the literature,[2, 26–28] which states that unplanned readmissions for heart failure and COPD accounted for a considerable proportion of all unplanned readmissions in the United States.

Table 2: Conditions Representing the Largest Number of Readmissions and Their Reasons for Return, for Medical Patients

Most Frequent Conditions at Index (CMG)	Readmission Rate	Readmission Volume	Two Most Frequent Conditions Upon Readmission (CMG, Percentage)	
COPD	18.8	10,517	COPD (56.3)	Heart Failure Without Coronary Angiogram (5.2)
Heart Failure Without Coronary Angiogram	21.0	7,855	Heart Failure Without Coronary Angiogram (42.2)	COPD (5.2)
Pneumonia (Viral/Unspecified)	12.5	4,386	Pneumonia (Viral/Unspecified) (18.8)	Heart Failure Without Coronary Angiogram (7.6)
Symptom/Sign of Digestive System	15.6	3,953	Symptom/Sign of Digestive System (25.7)	Gastrointestinal Obstruction (3.3)
Arrhythmia Without Coronary Angiogram	12.6	3,548	Arrhythmia Without Coronary Angiogram (31.6)	Heart Failure Without Coronary Angiogram (12.2)

Sources
Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Surgical Patient Group

The five interventions at index associated with the largest number of readmissions were (in order from high volume to low volume) percutaneous coronary intervention (PCI), colostomy/enterostomy,[iii] unilateral knee replacement, hysterectomy (for benign conditions) and pacemaker implantation/removal. Unlike the medical patient group, the conditions representing the highest volume of readmissions did not represent the highest volume of activity.

The readmission rate was greatest for colostomy/enterostomy, where approximately one in six (16.6%) discharges with this intervention was readmitted within 30 days.

When readmission conditions were examined for surgical patients, the CMG for post-operative complications (except hemorrhage) was commonly observed. Within this population, 86.1% of patients had an infection following a procedure. Moreover, 9.3% of all readmitted surgical patients were readmitted because of an infection following a procedure.

iii. A colostomy is the surgical formation of an opening from the colon onto the surface of the body. An enterostomy is a procedure in which the surgeon makes a passage into the patient's small intestine through the abdomen, with an opening to allow for drainage or to insert a tube for feeding.

Table 3: Conditions Representing the Largest Number of Readmissions and Their Reasons for Return, for Surgical Patients

Most Frequent Conditions at Index (CMG)	Readmission Rate	Readmission Volume	Two Most Frequent Conditions Upon Readmission (CMG, Percentage)	
Percutaneous Coronary Intervention With Myocardial Infarction/ Shock/Arrest/Heart Failure	7.9	1,539	Angina (Except Unstable)/Chest Pain Without Coronary Angiogram (14.2)	Heart Failure Without Coronary Angiogram (12.4)
Colostomy/ Enterostomy	16.6	1,500	Post-Operative Complication Except Hemorrhage (14.9)	Other Gastrointestinal Disorder (12.3)
Unilateral Knee Replacement	3.1	1,230	Orthopedic Aftercare (9.5)	Post-Operative Complication Except Hemorrhage (7.6)
Hysterectomy With Non-Malignant Diagnosis	3.3	1,133	Post-Operative Complication Except Hemorrhage (27.8)	Post-Operative Hemorrhage (15.7)
Pacemaker Implantation/ Removal Except Cardioverter/ Defibrillator Implant	9.1	1,109	Heart Failure Without Coronary Angiogram (15.5)	Other/Miscellaneous Cardiac Disorder (9.6)

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Obstetric Patient Group

Among obstetric patients, those who were originally hospitalized for antepartum disorders[iv] had the highest readmission volumes. While these readmissions were unplanned, they were not necessarily unexpected. In this study, the top antepartum disorders in the index hospitalization included diseases and complications of pregnancy, false labour before 37 weeks of gestation and pre-term labour without delivery.

Many readmissions were among patients who were originally hospitalized for deliveries. A high readmission rate was also observed for patients hospitalized for ectopic pregnancy (treated medically), for which more than one in five (22.1%) patients was readmitted, although the volume of readmissions was only 124 patients.

Upon readmission, postpartum disorders treated either medically or surgically were the conditions most frequently observed. In fact, these conditions were consistently observed in more than 70% of the readmitted cases. An in-depth examination of patients readmitted after undergoing a Caesarean section (C-section) delivery (both primary and repeated) indicated that 23.1% were readmitted for infections of an obstetric surgical wound.

iv. Antepartum disorders are conditions occurring before childbirth, with reference to the mother. These conditions often include false labour, pre-term labour without delivery and other pre-existing conditions or conditions arising during the pregnancy that complicate the pregnancy.

Table 4: Conditions Representing the Largest Number of Readmissions and Their Reasons for Return, for Obstetric Patients

Most Frequent Conditions at Index (CMG)	Readmission Rate	Readmission Volume	Two Most Frequent Conditions Upon Readmission (CMG, Percentage)	
Antepartum Disorder Treated Medically	9.4	2,688	Antepartum Disorder Treated Medically (90.3)	Abortion Diagnosis Treated Surgically/Non-Major Intervention (1.6)
Vaginal Delivery, No Other Intervention	0.9	1,729	Postpartum Disorder Treated Medically (49.7)	Postpartum Disorder Treated Surgically/Non-Major Intervention (24.3)
Primary Caesarean Section	2.1	1,108	Postpartum Disorder Treated Medically (71.4)	Postpartum Disorder Treated Surgically/Non-Major Intervention (12.7)
Caesarean Section With Previous Uterine Scar	1.3	488	Postpartum Disorder Treated Medically (68.4)	Postpartum Disorder Treated Surgically/Non-Major Intervention (12.5)
Forceps/Vacuum Delivery, No Other Intervention	1.2	327	Postpartum Disorder Treated Medically (50.5)	Postpartum Disorder Treated Surgically/Non-Major Intervention (23.6)

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Pediatric Patient Group

Among pediatric patients, respiratory infection, pneumonia, chemotherapy/radiotherapy, non-severe enteritis[v] and seizure disorder were the conditions associated with the highest number of readmissions. The highest readmission rate was observed among patients who were originally hospitalized for chemotherapy or radiotherapy. About one in five (22.5%) patients in this population was readmitted within 30 days of discharge due to an unplanned event. Many (48.1%) of these patients returned for symptoms related to white blood cell count (that is, agranulocytosis), which is a common side effect in patients receiving chemotherapy treatment.[29]

v. Enteritis is inflammation of the intestinal tract, especially of the small intestine.

Table 5: Conditions Representing the Largest Number of Readmissions and Their Reasons for Return, for Pediatric Patients

Most Frequent Conditions at Index (CMG)	Readmission Rate	Readmission Volume	Two Most Frequent Conditions Upon Readmission (CMG, Percentage)	
Upper/Lower Respiratory Infection	7.3	710	Upper/Lower Respiratory Infection (47.0)	Viral/Unspecified Pneumonia (14.4)
Viral/Unspecified Pneumonia	6.1	657	Viral/Unspecified Pneumonia (37.0)	Upper/Lower Respiratory Infection (13.6)
Chemotherapy/Radiotherapy Admission for Neoplasm	22.5	626	Agranulocytosis (48.1)	Fever (11.2)
Non-Severe Enteritis	5.4	526	Non-Severe Enteritis (37.8)	Symptom/Sign of Digestive System (8.2)
Seizure Disorder, Except Status Epilepticus*	9.3	473	Seizure Disorder, Except Status Epilepticus (62.4)	Status Epilepticus (7.6)

Note

* Status epilepticus is a continuous seizure or a series of similar seizures without return to consciousness between them.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Understanding Hospital Effects

Hospital factors, such as the total time spent in hospital and hospital size, can affect acute inpatient readmission rates; this section explores these effects.

Length of Inpatient Hospital Stay

An earlier study found that shorter lengths of stay are associated with greater readmission rates.[19] Other studies suggest that longer lengths of stay have also been associated with a greater risk for readmission.[14, 24, 28, 30] Although the effects of length of stay are not fully understood, one hypothesis suggests that longer-than-expected lengths of stay imply “sicker” patients who require more care,[30] but not necessarily in a hospital setting.[31]

In this section of the report, the impact on readmission is examined by average hospital length of stay instead of individual patient length of stay. Specifically, average hospital length of stay is compared with an expected length of stay that accounts for case-mix differences among hospitals. While there are always unique circumstances that affect the shorter or longer length of stay of an individual patient, one would expect that these would net out across a full hospital population. As a result, hospital-level average length of stay should be close to the overall expected length of stay, unless there are structural factors that impact length of stay across all patients. Such structural factors might include availability of post-discharge care alternatives, internal hospital administrative processes or clinical practice patterns that differ from the norm.

More on Hospital Length of Stay

For a given hospital, the length of stay examined in this report is the difference between the hospital's average length of stay and the expected patient length of stay, where the expected length of stay was determined for each patient based on his or her CMG, comorbidities, interventions and age. Analyses were also restricted to patients within each CMG who were considered to be typical patients. For more information about CIHI's CMG methodology and expected length of stay methodology, please refer to the CIHI document *DAD Resource Intensity Weights and Expected Length of Stay for CMG+ 2011*.[32]

Variation in hospital length of stay was a predictor of readmission to inpatient acute care when the following factors were controlled for: patient group, age, sex, neighbourhood income quintiles, urban/rural residence, admission via the emergency department and number of acute care visits six months prior to the index discharge. Patients discharged from hospitals that had average lengths of stay that were shorter than the expected length of stay (ELOS) had higher readmission rates. The risk of readmission increased by around 40% in patients discharged from hospitals with an average length of stay that was more than one day shorter than the national average ELOS. It should be noted that the population of hospitals where the average length of stay was more than one day shorter than ELOS includes 25 hospitals with average annual volumes of approximately 290 inpatients. Odds ratios and confidence intervals are provided in the appendix.

The Benefits of Shorter Hospital Stays

While some patients may benefit from extended hospital care, many patients are best served by shorter in-hospital lengths of stay.[33, 34] Patients who are seniors are especially vulnerable to hospital-acquired adverse events, such as infections or pressure ulcers. Furthermore, seniors waiting extensively for an alternate level of care (ALC) are at a greater risk of functional deterioration.[35] However, most of these seniors are too sick to be simply discharged home with no support. One study found that more than one in four (28.5%) patients age 75 and older had some ALC days during their hospital stays and that 35% of them were in need of home care. Close to half (46%) of those waiting for home care subsequently received it after waiting close to three days (on average 2.8 days).[36] Ultimately, the most appropriate length of hospital stay depends on the case. At the system level, longer lengths of hospital stay are often associated with higher hospital costs and can divert hospital resources away from providing care for other patients.[37, 38]

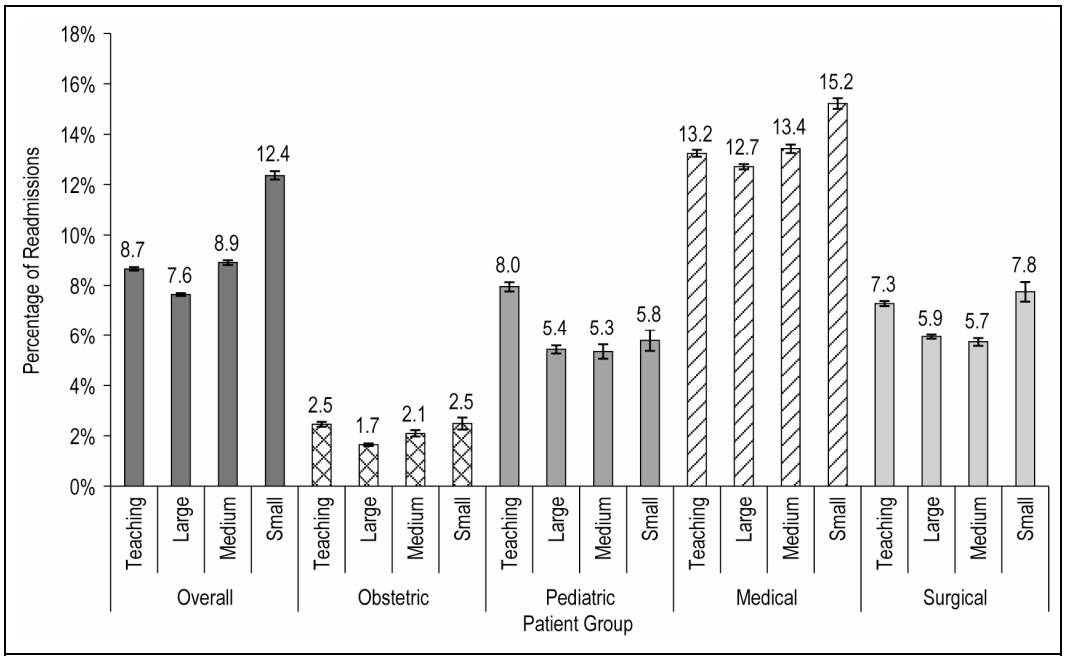
Hospital Size

Hospitals were stratified into four peer groups to see if there were patterns associated with hospitals of different sizes. The categories were based on the size of the index hospital,[vi] and data showed that small hospitals consistently had the highest readmission rates.

Overall, 12.4% of patients discharged from small hospitals returned for inpatient care within 30 days, compared with 7.6% for large community hospitals, 8.7% for teaching hospitals and 8.9% for medium community hospitals. Higher readmission rates in small hospitals were driven by two factors: first, small hospitals had a higher proportion of medical patients, who were more frequently readmitted regardless of hospital size; and second, within the medical group, small hospitals had higher readmission rates than their larger counterparts.

Readmission rates for surgical discharges were greater in both small (7.8%) and teaching (7.3%) hospitals than in large (5.9%) and medium (5.7%) hospitals. About 8.0% of pediatric index hospitalizations discharged from teaching hospitals returned for inpatient care within 30 days, a higher rate than that seen in small, medium and large hospitals. The teaching hospital category includes the few specialized children's hospitals that frequently treat complex pediatric patients.

Figure 2: Rate of Inpatient Readmissions for Hospital Peer Groups, Overall and by Patient Group



Note
Rates and 95% confidence intervals.
Sources
Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

vi. Most (80.3%) readmitted patients returned to the hospital they initially visited.

Understanding Community Effects

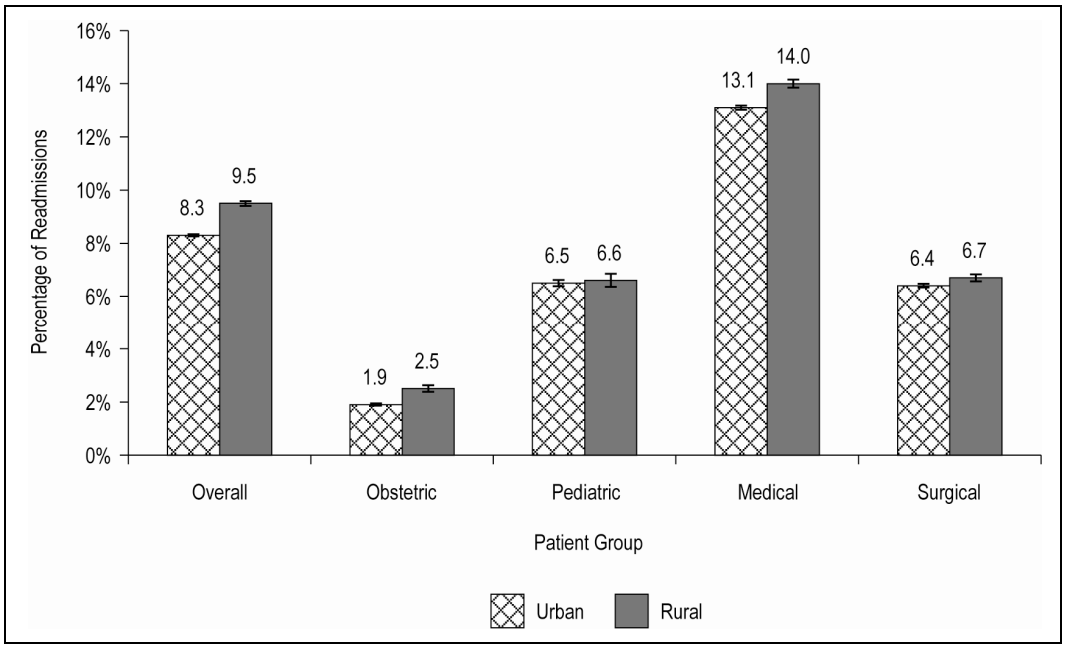
Like hospital factors, community-level factors can be associated with the risk of readmission. The literature suggests that follow-up care, such as having access to a family physician, community services and home care, as well as not living alone, are alternatives to hospitalization.[22, 39–42] However, limited data is available that can be directly linked to readmissions. As a result, this study examines this possible association using patients' residence as a proxy for community care service levels.

Urban and Rural Differences

Readmission rates were higher among patients residing in rural areas (9.5%) than among their urban counterparts (8.3%). This pattern was consistent across patient groups, and differences in rural and urban readmission rates were statistically significant among all patient groups except the pediatric population ($p<0.05$).

One potential explanatory factor is the high percentage of seniors living in rural areas. Overall, 39.3% of rural patients were seniors, compared with 36.8% of urban patients, and readmission rates for rural senior patients (13.2%) were greater than those for urban senior patients (12.0%). Additionally, higher hospitalizations among rural elderly patients may be at least in part explained by the fewer home care services available in the community, such as palliative care and physiotherapy.[43]

Figure 3: Rate of Inpatient Readmissions by Urban/Rural Residence, Overall and by Patient Group



Notes

Rates and 95% confidence intervals.

Rates were significantly different for rural patients for the following patient groups: obstetric, medical and surgical.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Income Quintiles

When examined at the aggregate level, patients in the lowest income quintiles demonstrated a significant difference in their readmission rates in all patient groups. Specifically, patients from the least affluent neighbourhoods experienced a readmission rate of 9.5%, whereas patients from the most affluent neighbourhoods were readmitted 7.9% of the time. After adjusting for patient-level characteristics and urban/rural residence, the risk of readmission in patients from the least affluent neighbourhoods was about 10% higher than the risk for those in the most affluent neighborhoods. This relationship was observed across all patient groups. Odds ratios can be found in the appendix.

Table 6: Rate of Inpatient Readmissions, by Income Quintile and by Patient Group (Percentage)

Income Quintile	Overall	Obstetric	Pediatric	Medical	Surgical
1—Least Affluent	9.5	2.3	7.2	14.1	7.3
2	8.7	2.0	6.7	13.3	6.6
3	8.3	1.8	6.2	13.2	6.4
4	8.0	1.8	6.3	12.9	6.1
5—Most Affluent	7.9	1.9	6.0	12.7	6.0

Notes

About 0.9% of patients could not be assigned to neighbourhood income quintiles.

There was a statistically significant difference in readmission rates between the lowest and the highest income quintiles in all patient groups ($p<0.05$).

Sources

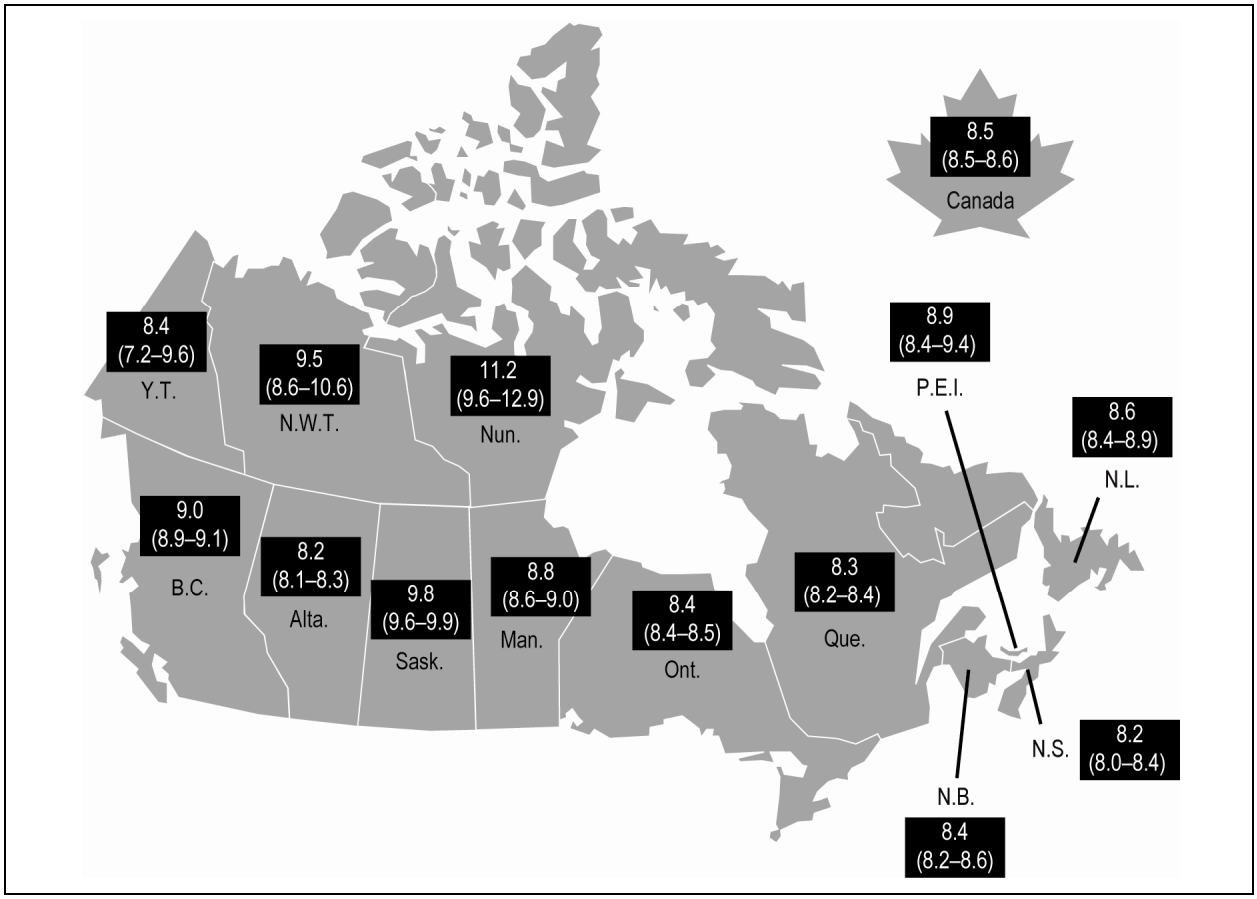
Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Jurisdictional Variation

Previous studies also reported variations in readmission rates across different regions and cities.[2, 28] In this study, geography was assigned based on the location of the hospital from which the patient was discharged in the index hospitalization. Multivariable risk-adjustment models were used to control for the contribution of multiple risk factors to readmission rates and to adjust for confounding jurisdictional differences across factors.

Overall, the adjusted readmission rate ranged from 8.4% to 11.2% for the territories and from 8.2% to 9.8% for the provinces. While some provinces demonstrated statistically different readmission rates from the national average, the overall variance of readmission rates was modest.

Figure 4: Risk-Adjusted 30-Day Readmission Rates to Acute Care, by Province/Territory



Notes

Rates and 95% confidence intervals.

Rates are calculated based on the province where hospital care was provided.

Readmission rates were adjusted to control for jurisdictional differences in factors, thereby allowing comparison of rates across jurisdictions. Adjusted variables were age, sex, admission via the emergency department, number of acute care visits six months prior to the index discharge, Charlson Index comorbidity score and Case Mix Group.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

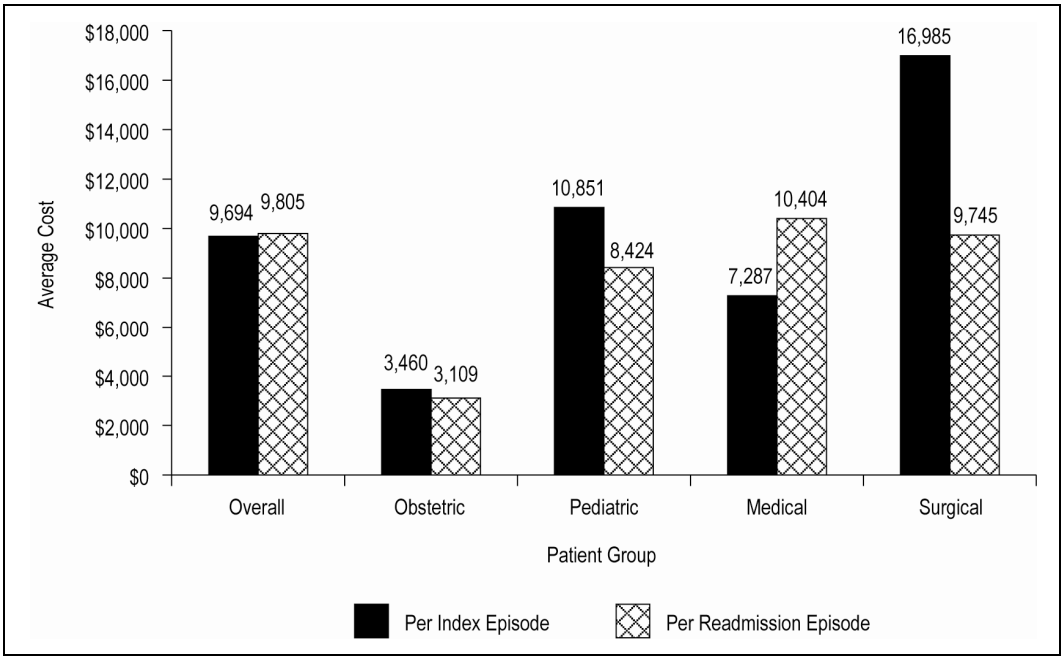
The Cost of Inpatient Readmissions

Inpatient readmissions within 30 days of discharge cost the Canadian health care system an estimated $1.8 billion during the study period. While readmissions accounted for 8.5% of all patient hospitalizations to inpatient care across acute care hospitals in Canada, they accounted for a slightly higher proportion (11.0%) of total inpatient care costs (excluding physician fees for services).

For three of the four patient groups, patients cost less on average during their readmission hospitalization than during their index hospitalization. For the obstetric and surgical groups, this can be explained based on the reasons for return described earlier. Specifically, most surgical patients did not return for a second surgery; instead, they returned due to complications from

the first surgery. The medical group was the exception to this pattern. Compared with their index hospitalization, medical patients cost on average 42% (or $3,117) more per hospitalization at readmission, for an average cost of $10,404 per hospitalization.

Figure 5: Average Cost of Index and Readmission Stay Among Readmitted Patients, by Patient Group



Notes

Cost = (Hospital CPWC) x (Episode RIW), per 2011 CMG methodology.

CPWC: cost per weighted case.

RIW: Resource Intensity Weight.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Summary—Part 1: Readmissions to Inpatient Acute Care

This section of the report provided insight on the factors that contribute to readmission. In particular, details were provided that enable identification of patients most susceptible to future readmission. While interprovincial variation in readmission rates was modest, with provincial risk-adjusted rates ranging from 8.2% to 9.8%, there were specific conditions that differed from the average. When examining the populations that were most often readmitted, the most frequent reason for readmission was related to or was the same as the condition in the index admission. However, it is important to note that this rarely represented the majority of the readmissions in a particular patient group, emphasizing the complex nature of this problem.

The highest readmission rate among the patient groups was observed in the medical population (13.3%). Perhaps most notably, the surgical and obstetric populations most often returned for complications following inpatient care. Infection after surgery was the most common diagnosis for readmitted surgical patients, representing 9.3% of readmitted patients. Patients who were admitted after undergoing a C-section (both primary and repeated) were readmitted 23.1% of the time for infections of an obstetric surgical wound.

When examining average hospital length-of-stay patterns, there was an association between length-of-stay variance and readmission rates. Specifically, after adjustment was made for patient and community characteristics, results indicated that as hospital average length of stay decreased, the readmission rates increased. However, the strong association was restricted to a small number of hospitals. This finding does not imply that extended lengths of stay are the solution to readmission, since extended length of stay may introduce other complicating factors, such as infections or pressure ulcers. Further study of hospitals that had short lengths of stay and low readmission rates could be informative in future attempts to better understand this relationship.

While hospitals are responsible for providing appropriate post-discharge planning for patients, adequate and timely post-acute care must be made available to patients in their communities for this planning to be effective. Given the limited data on community-level risk factors for readmission, patient residence was used as a proxy for patients' access to post-acute community services. Readmission rates were significantly greater for medical, surgical and obstetric patients residing in rural compared with urban areas. Factors that contribute to this finding in rural areas might include fewer community services, better inpatient bed availability and a higher proportion of seniors in the population. Patients from the least affluent neighbourhoods were more likely to be readmitted to hospitals than those from more affluent neighbourhoods. This disparity might be caused by factors that may include accessibility to primary health care.

Inpatient readmissions cost an estimated $1.8 billion during the 11-month study period, accounting for more than 1 in 10 dollars (11.0%) spent on inpatient care in Canada (excluding physician fees for services). While this number does not represent the potential cost savings in the system, because all readmissions cannot be eliminated, researchers have indicated that between 9% and 59% of readmissions are preventable.[6, 9–13] If the low end of this range is applied to costs from this study, that represents a potential reallocation of $162 million to other aspects of care.

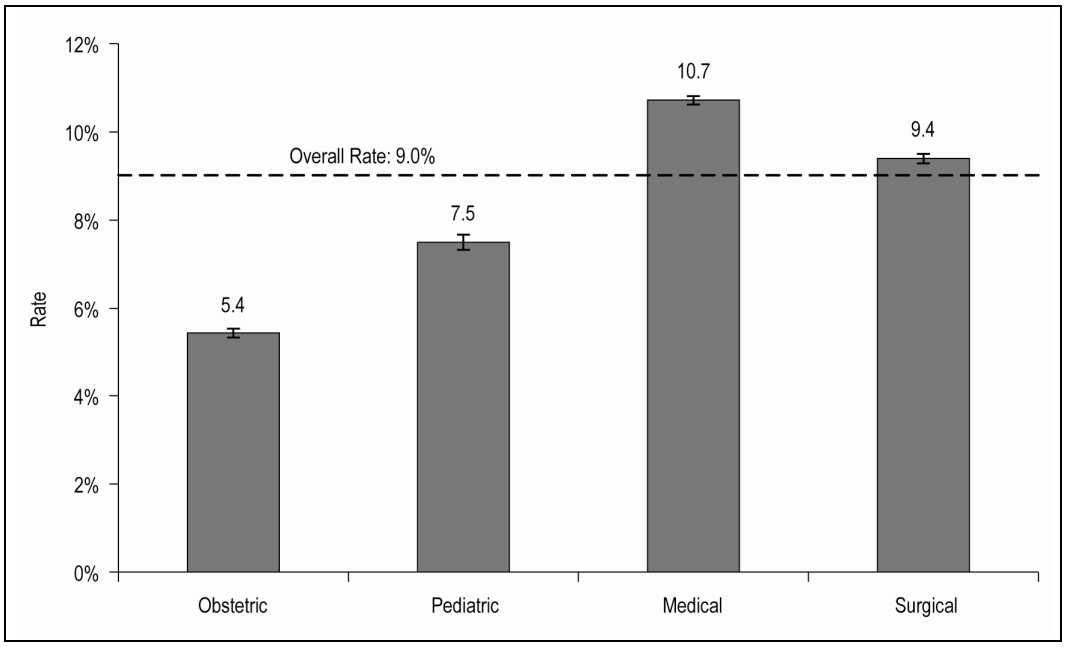
Part 2: Returning to the Emergency Department After Inpatient Care

This section of the report describes patients who returned to the ED within seven days of discharge from acute care using data from Ontario, Alberta and Yukon. Patient, hospital and community factors were examined for their contribution to ED returns.

In Ontario, Alberta and Yukon, there were more than one million (1,008,409) acute care hospitalizations during the 11-month study period.[vii] While this represents only three provinces/territories, these jurisdictions represented 47.4% of all acute care hospitalizations in Canada.

On average, approximately 9.0% (90,975) of patients discharged from acute care returned to the ED within seven days. Among patient groups, the rate of ED return was highest in the medical patient group (10.7%) and lowest in the obstetric patient group (5.4%). The variation in rates among patient groups was less pronounced than the pattern seen for inpatient readmissions.

Figure 6: All-Cause Rate of Return to the Emergency Department Within Seven Days After Discharge From Inpatient Care, by Patient Group



Notes
Rates and 95% confidence intervals.
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

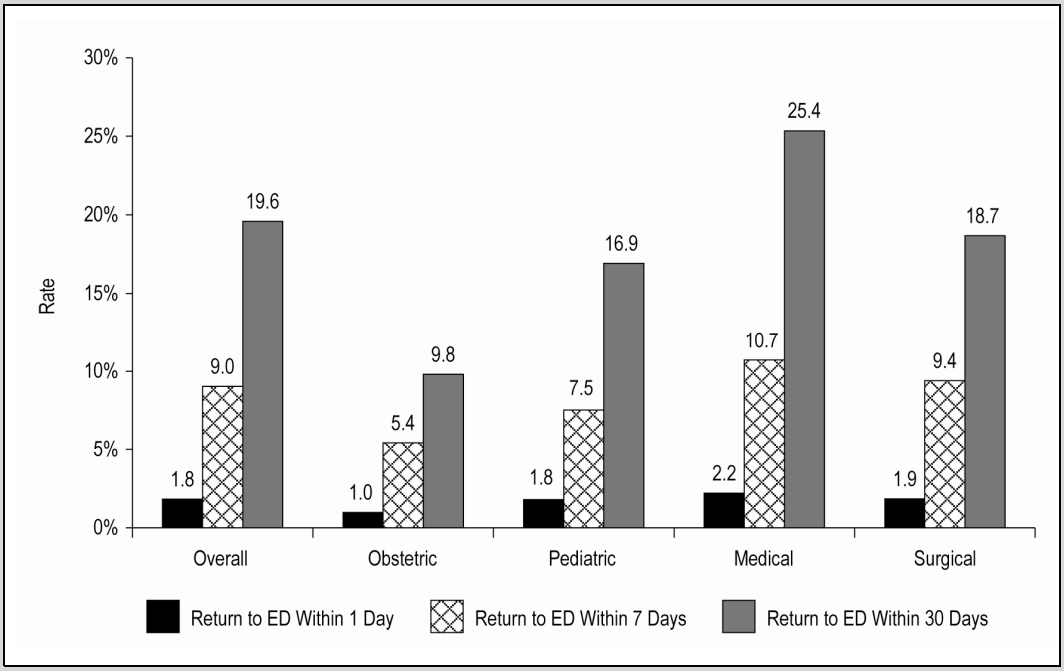
vii. The study period encompassed the months of April 2010 to February 2011 for index hospitalizations and the entire year of April 2010 to March 2011 for returns to the ED.

Medical patients also made up the largest proportion of all index hospitalizations returning to the ED. Among all patients with a return to the ED, almost half (48.7%) were in the medical group for their index hospitalization; one-third (32.5%) were in the surgical group and approximately one-tenth were in each of the obstetric and pediatric groups (11.2% and 7.6%, respectively).

Rates of Return to ED Within Different Time Frames

Rates of return to the ED can be calculated by examining different time frames. For example, intervals of 1, 7 and 30 days after discharge have been used to measure acute care readmissions.[4] This study used a time frame of 7 days. Figure 7 demonstrates that the 30-day time frame identifies 10 times the number of patients as the 1-day time frame and twice the number of patients as the 7-day time frame.

Figure 7: Rates of ED Return Using Different Capture Periods After Index Discharge, Overall and by Patient Group



Note
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Risk Factors for ED Return

In an approach similar to the one used to predict acute care readmissions, different models were fit to predict the risk of return to the ED. Table 7 shows the risk factors for each patient group. There were two key differences between the risk factors applied to the inpatient population and those applied to the ED population. In the ED population, clinical conditions were measured using the Comprehensive Ambulatory Classification System (CACS) and the number of ED visits in the six months prior to the index admission was used instead of the number of acute admissions six months prior to index.

Table 7: Summary of Risk Factors for Unplanned Return to ED

	Medical/Surgical	Obstetric	Pediatric
Patient Effects			
Age*	✓	✓	✓
Sex*	✓	✗	✓
Charlson Index Comorbidity Score*	✓	✗	✗
Admission via Emergency Department in Index*	✓	✓	✓
Patient Length-of-Stay Variance*	✓	✓	✓
Number of ED Visits Six Months Prior to Index*	✓	✓	✓
Clinical Conditions in Index	✓	✓	✓
Clinical Conditions in Readmission	✓	✓	✓
Hospital Effects			
Hospital Length-of-Stay Variance	✓	✓	✓
Hospital Size	✓	✓	✓
Community Effects			
Rural Residence*	✓	✓	✓
Neighbourhood Income Quintile*	✓	✓	✓

Note

* These risk factors were included in the multiple regression models. The odds ratios for these factors associated with return can be found in the appendix.

Source

Canadian Institute for Health Information.

Risk was reported as the odds of returning to the ED within seven days of inpatient discharge for each patient group. Odds ratios and confidence intervals for each factor within each patient group are detailed in the appendix of this report. The following factors were found to be predictors of returning to the ED:

- Number of ED visits in the six-month period prior to the index hospitalization; and
- Rural residence.

The factors listed in Table 7 will be explored in more detail in the following sections.

Understanding Patient Effects

A number of patient characteristics were found to predict a return to the ED, including age, sex and clinical complexity. Contrary to the inpatient readmission findings, seniors had a lower risk of returning to the ED, which is consistent with a study from the United States.[44] Among medical and surgical patient groups, male patients were more likely to return to the ED within seven days than female ones. Not surprisingly, patients with higher Charlson Index scores were at an increased risk of returning to the ED. In this section, we focus on the clinical characteristics of patients who returned to the ED to provide an understanding of patients who are most at risk of returning to the ED.

Who Is Returning and Why Are They Returning?

The five conditions[viii] with the highest ED return volumes were determined for each patient group. For each of these five conditions, the two most frequent clinical reasons for returning to the ED were analyzed.

Medical Patient Group

COPD was the index condition that accounted for the largest number of ED returns among medical patients. Other high-volume conditions observed in index hospitalizations included (in order) heart failure (without angiogram), digestive disorders, arrhythmia (without angiogram) and viral or unspecified pneumonia.

When examining the most frequent conditions upon return to the ED, the conditions observed most often were the same as or similar to the reason the patient was hospitalized in the first place. For example, among the 10.1% of COPD patients (N = 2,536) who returned to the ED within seven days, 42.3% were treated for respiratory care. More specifically, the most frequent diagnoses in the ED for patients returning to the ED after a COPD discharge included acute exacerbation (19.7%), COPD unspecified (8.8%) and COPD with acute lower respiratory infection (5.1%).

Also among the index conditions that most often returned to the ED were two cardiac conditions: heart failure without coronary angiogram and arrhythmia without coronary angiogram. In both of these groups, a high number (837) of patients returned to the ED but were dead on arrival. Further study would be required to better understand the unique circumstances of each death; however, it is likely that there was a rapid deterioration in the patient's health status following discharge.

viii. On average, the conditions associated with the highest return to ED volumes accounted for one-fifth of hospitalizations that subsequently returned to the ED. The exception to this is the obstetric patient group, where the conditions associated with the highest volume of returns to the ED accounted for 87% of hospitalizations that subsequently returned.

Table 8: Conditions Representing the Largest Number of ED Returns and Their Reasons for Return, for Medical Patients

Most Frequent Conditions at Index (CMG)	Return to ED Rate	Return to ED Volume	Two Most Frequent Conditions at Return (CACS, Percentage)	
Chronic Obstructive Pulmonary Disease	10.1	2,536	Respiratory Condition With Acute Admission/ Transfer (27.0)	Disease or Disorder, Respiratory System (15.3)
Heart Failure Without Coronary Angiogram	11.4	2,072	Dead on Arrival (25.9)	Other Condition With Acute Admission/ Transfer (11.0)
Symptom/Sign of Digestive System	13.9	1,646	Disease or Disorder, Digestive System (26.4)	Digestive System Condition With Acute Admission/Transfer (21.5)
Arrhythmia Without Coronary Angiogram	12.3	1,550	Other Disease or Disorder, Cardiac System (22.3)	Dead on Arrival (19.4)
Viral/Unspecified Pneumonia	9.9	1,498	Respiratory Condition With Acute Admission/Transfer (15.6)	Disease or Disorder, Respiratory System (15.2)

Note
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Surgical Patient Group

While unilateral knee replacement surgery accounted for the greatest number of surgical patients returning to the ED within seven days, the rate of ED return (15.2%) was highest for minor upper urinary tract interventions. Surgical patients with minor interventions on the upper urinary tract and interventions on the prostate returned to care for reasons similar to their index hospitalization.

A large number of surgical patients returned to the ED after discharge for either follow-up care (N = 5,301) or for trauma or shock (N = 3,555). In fact, in each of the groups representing unilateral knee replacement, hysterectomy and unilateral hip replacement, almost 20% of the patients who returned to the ED were for follow-up examination but were captured in the ED as unplanned visits.

Upon further examination of the unilateral knee replacement patients, the most frequent diagnoses observed when patients returned to the ED were infection following a procedure (10.3%) and acute post-operative pain (7.5%). Both of these diagnoses were associated with the CACS group for other trauma or shock (without admission/intervention). Since complications following a procedure were frequently observed among the inpatients discharged after a unilateral knee replacement, this was examined further for the entire return to ED population. The analysis indicates that the most frequent diagnoses for patients returning to the ED after surgery were infection following a procedure (7.1%), acute post-operative pain (4.9%) and

hemorrhage resulting from a procedure (4.1%). In relation to the CACS groups, infection following a procedure and hemorrhage resulting from a procedure were associated with the group for other trauma or shock (without admission/intervention), while acute post-operative pain was associated with follow-up examination and other non-emergent conditions.

Table 9: Conditions Representing the Largest Number of ED Returns and Their Reasons for Return, for Surgical Patients

Most Frequent Conditions at Index (CMG)	Return to ED Rate	Return to ED Volume	Two Most Frequent Conditions at Return (CACS, Percentage)	
Unilateral Knee Replacement	7.6	1,645	Follow-Up Examination and Other Non-Emergent Condition (19.2)	Other Trauma, Shock (Without Admission/ Intervention) (14.8)
Hysterectomy With Non-Malignant Diagnosis	8.6	1,471	Other Trauma, Shock (Without Admission/ Intervention) (20.2)	Follow-Up Examination and Other Non-Emergent Condition (20.1)
Partial Excision/ Destruction of Prostate, Closed Approach	11.7	872	Other Disease or Disorder, Urinary System (42.9)	Other Condition With Acute Admission/ Transfer (10.0)
Unilateral Hip Replacement	6.5	818	Follow-Up Examination and Other Non-Emergent Condition (17.5)	Other Trauma, Shock (Without Admission/ Intervention) (11.9)
Minor Intervention on Upper Urinary Tract, External/per Orifice Approach	15.2	775	Other Disease or Disorder, Urinary System (23.9)	Other General Genitourinary Disorders (15.7)

Note

Results are based on Ontario, Alberta and Yukon.

Sources

Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Obstetric Patient Group

Discharges with a primary C-section had the highest rate of return to the ED within seven days (8.7%), while patients who were in hospital for a vaginal delivery without other interventions had the lowest rate (3.7%) among the high-volume conditions. In all five CMGs representing the highest volume of return visits to the ED, the clinical condition upon return was disease or disorder of the female anatomy. Upon further review of this CACS group, the diagnoses most often observed were infection of an obstetric surgical wound and delayed and secondary postpartum hemorrhage. The generic nature of this diagnosis suggests that limited clinical details were captured for this population in the ED; however, in each of the five clinical categories listed in Table 10, it is reasonable to assume that the return to the ED was related to the index hospitalization.

Table 10: Conditions Representing the Largest Number of ED Returns and Their Reasons for Return, for Obstetric Patients

Most Frequent Conditions at Index (CMG)	Return to ED Rate	Return to ED Volume	Two Most Frequent Conditions at Return (CACS, Percentage)	
Vaginal Delivery, No Other Intervention	3.7	3,608	Disease or Disorder, Female Anatomy (36.8)	Maternal Care (9.6)
Primary Caesarean Section	8.7	2,334	Disease or Disorder, Female Anatomy (31.3)	Follow-Up Examination and Other Non-Emergent Condition (15.1)
Caesarean Section With Previous Uterine Scar	7.2	1,458	Disease or Disorder, Female Anatomy (27.8)	Follow-Up Examination and Other Non-Emergent Condition (19.3)
Forceps/Vacuum Delivery, No Other Intervention	5.7	835	Disease or Disorder, Female Anatomy (38.4)	Maternal Care (12.0)
Antepartum Disorder Treated Medically	6.1	681	Disease or Disorder, Female Anatomy (30.7)	Other Condition With Acute Admission/ Transfer (25.8)

Note
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Pediatric Patient Group

One in 10 discharges with oral cavity or pharynx interventions (10.5%) and digestive system conditions (10.0%) had a return to the ED within seven days. For index discharge conditions of non-severe enteritis and symptoms of the digestive system, the top condition for return to the ED was disease or disorder of the digestive system (without and with admission or transfer to acute care). These conditions combined accounted for 53.8% and 57.4% of ED returns among these two index conditions, respectively. Other conditions at return were follow-up examination and other non-emergent condition and disease or disorder related to the respective index discharge condition.

A further examination of disease or disorder of the digestive system indicated that the most frequent diagnoses were abdominal pain and gastroenteritis and colitis, which were closely related to the index CMG.

Table 11: Conditions Representing the Largest Number of ED Returns and Their Reasons for Return, for Pediatric Patients

Most Frequent Conditions at Index (CMG)	Return to ED Rate	Return to ED Volume	Two Most Frequent Conditions at Return (CACS, Percentage)	
Oral Cavity/Pharynx Intervention	10.5	304	Follow-Up Examination and Other Non-Emergent Condition (22.0)	Other Trauma, Shock (Without Admission/ Intervention) (15.8)
Non-Severe Enteritis	7.6	292	Disease or Disorder, Digestive System (33.9)	Digestive System Condition With Acute Admission/Transfer (19.9)
Viral/Unspecified Pneumonia	5.9	247	Disease or Disorder, Respiratory System (22.3)	Respiratory Condition With Acute Admission/ Transfer (21.5)
Symptom/Sign of Digestive System	10.0	246	Disease or Disorder, Digestive System (35.0)	Digestive System Condition With Acute Admission/Transfer (22.4)
Newborn/Neonate 2,500+ Grams, Jaundice	6.9	230	Disease or Disorder, Neonatal and Congenital (46.5)	Follow-Up Examination and Other Non-Emergent Condition (14.4)

Note
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Acuity of ED Returns

Among all ED encounters in Ontario, Alberta and Yukon, approximately 10.1% were admitted to an inpatient bed. An examination of the patients who returned to the ED within seven days of discharge indicates that 31.2% of these patients were readmitted.

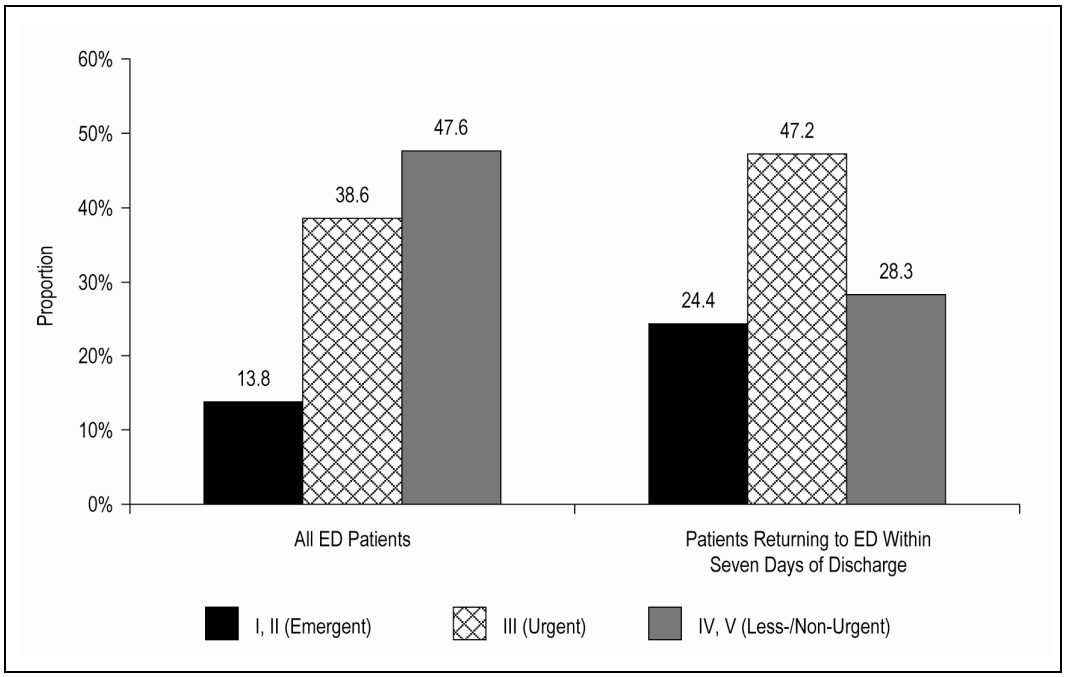
ED triage level can be used as a proxy measure of the acuity of a condition. On average, patients triaged as emergent or urgent presented in the ED with conditions of greater acuity than patients triaged as less- or non-urgent.[45]

During the study period, ED visits within seven days of inpatient discharge had a higher proportion of emergent or urgent triage assignments when compared with all ED visits. Of patients returning to the ED within seven days, 71.6% were triaged as emergent or urgent, compared with 52.4% of ED visits in the general population. This indicates that patients returning to the ED following discharge came for significant issues.

More on Triaging

Patients are triaged in the ED for urgency of care. Both the Canadian Triage and Acuity Scale (CTAS) for adults and the Pediatric Canadian Triage and Acuity Scale (PCTAS) have five triage levels. Levels I and II are reserved for emergent cases; level III is assigned to urgent cases; and levels IV and V are for less- or non-urgent cases.[45, 46]

Figure 8: Distribution of Triage Levels for Patients Returning to the ED Within Seven Days, Compared With All ED Patients



Note
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

While hospitals are the most appropriate care setting to treat returning patients who have greater acuity or triage urgency, more than one in four (28.3%) patients returning to the ED after inpatient acute care returned for conditions that were triaged as less- or non-urgent. While the proportion of patients returning to the ED with less- or non-urgent triage was lower than that in the overall population (47.6%), there may be opportunity to reduce the number of less- or non-urgent ED visits, since these are patients who were in contact with health care providers within the previous seven days.

Understanding Hospital Effects

Hospital factors, such as the total time spent in the hospital, hospital size and teaching status, can affect return to ED rates following inpatient discharge. This section explores these effects.

Length of Inpatient Hospital Stay

To better understand the effect of length of stay on rates of returning to the ED, adjustments were made that take into account the age, clinical condition and complexity of individual patients. Using a validated case-mix adjustment approach, CIHI was able to establish an expected length of stay for each inpatient hospitalization.

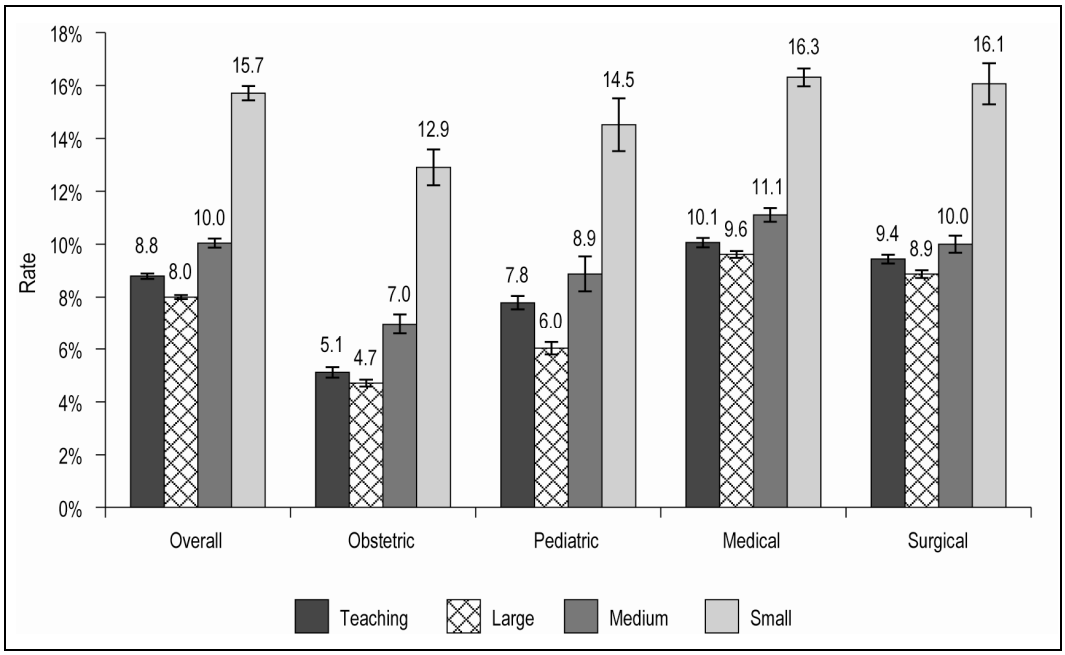
As shown earlier in this report, hospitals with shorter lengths of stay on average tended to have higher rates of acute care readmissions. A similar relationship was found for ED return rates when hospital length of stay was shorter than ELOS, although the magnitude of this association was not as strong as that observed in acute care readmission.

Hospital Size

Hospitals were stratified into four peer groups to see if there were patterns associated with hospitals of different sizes. Categories were based on index hospital size, and the data showed that small hospitals consistently had the highest rates of returning to the ED.

Rates of ED return varied across hospital peer groups. Overall, 15.7% of patients discharged from small hospitals returned to the ED for care within seven days, compared with 8.0% for large community hospitals, 8.8% for teaching hospitals and 10.0% for medium community hospitals. The same pattern was observed across patient groups.

Figure 9: Rate of Return to the Emergency Department for Hospital Peer Groups, Overall and by Patient Group



Notes
Rates and 95% confidence intervals.
Results are based on Ontario, Alberta and Yukon
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

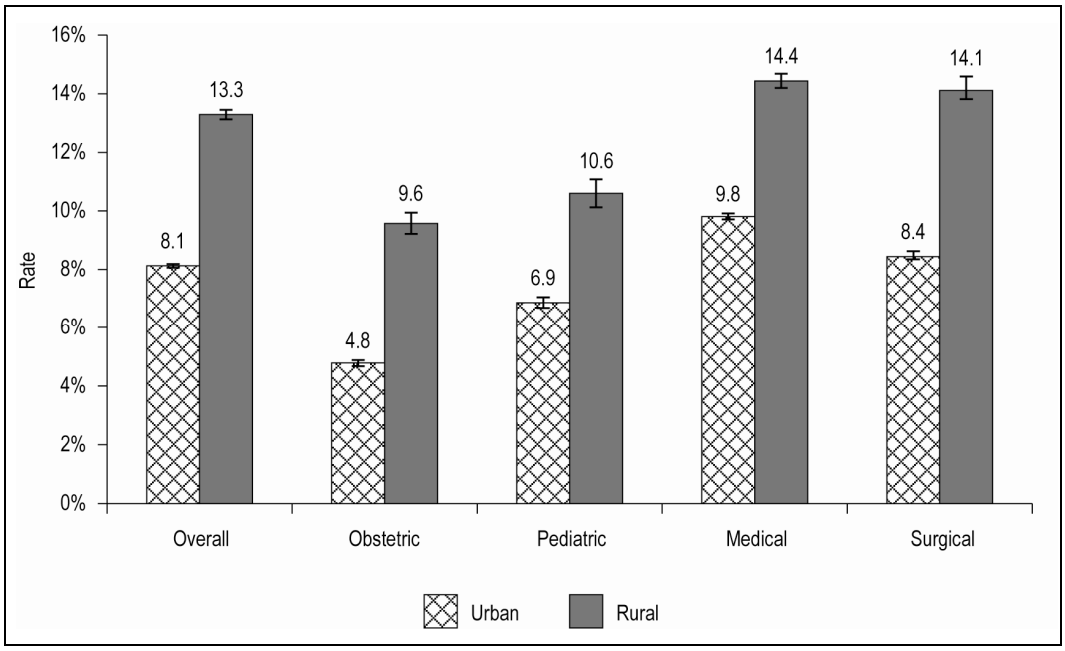
Understanding Community Effects

Like hospital factors, community-level factors can be associated with the risk of returning to the ED. The literature suggests that follow-up care, such as having access to a family physician, community services and home care, as well as not living alone, are alternatives to hospitalization.[22, 39–42] However, limited data is available that can be correlated to return visits to the ED. As a result, this study examines this possible association using rural patient residence as a proxy for community care service levels.

Urban/Rural Distribution

ED return rates were highest among patients residing in rural areas. Overall, the ED return rate for rural patients (13.3%) was more than 1.5 times the rate for urban patients (8.1%). Patients residing in rural areas also returned to the ED for non-urgent care more often (55.8%) than patients residing in urban areas (19.5%). Both of these findings were consistent across patient groups. This suggests that rural hospital EDs provide services that may not be available in the community.

Figure 10: Rate of Return to the Emergency Department, by Urban/Rural Residence, Overall and by Patient Group



Notes
Rates and 95% confidence intervals.
Results are based on Ontario, Alberta and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Since community supports and services tend to be more abundant in urban areas and their surrounding communities, this result lends support to the potential link between lower levels of community care and higher rates of return to the ED.

Income Quintiles

Patients in the lowest income quintile were more likely to return to the ED than those in the highest income quintile. For example, about 10.2% of surgical patients living in neighbourhoods with the lowest income returned to the ED, compared with 8.8% of surgical patients in the highest income patient group. After adjusting for patient-level characteristics and urban/rural residence, the risk of returning to the ED in patients from the least affluent neighbourhood was significantly higher than the risk for those from the most affluent neighbourhood in obstetric, medical and surgical patients. Odds ratios can be found in the appendix.

Table 12: Rate of Return to the Emergency Department, by Income Quintile and Patient Group (Percentage)

Income Quintile	Overall	Obstetric	Pediatric	Medical	Surgical
1—Least Affluent	9.8	6.0	7.9	11.5	10.2
2	9.2	5.5	7.5	10.8	9.7
3	8.8	5.3	7.4	10.4	9.3
4	8.5	5.0	7.3	10.4	8.9
5—Most Affluent	8.5	5.1	7.3	10.1	8.8

Notes

There was a statistically significant difference in return rates between the lowest and the highest income quintiles in all patient groups ($p<0.05$).

About 0.9% of patients could not be assigned to neighbourhood income quintiles.

Results are based on Ontario, Alberta and Yukon.

Sources

Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Understanding Multiple ED Visits Within One Week of Discharge

Most patients who returned to the ED within seven days of inpatient discharge returned only once; however, just less than one-fifth (17.0%) returned multiple times within one week of discharge. More patients with multiple visits were triaged as emergent (17.1%) or urgent (45.5%) at their first visit, compared with the overall ED population (13.8% and 38.6%, respectively). The leading medical reason at first ED visit for these patients was follow-up examination (21.4%), followed by digestive system disease or disorder (8.9%).

The Cost of Emergency Department Returns

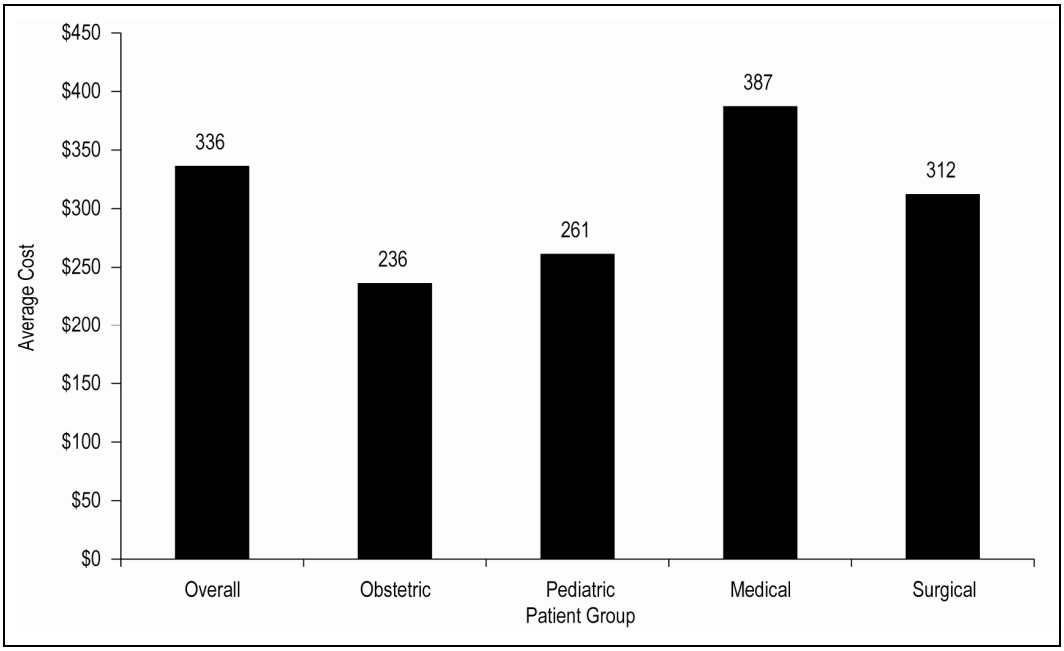
Return to the ED within seven days of discharge from inpatient care cost an estimated $30.6 million and accounted for 1.7% of total emergency costs for Alberta, Ontario and Yukon in 2010–2011.

The average cost of an ED visit for a recently discharged patient ($336) was almost 50% higher than the overall average ED visit cost ($234).

Return visits for medical patients accounted for 48.7% of all ED return visits. A total of $17.2 million, equivalent to 56.1% of all ED return costs, was spent on ED care for medical patients returning to the ED within seven days of discharge from inpatient care across the three jurisdictions studied.

ED care for medical patients also cost more on average than care for other patient groups, regardless of the type of patient care given upon readmission. An average of $387 per visit was spent on ED care for returning medical patients, compared with an average of $336 per visit for all returning patients.

Figure 11: Average Cost for Return Visits to the Emergency Department, by Patient Group



Notes
Costs for first ED visit within seven days of discharge from inpatient care.
Cost was available for Alberta, Ontario and Yukon.
Sources
Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Summary—Part 2: Returning to the Emergency Department After Inpatient Care

This section reviewed ED visits within a week of inpatient discharge for patients in three jurisdictions: Ontario, Alberta and Yukon. While there is jurisdictional variation in the role, distribution and utilization of EDs, this study may provide directional information for jurisdictions that do not currently submit ED data to the National Ambulatory Care Reporting System (NACRS).

Since approximately 31% of patients who returned to the ED within seven days were admitted to hospital, it is not surprising that many of the findings in the ED section align with the inpatient readmission findings. Specifically, among patients who returned most often to the ED, the clinical reasons for returning were very often the same as or related to the index hospitalization. However, the ED data also provides information about patients who were not readmitted yet returned to the hospital for care. Many surgical and obstetric patients returned to the ED for follow-up care. In particular, about 20% of unilateral knee replacement, hysterectomy and unilateral hip replacement patients returned to the ED for unplanned follow-up examination.

The ED data also provides valuable information about the acuity of patients. Almost three-quarters of patients who returned to the ED within seven days were triaged as urgent or emergent, providing a strong indication that these patients were in need of additional immediate care and were not seeking reassurances from health care practitioners following an inpatient discharge.

When examining the hospital effects associated with returns to the ED, shorter hospital length of stay at index was associated with a higher rate of return to the ED. There was no statistical correlation between extended lengths of stay in the index case and reduced rates of return to the ED. Therefore, there is no indication that longer stays in acute care would be the best solution to prevent ED visits after acute care discharge.

When examining community factors, rural EDs may play a unique role in compensating for lower levels of community and primary health care services, reflected in a return to ED rate of approximately 13%. However, in urban environments, there were still significant numbers of returns to the ED within a week of discharge (8%). Given the fact that these patients were in contact with a team of health care providers within the previous week, there may be opportunities to reduce the number of return ED visits with enhanced discharge planning or scheduled follow-up visits. The higher rate of return to the ED among patients from the least affluent neighbourhoods indicated that there is some room for rate reduction if the system can reduce the primary health care gap across socio-economic groups.

While the cost of patients returning to the ED within seven days represented only 1.7% of total emergency costs in the jurisdictions studied, this provides a first look at better understanding this important component of Canada’s health system.

Conclusion

This report presents information about unplanned readmissions to inpatient care and returns to EDs after acute care discharge. It shows that the readmission rate was affected by characteristics at patient, hospital and community levels.

The goals of this report were twofold: to provide information about unplanned readmission rates to acute hospitals and returns to the ED and to contribute to the discussion about factors associated with readmissions and potential policies or programs that could improve patients' post-discharge planning and health.

During the study period, 181,551 (8.5%) patients from the acute care population were readmitted to an acute hospital within 30 days of their index discharge, costing an estimated $1.8 billion and accounting for 11% of all acute hospital costs.

With respect to patient groups, medical patients accounted for nearly two-thirds (64.9%) of the unplanned readmissions. The readmission rate to acute care was highest in medical patients (13.3%). COPD and heart failure without coronary angiogram were the most common conditions recorded in the index discharge among medical patients, and a high proportion of readmissions were for the same, similar or related conditions. Surgical patients—the second-largest patient group—had an unplanned readmission rate of 6.5%. About 9.3% of these readmitted patients had a post-surgery infection. The readmission rates for pediatric and obstetric patients were 6.5% and 2.0%, respectively. Among patients readmitted after a C-section delivery, 23.1% were readmitted for infections of an obstetric surgical wound.

The rate of return to EDs within seven days of index discharge was 9.0% across the three jurisdictions from which data was available (Alberta, Ontario and Yukon). Among those who returned to the ED, 17.0% had multiple ED visits within the seven-day period. The rate of return to the ED by patient group demonstrated a different distribution than the readmission rates to inpatient care. The difference in the rate among patient groups was much smaller in the return to the ED. The rate of return to the ED was still highest for medical patients (10.7%), followed by surgical (9.4%) and pediatric patients (7.5%). The rate of return to the ED for obstetric patients (5.4%) was more than double the inpatient readmission rate. Overall, the cost of returns to EDs within seven days represented 1.7% of all ED costs in these jurisdictions.

This study examined factors that the literature has shown to be related to readmissions and for which CIHI had data. Among the factors examined, admission via the ED in the index discharge, a previous history of admission to acute care/ED and living in a rural community were the most important factors associated with readmission to acute care and return to the ED. As well, patient age, sex and Charlson Index score were the most important factors predicting readmission in medical and surgical patients.

Hospital effects, such as shorter lengths of stay, were found to be associated with higher rates of readmission to acute care, although the significant association was found in a small number of hospitals. Keeping patients longer in the hospital, however, is likely not the best way to reduce readmission rates. For example, this would increase waiting times and jeopardize the

number of hospital beds available to receive new patients.[34] Longer lengths of stay also increase the risk of hospital-acquired infections. However, discharging patients who are not yet ready to leave hospital may increase readmission rates and the burden of care on community health services and supports.[19] Sources of care beyond the acute care hospital (that is, home care), aligned with a comprehensive discharge plan, have proven to be useful in the prevention of hospital readmissions for COPD and heart failure.[47, 48]

The readmission rate was found to be associated with hospital peer group. The readmission rate was highest in small hospitals (12.4%), compared with teaching (8.7%), large (7.6%) and medium (8.9%) community hospitals. Further analysis indicated that a higher proportion of medical patients in small hospitals and higher readmission rates in this patient population can account for the hospital size effect.

Beyond length of stay and hospital peer groups, quality processes within hospitals are thought to influence readmission rates. A review of interventions to reduce 30-day readmissions was recently published in the *Annals of Internal Medicine*.[49] This review detailed a variety of pre-discharge interventions, post-discharge interventions and interventions that were implemented both before and after the patient went home. The interventions were aimed at improving transitions in care. Some of the interventions described include the following:

- Pre-discharge interventions: Patient education, discharge planning and follow-up appointments scheduled before discharge.
- Post-discharge interventions: Follow-up phone calls, patient hotlines and timely clinical follow-up.
- Interventions active both before and after discharge: Patient-centred discharge instructions, transition coach and same-provider continuity.

A recent assessment of Ontario hospitals' quality improvement plans identified many of the same strategies.[50]

At the macro level, rural and urban readmissions were used as a proxy for the effect of community support. In general, rural areas had higher rates of unplanned readmissions than urban areas. In addition, rural patients who returned to the ED within seven days were triaged as less urgent than urban patients. Studies suggest that characteristics of urban and rural environments contribute to differences in readmission rates.[4] For example, hospitals may be the best, or only, place to return to receive follow-up care when primary health care and home care services are not available.[51] Significantly fewer physician visits per capita were observed in small urban, rural or remote locations, compared with those in urban settings.[43] The proportion of patients receiving home care or community-based care services was also significantly lower for people in rural/remote locations.[43]

Reducing readmission rates is not a simple task; rather, it is a multi-faceted issue that requires multiple actions from all levels of the health care system. This report provided information about patient-level, hospital-level and community-level factors that contribute to readmission rates in Canada. An improved understanding of these factors may contribute to increased collaboration among leaders of the different system components to improve readmission outcomes.

Appendix

Technical Notes

Data Sources

Three databases were used in this study: CIHI's Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS) and the Fichier des hospitalisations MED-ÉCHO, from the ministère de la Santé et des Services sociaux du Québec.

General Methodology

In this study, two outcomes were defined: unplanned readmission to acute care within 30 days of the index discharge and unplanned return to the ED within seven days of the index discharge. The latter outcome was measured using data from Alberta, Ontario and Yukon.

Index hospitalizations (initial hospital admissions) were restricted to acute care discharges from all Canadian facilities (except for those in Quebec) that occurred between April 1, 2010, and March 1, 2011, and to discharges from Quebec facilities that occurred between April 1, 2009, and March 1, 2010. Acute care readmission discharges were discharges from all Canadian acute care facilities (except for those in Quebec) that occurred between April 1, 2010, and April 1, 2011, and from Quebec facilities that occurred between April 1, 2009, and April 1, 2010. ED return discharges were all discharges from EDs in Alberta, Ontario and Yukon between April 1, 2010, and April 1, 2011.

The unit of analysis was an episode of care. An episode of care refers to all contiguous acute care hospitalizations and same-day surgery visits. To construct an episode of care, transfers within and between facilities were linked. A transfer was assumed to have occurred if either of the following conditions was met:

- An acute care hospitalization or a same-day surgery visit occurred within six hours of discharge from a previous acute care hospitalization or same-day surgery visit, regardless of whether a transfer was coded; or
- An acute care hospitalization or same-day surgery visit occurred between 6 and 12 hours after discharge from a previous acute care hospitalization or same-day surgery visit and at least one hospitalization or visit was coded as a transfer.

Readmission outcomes were reported for patient groups. Patients were categorized into four patient groups according to the following sequence:

1. Obstetric patient: Identified as any episode with an acute care discharge with a major clinical category (MCC) code of 13 only.
2. Pediatric patient: If not (1), any episode with an acute care discharge for a patient younger than age 20.
3. Adult surgical patient: If not (1) or (2), any episode with an acute care discharge with an MCC partition code of "intervention."

4. Adult medical patient: If not (1), (2) or (3), episodes with an acute care discharge with an MCC partition code of "diagnosis."

The following exclusions were applied in sequence:

1. All discharge abstracts with data quality issues (that is, an invalid admission and/or discharge date), including all discharges for newborns.[ix]
2. Episodes with a first and last discharge abstract for day surgery and with an MCC code of mental health diseases or disorders (MCC = 17) or a most responsible diagnosis of palliative care (ICD-10-CA = Z51.5).
3. Index discharges with a discharge of death or self sign-out.
4. Acute care readmission or ED return with a chemotherapy intervention for neoplasm and maternal discharges for newborn delivery.

The Postal Code Conversion File Plus (PCCF+) from Statistics Canada was used to assign urban/rural residence and neighbourhood income quintile in conjunction with the 2006 census.

Cost Analysis

Costs were estimated separately for acute care and ED discharges using the 2011 CMG and CACS methodologies. Costs were summed across facilities in each setting according to the following equation: (Resource Intensity Weight $[RIW]_1$ x facility-specific cost per weighted case $[CPWC]_1$) + (RIW_2 x $CPWC_2$), etc. When a facility's CPWC value was not available, the provincial average CPWC was used. The national average CPWC was used as a substitute for facilities in territories with missing CPWC values. Acute care episode costs included the cost of typical and atypical inpatients and day surgery. All cost estimates included portions of costs for hospital overhead, nursing care, other personnel salaries, drugs, diagnostic and laboratory services, medical supplies and equipment. They did not include fee-for-service physician compensation and out-of-pocket expenses for non-insured care, outpatient care and home care.

Hospital Peer Groups

Hospitals were assigned to one of four standard peer groups: teaching, large, medium and small. Teaching hospitals are those with full membership in the Association of Canadian Academic Healthcare Organizations (ACAHO). For Quebec, a list of teaching hospitals was provided by the Association québécoise d'établissements de santé et de services sociaux (AQESSS). Non-teaching hospitals were assigned to peer groups based on their volumes, using inpatient cases, total weighted cases and inpatient days.[52]

ix. Newborn discharges were excluded because a large proportion of these discharge abstracts had an invalid health care number.

Predictors and Risk-Adjustment Model

Logistic regression models were used to measure the strength of association of readmission with selected risk factors. In this study, variation in readmission rates across jurisdictions was determined based on the location of the submitting facility, which may be different from the patient's place of residence.

To compare readmission rates across jurisdictions, a logistic regression model was fit for each patient group using selected risk factors and adjusted for confounding jurisdictional differences across factors. Coefficients derived from the logistic model were used to calculate the probability of readmission for each case (index episode). The expected number of readmissions in a jurisdiction was the sum of the case probabilities for that jurisdiction. The risk-adjusted readmission rate was calculated by dividing the observed number of readmissions by the expected number of readmissions for each jurisdiction and then multiplying this number by the national average readmission rate. The risk factors included in the models were patient age, urgent admission through the ED at index and number of acute care hospitalizations in the six months before the index discharge. In addition to these risk factors, patient sex and the CMGs accounting for 80%[x] of all inpatient acute care discharges for medical, surgical and pediatric patient groups were included in the model for these three patient groups, respectively. Patient comorbidity measured by the Charlson Index comorbidity score was also included as a risk factor for medical and surgical patients.

x. Based on a three-year sample of medical, surgical and pediatric discharge abstracts.

Table 13: Selected Patient Characteristics, by Patient Group

Characteristic	Overall	Obstetric	Pediatric	Medical	Surgical
Number of Episodes of Care	2,129,633	378,951	197,080	885,806	667,796
Share of Episodes of Care (Percentage)	100.0	17.8	9.2	41.6	31.4
Female (Percentage)	59.7	100	44.8	52.2	51.3
Seniors, Age 65+ (Percentage)	37.2	0	0	57.4	42.3
Neighbourhood Income (Percentage)					
1—Least Affluent	22.4	22.6	22.0	24.3	20.0
2	20.5	19.8	19.0	21.3	20.2
3	19.7	20.0	19.7	19.3	20.0
4	19.3	20.5	20.5	18.0	19.9
5—Most Affluent	17.3	16.4	18.0	16.1	19.1
Rural (Percentage)	19.7	15.7	19.8	22.0	18.7
Inpatient Admitted Through ED (Percentage)	50.7	6.2	61.1	83.3	29.8
Charlson Index Score 1+ (Percentage)	26.5	N/A	N/A	33.2	17.5
Number of Acute Care Admissions in Six Months Prior to Index Admission (Percentage)					
0	77.9	90.8	79.9	68.0	83.0
1	14.9	7.4	12.3	20.1	12.9
2+	7.2	1.8	7.8	11.9	4.1

Note

N/A: not applicable to this patient group.

About 0.9% of patients could not be assigned to neighbourhood income quintiles and rural/urban residence.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Table 14: Selected Patient Characteristics for Return to Emergency Department, by Patient Group

Characteristic	Overall	Obstetric	Pediatric	Medical	Surgical
Number of Episodes of Care	1,008,409	188,448	92,240	413,197	314,524
Share of Episodes of Care (Percentage)	100.0	18.7	9.1	41.0	31.2
Female (Percentage)	59.9	100.0	44.2	51.7	51.3
Seniors, Age 65+ (Percentage)	36.0	0	0	56.5	41.3
Neighbourhood Income (Percentage)					
1—Least Affluent	21.9	22.4	21.6	23.7	19.2
2	20.2	19.8	19.1	20.9	19.9
3	19.8	20.3	19.9	19.4	19.9
4	19.6	20.9	21.0	18.3	20.2
5—Most Affluent	17.6	15.9	17.4	16.6	20.0
Rural (Percentage)	17.4	13.5	17.3	19.7	16.8
Inpatient Admitted Through ED (Percentage)	49.6	6.8	57.5	83.6	28.2
Charlson Index Score 1+ (Percentage)	22.7	N/A	N/A	29.1	14.4
Number of ED Visits Within Six Months Prior to Index Admission (Percentage)					
0	51.1	75.8	48.4	34.0	59.6
1	23.2	13.9	24.7	28.2	21.8
2	11.4	5.4	12.6	15.5	9.3
3+	14.2	4.9	14.3	22.2	9.3

Notes

N/A: not applicable to this patient group.

Results are based on Ontario, Alberta and Yukon.

About 0.9% of patients could not be assigned to neighbourhood income quintiles and rural/urban residence.

Sources

Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Table 15: Risk-Adjusted Rate of Readmission to Acute Care, by Patient Group and Jurisdiction

Jurisdiction	Patient Group			
	Obstetric	Pediatric	Medical	Surgical
B.C.	2.5 (2.4–2.6)	6.0 (5.7–6.3)	14.1 (13.8–14.2)	7.0 (6.8–7.1)
Alta.	2.0 (1.8–2.1)	6.1 (5.8–6.4)	12.7 (12.5–13.0)	6.4 (6.2–6.6)
Sask.	2.3 (2.1–2.5)	7.6 (7.2–8.1)	15.2 (14.9–15.5)	7.3 (7.0–7.6)
Man.	2.7 (2.6–2.9)	7.0 (6.5–7.5)	13.8 (13.4–14.1)	6.2 (5.9–6.4)
Ont.	1.8 (1.8–1.9)	6.8 (6.7–7.1)	13.0 (13.0–13.2)	6.5 (6.3–6.5)
Que.	1.6 (1.4–1.6)	5.9 (5.8–6.2)	13.2 (13.0–13.3)	6.4 (6.2–6.4)
N.B.	2.3 (2.0–2.6)	6.1 (5.4–6.8)	13.0 (12.6–13.4)	6.5 (6.2–6.9)
N.S.	3.0 (2.8–3.3)	7.3 (6.7–7.8)	12.1 (11.7–12.6)	6.2 (5.9–6.5)
P.E.I.	1.9 (1.2–2.6)	8.8 (7.1–10.4)	13.8 (12.9–14.7)	6.4 (5.4–7.3)
N.L.	2.9 (2.5–3.2)	6.3 (5.5–7.2)	13.5 (13.1–14.1)	6.0 (5.6–6.4)
Y.T.	1.9 (0.7–3.2)	4.9 (0.8–8.8)	13.2 (11.0–15.3)	6.8 (4.4–9.3)
N.W.T.	1.5 (0.7–2.4)	8.8 (6.7–11.0)	14.2 (12.4–16.0)	9.7 (7.4–11.9)
Nun.	2.0 (0.6–3.3)	9.1 (5.9–12.1)	18.0 (14.9–21.0)	9.6 (2.8–16.1)
Canada	2.0 (1.9–2.0)	6.5 (6.4–6.6)	13.3 (13.2–13.4)	6.5 (6.4–6.5)

Note

Rates were adjusted for age, sex, admission via the emergency department, number of acute care visits six months prior to the index discharge, comorbidity score and Case Mix Group.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Table 16: Odds Ratios of Readmission to Acute Care, by Risk Factors and Patient Group

	Obstetric	Pediatric	Medical	Surgical
Patient Age	Reference: 25–34	Reference: 0–4	Reference: 20–44	Reference: 20–44
	<25: 1.13 (1.07–1.20)	5–9: 0.81 (0.76–0.86)	45–64: 1.18 (1.15–1.21)	45–64: 1.09 (1.05–1.12)
	35+: 1.14 (1.07–1.21)	10–14: 0.90 (0.85–0.95)	65–84: 1.32 (1.29–1.35)	65–84: 1.30 (1.26–1.34)
		15–19: 0.89 (0.84–0.93)	85+: 1.35 (1.32–1.39)	85+: 1.36 (1.30–1.42)
Male (Versus Female)	NA	NS	1.05 (1.03–1.06)	1.12 (1.10–1.14)
Charlson Index Score 1 (Versus 0)	NA	NA	1.36 (1.34–1.38)	1.60 (1.55–1.64)
Charlson Index Score 2	NA	NA	1.64 (1.60–1.68)	1.94 (1.87–2.02)
Rural Residence (Versus Urban)	1.09 (1.03–1.16)	1.05 (1.003–1.10)	1.10 (1.08–1.11)	1.06 (1.03–1.08)
Income Quintile 1 (Versus Quintile 5)	1.10 (1.02–1.18)	1.12 (1.05–1.18)	1.10 (1.08–1.12)	1.12 (1.08–1.15)
Admission via ED	2.61 (2.45–2.78)	1.13 (1.09–1.17)	1.27 (1.25–1.30)	1.31 (1.28–1.34)
LOS Variance ≤-5 (Versus 0)	7.15 (3.76–13.60)	2.13 (1.92–2.36)	1.33 (1.30–1.37)	2.15 (2.05–2.25)
LOS Variance -4 to -3	1.64 (1.18–2.30)	1.57 (1.43–1.71)	1.16 (1.13–1.19)	1.54 (1.48–1.62)
LOS Variance -2 to -1	1.23 (1.16–1.31)	1.08 (1.03–1.14)	NS	1.06 (1.02–1.09)
LOS Variance 1 to 2	1.78 (1.68–1.90)	1.26 (1.18–1.34)	1.11 (1.08–1.14)	1.38 (1.33–1.43)
LOS Variance 3 to 4	3.07 (2.76–3.41)	1.57 (1.45–1.71)	1.21 (1.17–1.24)	1.82 (1.74–1.90)
LOS Variance ≥5	3.65 (3.27–4.08)	2.26 (2.11–2.42)	1.15 (1.12–1.18)	2.07 (2.00–2.15)
Number of Admissions to Acute Care Six Months Prior to Index: 1 (Versus 0)	1.93 (1.80–2.06)	2.31 (2.20–2.43)	1.72 (1.69–1.74)	1.63 (1.59–1.67)
Number of Admissions to Acute Care Six Months Prior to Index: 2+	4.50 (4.12–4.92)	5.47 (5.22–5.73)	3.16 (3.11–3.21)	2.53 (2.44–2.62)

Notes

NA: not applicable to this patient group.

NS: not statistically significant.

LOS: length of stay.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

Table 17: Odds Ratios of Return to ED, by Risk Factors and Patient Group

	Obstetric	Pediatric	Medical	Surgical
Patient Age	Reference: 25–34	Reference: 0–4	Reference: 20–44	Reference: 20–44
	<25: 1.10 (1.05–1.16)	5–9: NS	45–64: 0.90 (0.87–0.93)	45–64: 0.84 (0.81–0.87)
	35+: NS	10–14: NS	65–84: 0.80 (0.78–0.83)	65–84: 0.85 (0.82–0.88)
		15–19: 1.32 (1.24–1.40)	85+: 0.77 (0.75–0.80)	85+: 0.72 (0.68–0.77)
Male (Versus Female)	NA	NS	1.10 (1.07–1.12)	1.10 (1.07–1.12)
Charlson Index Score 1 (Versus 0)	NA	NA	1.08 (1.06–1.11)	1.10 (1.06–1.14)
Charlson Index Score 2	NA	NA	1.23 (1.19–1.28)	1.23 (1.16–1.31)
Rural Residence (Versus Urban)	1.56 (1.48–1.64)	1.50 (1.41–1.59)	1.49 (1.46–1.53)	1.68 (1.63–1.72)
Income Quintile 1 (Versus Quintile 5)	1.09 (1.02–1.16)	NS	1.08 (1.05–1.11)	1.07 (1.03–1.11)
Admission via ED	1.41 (1.32–1.50)	1.09 (1.04–1.15)	1.21 (1.18–1.25)	NS
LOS Variance ≤-5 (Versus 0)	3.36 (1.71–6.61)	1.28 (1.10–1.49)	1.20 (1.14–1.25)	1.26 (1.19–1.34)
LOS Variance -4 to -3	2.21 (1.73–2.82)	1.21 (1.07–1.38)	1.15 (1.10–1.19)	1.21 (1.15–1.28)
LOS Variance -2 to -1	0.87 (0.83–0.91)	NS	NS	1.04 (1.01–1.08)
LOS Variance 1 to 2	1.25 (1.18–1.33)	NS	NS	1.11 (1.07–1.16)
LOS Variance 3 to 4	1.25 (1.09–1.42)	1.14 (1.02–1.28)	NS	1.27 (1.20–1.34)
LOS Variance ≥5	1.25 (1.08–1.44)	1.41 (1.28–1.55)	0.87 (0.84–0.91)	1.08 (1.03–1.13)
Number of ED Visits Six Months Prior to Index: 1 (Versus 0)	1.66 (1.57–1.75)	1.25 (1.17–1.34)	1.20 (1.16–1.23)	1.32 (1.28–1.36)
Number of ED Visits Six Months Prior to Index: 2	1.99 (1.85–2.15)	1.55 (1.44–1.68)	1.48 (1.44–1.53)	1.65 (1.58–1.71)
Number of ED Visits Six Months Prior to Index: 3+	3.09 (2.89–3.31)	2.30 (2.16–2.46)	2.51 (2.45–2.58)	2.40 (2.32–2.49)

Notes

NA: not applicable to this patient group.

NS: not statistically significant.

LOS: length of stay.

Results are based on Ontario, Alberta and Yukon.

Sources

Discharge Abstract Database and National Ambulatory Care Reporting System, 2010–2011, Canadian Institute for Health Information.

Table 18: Odds Ratios for Acute Care Readmission, by Hospital Length-of-Stay Variance

Hospital LOS Variance	Odds Ratios	95% Confidence Intervals
<-1.00 Day	1.40	(1.31–1.50)
-1.00 to -0.49 Days	1.03	(1.01–1.06)
-0.50 to -0.01 Days	1.04	(1.03–1.05)
0 to 0.49 Days	Reference	
0.50 to 0.99 Days	0.96	(0.94–0.97)
≥1 Day	0.95	(0.92–0.97)

Notes

This analysis excluded hospitals with fewer than 50 index discharges annually.

Only typical patients were included in the calculation of hospital length-of-stay variance.

Odds ratios were adjusted for patient group, age, sex, neighbourhood income quintiles, rural/urban residence, admission via emergency department and number of acute care visits six months prior to index discharge.

Sources

Discharge Abstract Database, 2010–2011, Canadian Institute for Health Information; Fichier des hospitalisations MED-ÉCHO, 2009–2010, ministère de la Santé et des Services sociaux du Québec.

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Canadian Institute for Health Information
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6

Phone: 613-241-7860
Fax: 613-241-8120
www.cihi.ca
copyright@cihi.ca

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Talk to Us

CIHI Ottawa
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6
Phone: 613-241-7860

CIHI Toronto
4110 Yonge Street, Suite 300
Toronto, Ontario M2P 2B7
Phone: 416-481-2002

CIHI Victoria
880 Douglas Street, Suite 600
Victoria, British Columbia V8W 2B7
Phone: 250-220-4100

CIHI Montréal
1010 Sherbrooke Street West, Suite 300
Montréal, Quebec H3A 2R7
Phone: 514-842-2226

CIHI St. John's
140 Water Street, Suite 701
St. John's, Newfoundland and Labrador A1C 6H6
Phone: 709-576-7006

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