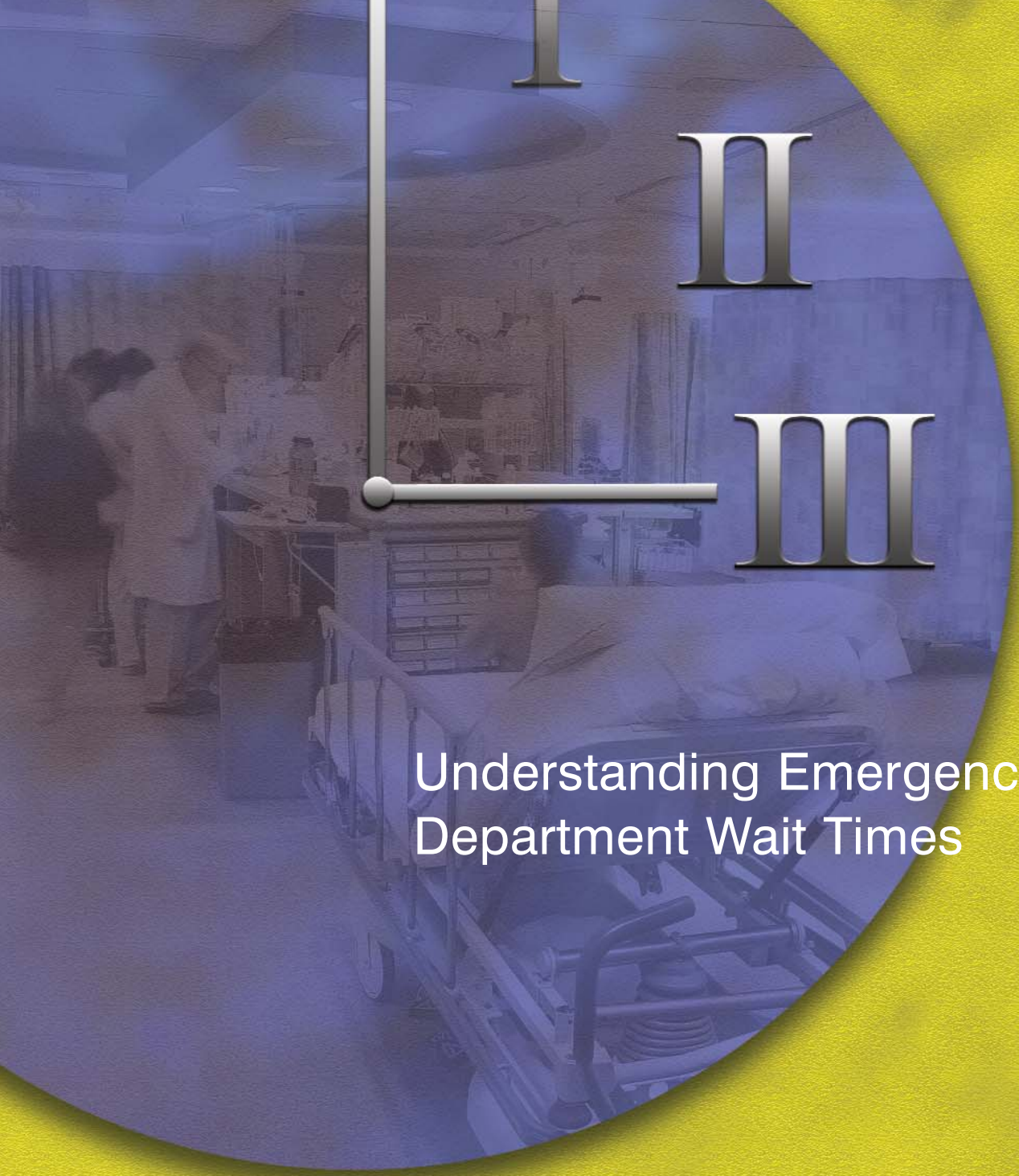

Understanding Emergency Department Wait Times

Access to Inpatient Beds and Patient Flow

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About the Canadian Institute for Health Information

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It should be noted that the interpretations in this report do not necessarily reflect those of the individual members of the Advisory Committee or their affiliated organizations.

The editorial committee for the report included Heather Dawson, Sharon Gushue, Greg Webster and Jennifer Zelmer. The Technical Notes were prepared by Audrey Boruvka. Other staff who made contributions to the report include Debbie Gibson, Sara Grimwood and Jaya Weerasooriya.

Highlights

More than one million Canadians are admitted to hospital via the emergency department (ED) every year. During 2005–2006:[i]

- Over half (60%) of patients hospitalized were admitted through the ED. This proportion varied across Canada, from 56% in Nova Scotia and Alberta to 77% in Nunavut.
- The 1.1 million patients admitted via the ED accounted for 65% of acute care inpatient days.
- The majority (68%) of patients admitted via the ED were in the medical patient service group, followed by the surgical (19%), neonatal and pediatric (6%), mental health (5%) and obstetrics (1%) patient groups.
- Patients admitted via the ED were more likely to be older and sicker (have multiple and/or more severe conditions or diseases) than patients admitted via other means. On discharge, these patients were also more likely to be transferred to further facility-based care.

Bed wait times (from the decision to admit the patient to the time the patient leaves the ED) among admissions during 2005 showed that in a sample of 277 Canadian hospitals:

- Overall, 1 in 25 patients waited in the ED longer than 24 hours to access an acute care bed once the decision to admit the patient had been made. In large community and teaching hospitals, 1 in 20 patients admitted via the ED waited 24 hours or longer.
- The median bed wait time varied by hospital type, from 18 minutes in small community hospitals to 2.3 hours in teaching hospitals.
- Ten percent of patients waited in the ED 2.8 hours or more for access to an acute care bed in small hospitals. In comparison, 10% of patients in large and teaching hospitals waited over 17 hours.
- Eighty-six percent of patients in small hospitals spent two hours or less in the ED waiting for an acute care bed. In comparison, 45% of patients in teaching hospitals waited two hours or less.

i. Analysis excluded Canadian acute care hospitalizations in Quebec and among women admitted for childbirth and infants born in hospital.

- Larger hospital size, older age, sicker patients and longer length of inpatient stay were associated with longer bed wait times.
- In large community and teaching hospitals, wait times tended to be shorter in some summer and winter months, on weekends and in the evening.

A number of factors may affect bed wait times and patient flow, such as the capacity to discharge alternate level of care (ALC) patients. ALC patients are inpatients who no longer require acute care. During 2005, we found that in a sample of 277 Canadian hospitals:

- Compared to large community and teaching hospitals, small and medium hospitals were more likely to carry a larger proportion of ALC patients in their acute care caseloads. Smaller hospitals also saw greater variation in the proportion of ALC patients day to day.
- For those patients who waited over 24 hours to access an acute care bed in large community hospitals at the time of decision to admit, the median number of ALC patients at the time of decision to admit was 11. In teaching hospitals, the median number of ALC patients was 20.

About This Report

More than one million Canadians are admitted to acute care hospitals via emergency departments (EDs) every year. Given the importance of this aspect of health care, the amount of time people spend in EDs continues to be a topic of interest to patients, health care providers, health system planners and policy-makers.

CIHI's three-part report series on *Understanding Emergency Department Wait Times* aims to provide new information on the number and types of patients accessing EDs and how long they are waiting for care. The report series also provides information on hospital-based factors that may influence wait times and the flow of patients through the ED to the inpatient setting. The report series is available in both official languages on the CIHI website at www.cihi.ca.

The first report, *Understanding Emergency Department Wait Times: Who Is Using Emergency Departments and How Long Are They Waiting?*, focused on the characteristics of patients visiting selected EDs in Canada and the overall length of time that people spent there. The second report, an Analysis in Brief, looked more closely at wait times in Ontario, specifically variations in overall time spent in the ED by type of hospital and geographic location, wait times to initial physician assessment and variations by patient triage level and discharge disposition. This third report examines factors associated with the flow of patients from the ED to the inpatient setting. Using data from a sample of hospitals from across Canada, the time from the physician's decision to admit to the time the patient leaves the ED (referred to as "bed wait time") is examined. The distribution of this wait time is explored with respect to patient characteristics, hospital type and volume of alternate level of care (ALC) patients.

The first section of the report highlights both the percentage of hospital admissions in Canada that occur via the ED and the patient groups comprising the largest proportion of those admissions. The second section of the report focuses on variations in bed wait time by hospital type, patient group, day of week and season. Factors associated with inpatient bed availability are explored in the third part of the report. Specifically, the relationship between bed wait time and volumes of ALC patients is examined. In conclusion, the report highlights some initiatives under way across Canada to improve patient flow and wait times in EDs, and points to "what we know" and "what we don't know" about initiatives targeted toward patient flow from the ED to inpatient beds.

The descriptive analysis of bed wait time and overview of initiatives provided in this report are intended to provide new information for health care providers and health system managers as they move forward with strategies to improve patient flow from the ED to acute care and from acute care to alternate care settings.

Data Source and Interpretive Cautions

The data source for the analyses presented in this report is CIHI's Discharge Abstract Database (DAD), which comprises demographic, administrative and clinical data for hospital discharges and day surgeries in Canada.

The objective of this report is to inform efforts to reduce ED wait times and improve patient flow. That said, the following cautions should be considered when interpreting the results:

1. While CIHI has introduced a number of procedures to check and improve data quality, there have been no formal reabstraction studies directly assessing the accuracy of decision-to-admit and ED-leaving date and time data elements in the DAD. Our analysis includes a sample of acute care hospitals that met criteria based on both availability of the data elements needed to calculate bed wait times and the absence of suspected data quality issues identifiable from the discharge abstracts received by CIHI.
2. Anecdotal information and patterns in coding that are identifiable in the data indicate variation across hospitals in the process used to assign times to decision to admit and ED leaving, and accuracy in time measurement.
3. Bed wait time results aggregated by hospital type represent the "average" or "typical" scenario, but even within a given hospital type, the bed wait time distribution may vary substantially between individual hospitals.
4. Anecdotal information and patterns in coding that are identifiable in the data indicate that there is under-reporting of alternate level of care (ALC) patients. The degree to which ALC patients are under-reported varies by province and territory.

Also note that Quebec hospitals do not participate in the DAD, and the Quebec data submitted to CIHI do not contain the information required to identify acute care inpatients admitted from the ED or ALC patients. As a result, the findings presented in this report do not include hospitalizations in Quebec.

The Fine Print

To put the results of this report into context, the following points are worth noting:

Data source. Results were obtained from acute care hospitalizations in the Discharge Abstract Database (DAD). With the exception of information on mode of admission, decision-to-admit time and ED-leaving time, the DAD does not contain any additional data on emergency department (ED) visits prior to hospitalization. Our results, therefore, do not consider ED visit characteristics such as triage level or time spent in the ED prior to the decision to admit.

Bed wait time. The ED wait time examined in this report is the bed wait time, measured from the time the physician or other authorized health professional decides to admit the patient to the time the patient leaves the ED.

Alternate level of care (ALC). An ALC patient is a patient who has finished the acute phase of his or her treatment but remains in an acute care bed. The majority of patients who receive ALC are awaiting placement in some form of facility-based, follow-up care, such as long-term care, complex continuing care or physical rehabilitation.

Hospitalizations due to childbirth. Both women admitted for delivery and infants born in hospital were considered as having hospitalizations due to childbirth. The first section of this report compares hospital utilization between patients admitted via the ED and those admitted via other means. To limit the comparison primarily to patients admitted for health problems, results in this section exclude hospitalizations due to childbirth.

Clinical Decision Units. Some hospitals have units adjacent to the ED referred to as observation or clinical decision units (CDUs). CDUs are designated for patients requiring further investigation and monitoring to inform a physician's decision to admit or discharge from the ED. These units are a relatively new strategy being used by an increasing number of hospitals in an attempt to address ED overcrowding and extended ED wait times.[1]

The DAD is not always able to distinguish between CDUs and acute care wards, but patients who receive inpatient care exclusively through a CDU can be identified by comparing the date and time elements available in DAD. CDUs are different from acute care wards, and for this reason we excluded CDU-exclusive patients from the analysis of bed wait time. For further details on the identification of these patients, refer to Appendix A.

Sample of 277 hospitals. Not all hospitals report the DAD data elements required to calculate bed wait time (decision-to-admit and ED-leaving dates and times). As a result, this report presents bed wait times for the calendar year 2005, based on a sample of 277 hospitals primarily in provinces where submission of these data elements is mandatory (that is, Alberta, Manitoba, Ontario, Nova Scotia and Newfoundland and Labrador). This sample represents approximately 58% of admissions via the ED to Canadian hospitals outside Quebec.

Appendix A provides a detailed breakdown of inclusion criteria and sample coverage of the 277-hospital data set by province and territory, plus additional information on data sources, methodology and interpretive limitations.

Emergency Departments as Part of the Health Care System

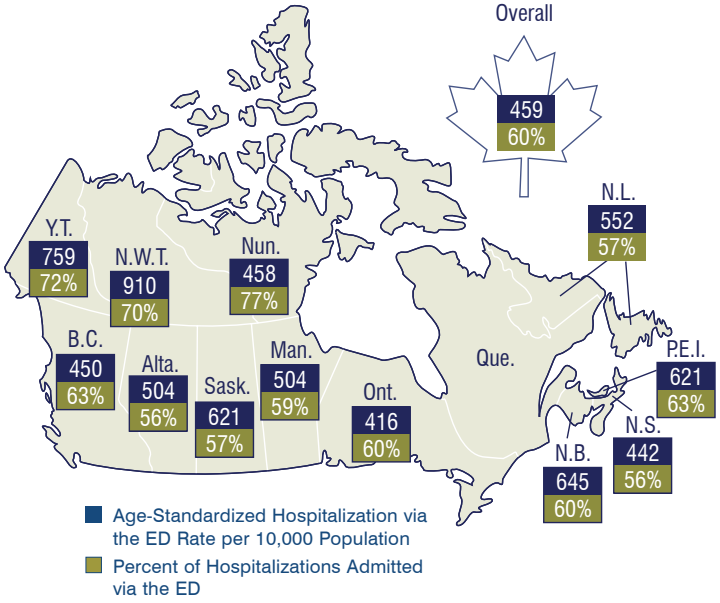
Every year, Canadians make over 14 million visits to hospital emergency departments (EDs)[2] resulting in over one million admissions to acute care hospitals via the ED.

Over the past five years, the proportion of hospitalizations via the ED has remained fairly stable at around 60% of patients admitted for a health-related problem. Hospitalization rates via the ED vary across the country. In 2005–2006, the age-standardized hospitalization rate via the ED ranged from 416 per 10,000 population in Ontario to 910 per 10,000 population in the Northwest Territories.

Factors influencing hospitalization rates, such as overall population health,[3] availability of or access to appropriate primary care[4] and ED practice patterns or management,[5] may account for some of the variation in hospitalization rates via the ED across the country. It is interesting to note that while there has been a general downward trend in the overall number of acute care hospitalizations over the past 10 years,[6] the number of hospitalizations to acute care via the ED has remained steady at about 1.1 million a year over this same period of time.

1 Rate of Hospitalizations via the ED

In Canada, age-standardized rates of acute care hospitalization via the ED vary by province and territory. This map shows the proportion of hospitalizations with admission via the ED and per capita rates of hospitalization via the ED across provinces and territories during 2005–2006.



Notes: Results exclude hospitalizations in Quebec due to differences in coding mode of admission. Hospitalizations among women admitted for childbirth and infants born in hospital were also excluded for the purpose of comparison. Provincial and territorial per capita rates were age-standardized using the overall Canadian population excluding Quebec as the reference. The rate for Canada excluding Quebec, therefore, gives the crude hospitalization rate.
Sources: Discharge Abstract Database, CIHI; Statistics Canada, Demography Division (2005–2006 population estimates).

Mode of Admission

Hospitalizations via the ED include patients admitted to the hospital via that hospital's ED. Hospitalizations via other means include elective or planned admissions, direct admissions from a doctor's office or clinic or transfers from another facility.

Hospital Utilization and Patient Characteristics

In order to determine if patients admitted via the ED had different characteristics than patients admitted via other means, we examined these two groups of patients. For the purpose of comparison, hospitalizations were examined based on mode of admission and were categorized into patient service groups primarily according to the discipline of their main acute care service or health care provider. An index of health problems during each hospitalization was also measured using the Charlson Index.[7, 8]

We found that excluding hospitalizations due to childbirth, the majority (68%) of patients admitted via the ED were in the medical patient service group. In contrast, hospitalizations via other means were primarily in the surgical group (58%). Patients admitted via the ED tended to be older and sicker (have multiple and/or more severe conditions or diseases) than patients admitted via other means. On discharge, these patients were also more likely to be transferred to further facility-based care.

Understanding Descriptive Statistics

The distribution of numeric variables, such as length of stay (LOS) and bed wait time, across a sample can be summarized using a variety of descriptive statistics. Most statistics describe either the *centre* or *spread* of the distribution.

Measures of centre quantify the "typical" value in the sample. One common measure of centre is the *average* or *mean*. Although widely used, the mean can be influenced by a relatively small number of very large or small observations.

The *median* is an alternative measure of centre that is not as sensitive to large outliers. It is calculated by ordering the observed values from lowest to highest and selecting the middle value. This value corresponds to the 50th percentile of the distribution. Other percentiles are calculated in a similar manner. For example, the 25th percentile corresponds to the value below which you will find 25% of the ordered observations. Since we found that the distributions of LOS and bed wait time were skewed (that is, some patients had extremely long LOS or bed wait time relative to others), we used percentiles to summarize these variables.

Measures of spread quantify the amount of variation in the sample. With respect to the median, a common measure of spread is the interquartile range (IQR), equal to the interval between the 25th and 75th percentiles of the distribution.

Understanding the Charlson Index

The Charlson Index is a weighted index of health problems that takes into account the number and seriousness of specific diseases.[8] Charlson Index scores are assigned so that the number and severity of diseases are greater in patients with higher scores. To summarize scores across a group of patients, we translated the scores into a four-point ordinal scale, ranging from scores equal to zero (no presence of disease) to scores of three or more.[9] In our analysis, 44% of patients admitted via the ED had a Charlson Index score of one or more, compared to 21% of patients admitted via other means. Further details on the Charlson Index can be found in Appendix B.

2 Characteristics of Patients Admitted via the ED Versus Other Means

Patients admitted via the ED appeared to differ from patients admitted via other means. The table below compares these two groups using acute care hospitalizations across Canada in 2005–2006.

Characteristic	Hospitalization via the ED	Hospitalization via Other Means
Number (Percent)	1.1 million (60)	0.8 million (40)
Total Inpatient Days (Percent)	9.2 million (65)	5.0 million (35)
Mean Age on Admission	56	53
Percent Female	51	54
Charlson Index		
Percent with Score = 0	56	79
Percent with Score = 1	22	7
Percent with Score = 2	10	8
Percent with Score of 3 or More	12	6
Median Length of Stay in Days (Interquartile Range)	4 (2–8)	3 (1–6)
Patient Service Group		
Percent Medical	68	29
Percent Surgical	19	58
Percent Neonatal and Pediatric	6	7
Percent Obstetrics	1	3
Percent Mental Health	5	3
Discharge Disposition		
Percent Transferred to Another Facility	15	7
Percent to Acute Care Facility	8	5
Percent to Continuing Care Facility	7	2
Percent to Other Facility	1	<1
Percent Discharged Home	78	91
Percent With Home Care	10	7
Percent Without Home Care	68	85
Percent Left Against Medical Advice	2	<1
Percent Discharged Due to Death	5	2

Notes: Results exclude hospitalizations in Quebec due to differences in coding mode of admission. Hospitalizations among women admitted for childbirth and infants born in hospital were also excluded for the purpose of comparison.
Source: Discharge Abstract Database, CIHI.

Patient Service Groups

Acute care patients are hospitalized for a wide variety of reasons. In an attempt to understand differences in the types of acute care services received by patients who were admitted via the ED, patients were assigned to one of six patient service groups:

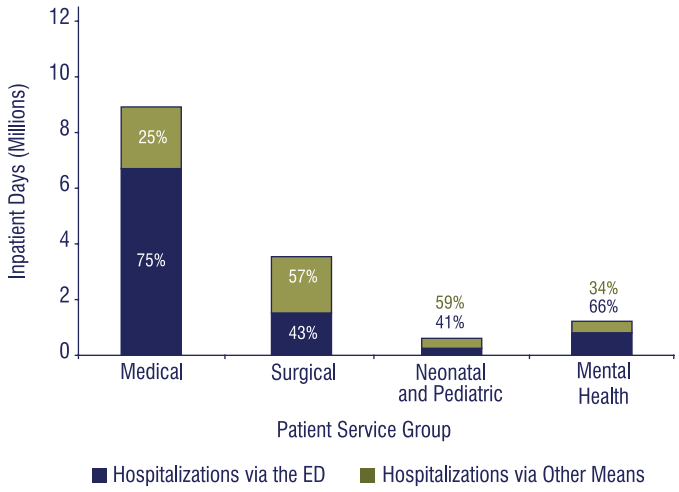
- Medical
- Surgical
- Pediatric
- Neonatal
- Obstetric
- Mental Health

Group assignment was primarily based on discipline of the main patient service or health care provider. For example, the medical group included patients admitted to general internal medicine, sub-specialties (for example, cardiology, neurology) as well as general/family practice service providers. The neonatal group was identified using additional information on the mode of admission and age. Due to sample size and for ease of presentation, the neonatal and pediatric groups were combined.

In general, patient service group does not necessarily reflect the physical location of an inpatient in terms of type of bed or ward. Further details on patient service groups can be found in Appendix C.

3 Inpatient Days by Mode of Admission and Patient Service Group

Cumulative length of stay, also known as inpatient days, among acute care patients varies by mode of admission and patient service group. The graph below shows inpatient days by mode of admission (ED or other means) and patient service group among hospitalizations outside Quebec during 2005–2006.



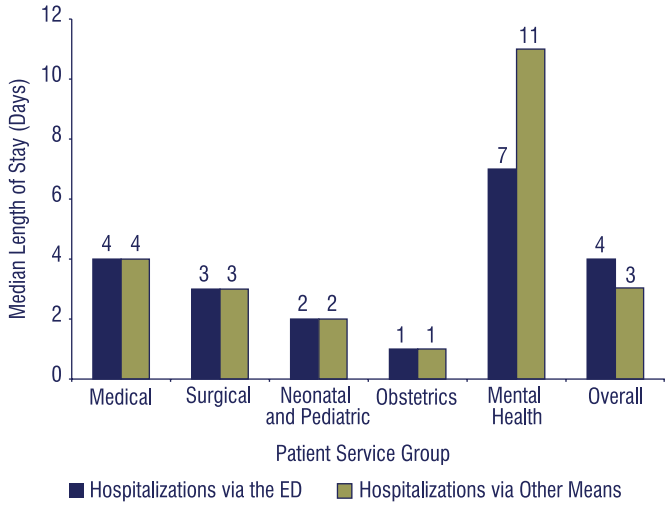
Notes: Results exclude hospitalizations in Quebec due to differences in coding mode of admission. Hospitalizations among women admitted for childbirth and infants born in hospital were also excluded for the purpose of comparison.
Source: Discharge Abstract Database, CIHI.

Comparing within each patient service group revealed that differences in hospitalizations and inpatient days between inpatients admitted through the ED and those admitted via other means were primarily due to discrepancies in the medical patient service group. Overall, patients admitted via the ED accounted for 65% of inpatient days in 2005–2006. This proportion was 75% in the medical patient service group, but smaller in other patient service groups.

With the exception of patients in the mental health group, there appears to be no difference in median length of stay by patient service group for patients admitted via the ED when compared to patients admitted via other means. The longer overall length of stay for patients admitted via the ED (four days) compared to patients admitted via other means (three days) is due to the larger volume of patients in the medical patient group.

4 Median Length of Stay by Mode of Admission and Patient Service Group

The graph below shows the median LOS by mode of admission (ED or other means) and patient service group.



Notes: Results exclude hospitalizations in Quebec due to differences in coding mode of admission. Hospitalizations among women admitted for childbirth and infants born in hospital were also excluded for the purpose of comparison.
Source: Discharge Abstract Database, CIHI.

In summary, overall, the results indicate some underlying differences between hospitalizations via the ED versus those via other means in terms of both utilization and patient characteristics. In 2005–2006, patients admitted via the ED were more likely to be older, to be sicker and to spend more time in acute care. As a whole, patients admitted via the ED also accounted for a larger proportion of the acute care caseload across hospitals in Canada than patients admitted via other means.

Waiting for Inpatient Care in the ED

How quickly patients are admitted from the ED to an inpatient bed is complex and affected by many factors both within and outside of the ED.[10, 11]

It is important to understand the extent to which patients are waiting for beds in EDs in Canada's hospitals, because waiting for care can result in delays to treatment for individual patients and reduced efficiency in the flow of patients that require admission from the ED onto an inpatient ward.

There is some evidence to indicate that a relationship between patient flow through the ED and delays in care exists. For example, delays in some door-to-treatment times have been found in recent studies to be associated with ED overcrowding or longer ED wait times.[12, 13]

Additionally, some experts suggest that optimized flow could potentially translate into better quality of care.[14] For example, Canadian ED directors surveyed in 2005 identified ED overcrowding to be a major or severe problem and felt that such delays led to poor quality of care.[15] And a 2003 survey of hospital executives indicated that waiting times in EDs due to delays in discharge because of limited availability of post-hospital care and diversion of patients to other facilities because of a lack of capacity was an area of much concern, particularly in Canada, the U.S. and the UK.[16]

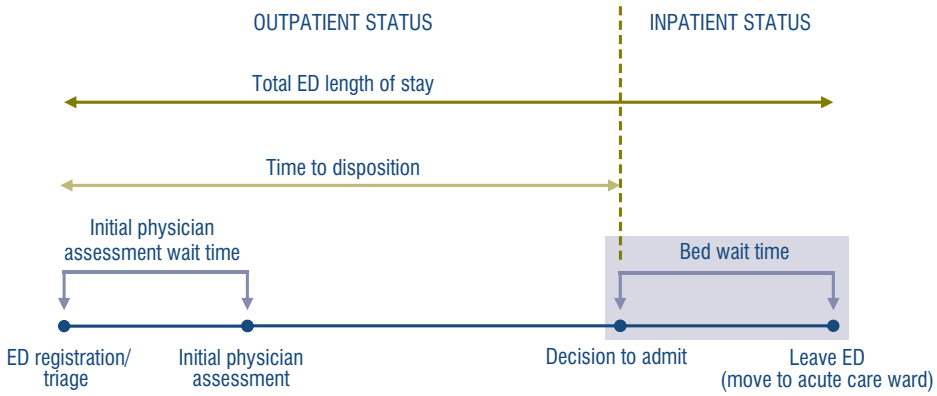
In this section of the report, we provide analysis of data related to ED wait times that is intended to assist hospitals to achieve success in strategies to reduce bed wait times and enhance patient flow. Variation in bed wait times by hospital type, patient group, day of the week, time of day and season is explored.

Variation in Bed Wait Times

Earlier reports in CIHI's *Understanding Emergency Wait Times* series found variation in the time to initial physician assessment and in how long, in total, patients spend in the ED by hospital type, day of week, time of day and season. The same is true for bed wait times. Variation in ED wait times reflects a combination of factors, including hospital operational patterns and changes in the demand for hospital services.[17–19]

5 Waiting Times in the Emergency Department

In this report, the bed wait time is calculated as the time a patient spends waiting in the ED from the physician's decision to admit them to an inpatient bed to the time that the patient leaves the ED. More details about the bed wait time calculation can be found in the Technical Notes in Appendix A.



Hospital Type

In order to examine variations among different kinds of hospitals, the 277 hospitals meeting selection criteria for valid bed wait time data have been grouped into four categories based on CIHI's Comparison of Hospital Activity Program (CHAP) peer groups.

Small community hospitals include 155 hospitals with up to 49 acute care beds.

Medium community hospitals include 64 hospitals with 50 to 199 acute care beds.

Large community hospitals include 34 hospitals with 200 or more acute care beds.

Teaching hospitals include 24 hospitals. The two pediatric hospitals in the sample are contained in this group.

Bed Wait Time by Hospital Type

Previous analysis has shown that patients in larger hospitals appeared to wait longer in the ED for initial physician assessment and visit completion compared to patients visiting EDs in smaller hospitals. The same is true among patients waiting in the ED for an acute care bed in larger hospitals. That is, bed wait times tend to be longer in larger hospitals.

Based on our analysis of bed wait time in 277 hospitals during 2005, 86% of patients in small hospitals spent two hours or less in the ED waiting for an acute care bed. In contrast, 45% of patients in teaching hospitals had bed wait times of two hours or less.

6 Distribution of Bed Wait Time by Hospital Type

A larger proportion of patients in small and medium community hospitals was admitted within two hours than patients in large community and teaching hospitals.

Hospital Type	Number of Hospitals	Number of Patients (Percent)	Percent of Patients in Bed Wait Time Intervals				
			0–2 Hours	2–6 Hours	6–12 Hours	12–24 Hours	Over 24 Hours
Small Community	155	79,827 (12)	86	10	2	2	1
Medium Community	64	138,542 (21)	66	21	4	5	3
Large Community	34	248,594 (38)	49	27	9	10	5
Teaching	24	193,816 (29)	45	29	10	10	5
Overall	277	660,779 (100)	56	24	7	8	4

Notes: Based on a sample of 277 hospitals. Total number of bed wait times represented is 660,779. The bed wait time categories include the upper end-point. For example the "6–12" category includes bed wait times greater than 6 hours and less than or equal to 12 hours.
Source: Discharge Abstract Database, CIHI.

The median bed wait time corresponds to the wait time at which half of the patients in the group under consideration had shorter waits; the other half had longer waits. Overall, the median bed wait time was longest in teaching hospitals (2.3 hours) and in large community hospitals (2.1 hours). Median waits were 1 hour and 18 minutes in medium community hospitals and 18 minutes in small community hospitals. The 90th percentile corresponds to the wait time at which 90% of patients in the group under consideration had shorter waits and 10% had longer waits. Our results for the 90th percentile showed variation across hospital type—from 2.8 hours in small community hospitals to 17.7 hours in large community hospitals.

7 Percentile Distribution of Bed Wait Time by Hospital Type

Using the 90th percentile, the results show a range in bed wait time—in small community hospitals 10% of patients had bed waits of 2.8 hours or greater whereas in large community and teaching hospitals, 10% of patients had bed waits of 17.3 hours or greater.

Hospital Type	Number of Hospitals	Number of Patients (Percent)	Bed Wait Time Percentile (Hours)				
			10th	25th	50th (Median)	75th	90th
Small Community	155	79,827 (12)	0	0	0.3	1.2	2.8
Medium Community	64	138,542 (21)	0	0.4	1.3	2.8	9.1
Large Community	34	248,594 (38)	0.1	0.8	2.1	5.7	17.7
Teaching	24	193,816 (29)	0.3	1.0	2.3	6.3	17.3
Overall	277	660,779 (100)	0.0	0.6	1.7	4.4	15.1

Notes: Based on a sample of 277 hospitals. Total number of wait times represented is 660,779.
Source: Discharge Abstract Database, CIHI.

Bed Wait Time by Time of Day and Day of Week

Studies have shown that ED wait times and patient volume also fluctuate throughout the week.[20–24] This research suggests that these patterns may reflect a combination of:

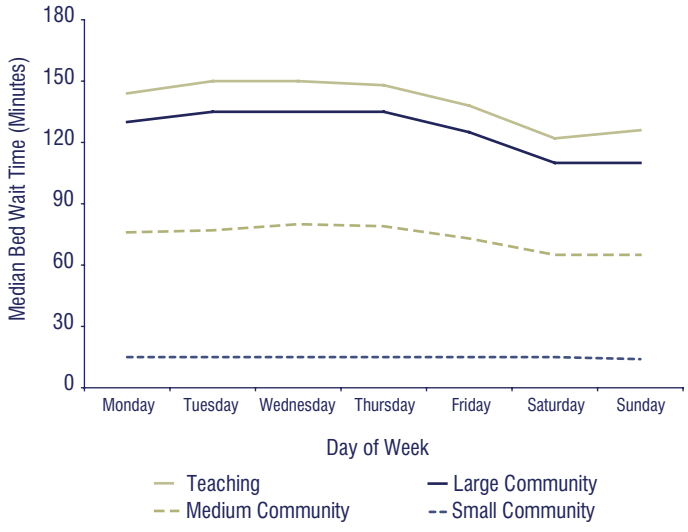
- Hospital operational patterns, such as emergency and elective admissions peaking on certain days of the week;
- Fewer discharges on weekends resulting in a potential backlog of patients in the ED, particularly on Mondays; and
- ED patient volume patterns.

Similarly, in our analysis using the sample of 277 hospitals, bed wait times during 2005 tended to be shorter on weekends in larger hospitals. For example, in teaching hospitals the median wait times with decision to admit occurring Saturday and Sunday were 2.0 and 2.1 hours, respectively. At mid-week, the median was 2.5 hours.

When considering staffing and bed management strategies to improve patient flow from the ED to inpatient wards, it is important to understand the day-to-day fluctuations in ED volumes and resulting admissions.

8 Median Bed Wait Time by Hospital Type and Day of Week

In a sample of large community and teaching hospitals across Canada, the median bed wait time during 2005 tended to be shorter on weekends than weekdays. There was little difference (a range between 14 and 15 minutes) in the median bed wait time by day of week for small hospitals.



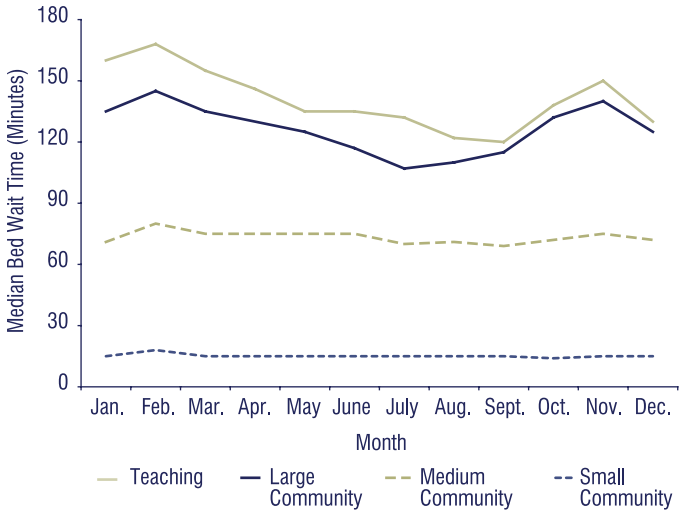
Notes: Based on a sample of 277 hospitals. Total number of wait times represented is 660,779.
Source: Discharge Abstract Database, CIHI.

Depending on the Shift

Median bed waits also vary depending on the time of day at which the decision to admit is made, particularly for larger hospitals. Median bed waits were longest during the day, at 1.4 hours, 2.4 hours and 2.8 hours for medium community, large community and teaching hospitals, respectively. They tended to be shortest in the evening (4 p.m. to 11:59 p.m.) for large community and teaching hospitals, potentially reflecting hospital discharge patterns in which patients are often discharged throughout the late afternoon.

9 Median Bed Wait Time by Season and Hospital Type

In a sample of hospitals across Canada, median bed wait times during 2005 were generally shortest during summer and longer during fall and winter seasons for medium and large community hospitals and teaching hospitals. These patterns may reflect hospital operational planning as well as changes in hospitalizations over the year.



Notes: Based on a sample of 277 hospitals. Total number of wait times represented is 660,779.
Source: Discharge Abstract Database, CIHI.

Bed Wait Time by Time of Year

Researchers have found that hospitals are typically busier during fall and winter, but see fewer patients during the summer. Experts suggest a number of potential reasons for this phenomenon, including that admissions due to cardiovascular or respiratory conditions (for example, influenza) tend to peak during that time.[25–27] During the summer months, in contrast, elective admissions may be reduced because of staff scheduling and other factors that may affect the number of beds staffed and available.[25–27]

Bed wait times also show seasonal patterns. For example, median bed waits are typically longer during the fall and winter months (with the exception of December) and shortest during summer months (July, August and September). This seasonal effect was least evident in small community hospitals.

Who Waits Longest for an Inpatient Bed?

Most ED patients admitted to hospital are moved to their inpatient beds within hours, but that is not true for everyone. Based on our analysis of bed wait times in 2005 across a sample of Canadian hospitals, 4% of patients waited over 24 hours in the ED for an acute care bed once the decision to admit had been made. Teaching and large community hospitals had the largest proportion of patients who waited over 24 hours for an acute care bed (5% each).

Patients in this group tended to be different from patients whose bed wait times were shorter than 24 hours. In particular, patients with bed waits over 24 hours were more likely to be older and sicker. The type of acute care services these patients typically received was also different. For example, patients with longer bed wait times were more likely to be in the medical patient service group and less likely to be admitted from the ED to special care units (SCUs)—intensive care or step-down units. After leaving the ED, patients who waited longer also appeared to be hospitalized for greater periods of time. There was virtually no difference in the distribution of females versus males with respect to bed wait times—within each wait time interval we considered, the proportion of females ranged between 51% and 52%. These similarities and differences persisted when we limited the comparisons to within each hospital type.

10 Patient Characteristics by Bed Wait Time

The table below illustrates patient characteristics for each of the bed wait time intervals. As noted, patients who waited more than 24 hours tended to be older and sicker.

Characteristics	Percent of Patients in Bed Wait Time Intervals				
	0–2 Hours	2–6 Hours	6–12 Hours	12–24 Hours	Over 24 Hours
Number (Percent)	369,852 (56)	159,930 (24)	48,068 (7)	54,147 (8)	28,782 (4)
Mean Age on Admission	54	57	61	64	67
Percent Female	51	51	51	52	52
CharIson Index					
Percent with Score = 0	58	52	46	43	39
Percent with Score = 1	21	22	24	25	27
Percent with Score = 2	10	11	13	14	15
Percent with Score 3 or More	11	14	17	18	20
Percent Admitted Directly to Special Care Unit (SCU)	8	5	4	3	2
Patient Service Group					
Percent Medical	65	64	74	81	87
Percent Surgical	20	24	18	13	8
Percent Neonatal and Pediatric	7	8	4	3	1
Percent Obstetrics	2	1	<1	<1	<1
Percent Mental Health	6	4	3	3	4
Median Length of Inpatient Stay (Days)	4	4	5	5	5

Notes: Based on a sample of 277 hospitals. Total number of bed wait times represented is 660,779. The bed wait time categories include the upper end-point. For example the "6–12" category includes bed wait times greater than 6 hours and less than or equal to 12 hours.
Source: Discharge Abstract Database, CIHI.

In summary, although the bed wait time may represent only part of the total time admitted patients spend in the ED, it is an ED wait time of interest to patients, policy-makers and health care providers.[20, 28] Overall, the findings indicate that bed wait times were more likely to be longer in larger hospitals. Compared to patients with shorter bed wait times, patients who waited longer in the ED to access an acute care bed were more likely to be older, to be sicker and to remain longer in hospital after leaving the ED.

How Does Patient Volume Relate to Patient Flow From the ED?

Researchers and clinicians suggest that a key to understanding delays in the patient flow process requires looking beyond the walls of the ED to other system-level factors.[11, 20, 29, 30]

Frequently noted factors associated with ED bed wait times include:

- Inpatient acute care bed availability within a specific hospital;[15, 17–20, 25]
- Scheduling of elective surgical admissions;[33]
- Staff availability, for example, staff-to-patient ratio;[11, 29–32]
- A reduction in the ED's capacity to care for new patients—as the number of admitted patients waiting in the ED increases, the ability to treat new patients coming into the ED may be limited;[11] and
- Hospital process(es) for discharging inpatients to post–acute care settings.[11, 33]

Care providers and researchers from across Canada have identified high numbers of ALC patients as a key factor impeding patient flow—among other concerns—for ED patients awaiting admission to inpatient care.[34–36] The potential consequences for ALC patients occupying acute care beds can be felt on many levels—the ALC patient not receiving care in the right place; patients being moved to post-acute beds such as complex continuing care until the required level of care is found; and a facility's capacity to provide acute care services being lowered, which may lead to crowding in other areas of the hospital, including the ED.[37]

In this section of the report, we examine some of the factors mentioned above with a focus on inpatients awaiting post–acute care.

Characteristics of Alternate Level of Care Patients

Alternate level of care (ALC) is designated to inpatients who no longer require acute care, but require some form of ongoing support or follow-up. This type of care is often referred to as "post-acute" care, and can include specialized services such as rehabilitation, complex continuing care, mental health, palliative care or long-term care. Experts suggest that for many patients these services should ideally be provided in settings other than acute care, such as long-term care facilities, supportive housing, home-care programs or at home, possibly with support by patients' families.[32] That said, alternatives are not always readily available when patients need them. This can lead to extended stays in an acute care facility.[16, 38]

While we feel this is a conservative estimate due to potential under-reporting of ALC patients, we found that in 2005–2006, (excluding Quebec) ALC patients accounted for 4% of acute care patients and 10% of inpatient acute care days. ALC patients were more likely to be older, to be sicker (have multiple and/or more severe conditions or diseases), to stay in hospital longer and to be transferred to another facility as opposed to being discharged home.

11 Characteristics of ALC Patients

The table below illustrates characteristics of patients who received alternative levels of care (ALC) in 2005–2006 compared to other acute care patients. ALC patients were more likely to be older, to be sicker, to stay in hospital longer and to be transferred to another facility as opposed to being discharged home.

Characteristics	Received ALC	Did Not Receive ALC
Number (Percent)	74,093 (4)	1,830,393 (96)
Mean Age on Admission	76	54
Percent Female	58	52
CharIson Index		
Percent with Score = 0	31	61
Percent with Score = 1	27	18
Percent with Score = 2	17	11
Percent with Score of 3 or More	25	11
Median LOS in Days	23	3
Patient Service Group		
Percent Medical	81	52
Percent Surgical	16	35
Percent Neonatal or Pediatric	<1	7
Percent Obstetrics	<1	2
Percent Mental Health	2	5
Discharge Disposition		
Percent Transferred to Another Facility	60	12
Percent Acute Care Facility	12	8
Percent Continuing Care Facility	44	4
Percent Other Facility	4	<1
Percent Discharged Home	31	84
Percent With Home Care	16	10
Percent Without Home Care	15	74
Percent Left Against Medical Advice	<1	1
Percent Discharged Due to Death	9	4

Note: Based on hospitalizations with discharge in 2005–2006, excluding hospitalizations in Quebec (due to differences in reporting ALC).
Source: Discharge Abstract Database, CIHI.

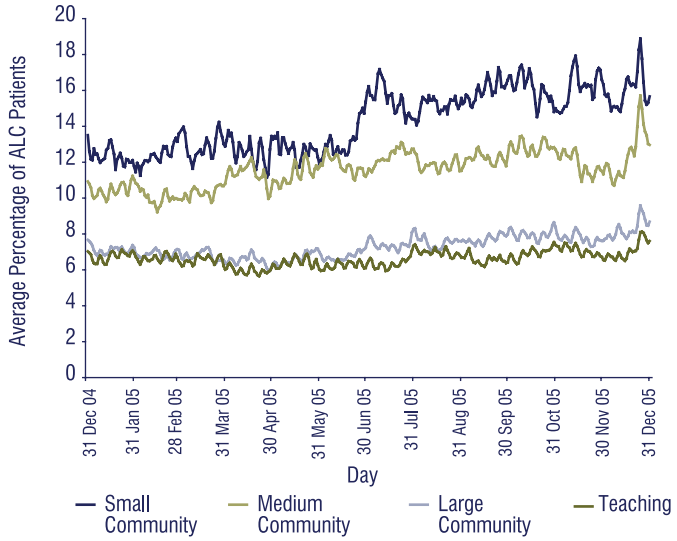
Variation in ALC Rates by Hospital Type

Similar to bed wait times, variation among hospital ALC rates reflects a combination of factors including access to post-acute care services, communication and coordination among care providers,[37] discharge planning protocols[39] and efficient acute bed utilization.[38]

Based on our sample of 277 hospitals, in 2005, teaching and large community hospitals tended to have the lowest proportion of patients receiving ALC compared to medium and small community hospitals. Specifically, small community hospitals had, on average, a higher volume of their inpatient populations receiving ALC (14.3%), followed by medium community hospitals (11.6%), large community (7.3%) and teaching hospitals (6.6%).

12 Day-to-Day Variation in the Proportion of ALC Patients

Based on the total number of hours spent in hospital among inpatients on a given day, the average proportion of ALC patients within each hospital type in 2005 is illustrated in the figure below. On any given day, small and medium community hospitals had a larger proportion of ALC patients than large and teaching hospitals. The average proportion of ALC patients among smaller hospitals also tended to have wider variation day to day than the average among larger hospitals.



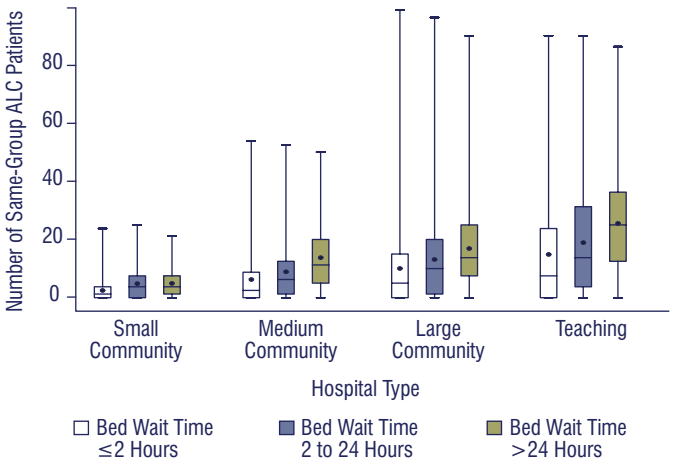
Note: Based on a sample of 277 hospitals.
Source: Discharge Abstract Database, CIHI.

Understanding Box-and-Whisker Plots

Box-and-whisker plots provide a way to graphically represent the distribution of a numeric variable. The "box" in these plots provides the 25th and 75th percentiles. A line drawn through the box corresponds to the 50th percentile, also known as the median. The "whiskers" are lines drawn from the edges of the box. The lengths of these lines are typically determined by the distance from the smallest and largest observations between the box and some multiple of the interquartile range (given by the difference between the 25th and 75th percentiles). For ease of presentation, we simply extended the whiskers out to the minimum and maximum observations. The average value is sometimes included on the plot using a symbol. In this report, we used a dot to depict the location of the average.

13 Volume of Same-Group ALC Patients at the Time of Decision to Admit

The figure below illustrates the volume of same-group ALC patients at the time of decision to admit for each patient admitted through the ED during 2005. In larger hospitals, the median number of same-group ALC patients was higher among patients who waited longer in the ED for an inpatient bed.



Note: Based on a sample of 277 hospitals.
Source: Discharge Abstract Database, CIHI.

Bed Wait Time and Volume of Alternate Level of Care Patients

To investigate the potential relationship between bed wait time and the volume of ALC patients in acute care beds, we examined the volume of ALC patients at the time of decision to admit for each patient admitted via the ED. Considering the differences in both bed wait times and volume of ALC patients across patient groups, we matched the ALC patient counts to allow for a "like-with-like" or "same-group" approach. Same-group volume was measured using the following process:

- If the patient waiting was admitted directly to a special care unit (SCU), the ALC volume was set to zero (since, by definition, there are no ALC patients in SCU);
- Otherwise, the ALC volume was set to the number of ALC patients in the same patient service group as the patient waiting. For example, if the patient waiting was in the medical patient service group, the ALC volume would be the number of medical ALC patients.

Using this approach, we found that as the bed wait time increased, so did the average number of ALC patients. This result generally held across all hospital types, but was most pronounced in medium, large and teaching hospitals. In medium community hospitals the median ALC volume ranged from two ALC patients among patients who waited up to 2 hours to nine ALC patients among those who waited over 24 hours. In large community and teaching hospitals, the median volume ranged from 4 to 11 and 6 to 20 ALC patients, respectively.

In summary, experts point to a variety of system-level factors that may influence ED wait times. Although the analysis presented here does not definitively establish a relationship between higher ALC patient volume and longer bed wait time, it does provide some descriptive findings as a starting point for further work. A deeper examination would likely require consideration of additional factors such as bed occupancy, surges in admissions to hospital, staffing for both ED and acute care services, management of elective admissions and infection control.

Conclusion

In Canada and other countries, experts suggest that the ability to smoothly transfer patients to acute care beds is key to avoiding ED crowding and ensuring appropriate care for incoming ED patients.[20, 28, 40]

Awareness of the need to address patient flow issues within the health care system is not new. There are numerous examples from across Canada of initiatives being undertaken by individual hospitals, groups of hospitals and other stakeholders to address patient flow issues. Many of these processes are operating with a focus to reduce ED overcrowding and ED length of stay through improved inpatient bed capacity.

For example:

- In Nova Scotia, at Colchester Regional Hospital, ALC patients are being physically grouped together in an "ALC unit" with dedicated staff trained appropriately to meet the needs of these patients as they await placement in a long-term care setting. The overall aim is to free up acute care beds and nursing staff with an intended result of creating a better system for patients and staff.
- The Cape Breton District Health Authority (CBDHA) addressed three key factors contributing to ED overcrowding by establishing the following operational goals:
  - To have 90% of patients admitted through EDs admitted to an inpatient bed within 6 hours of the decision to admit;
  - To have 60% of patient discharges completed before 12:00 noon; and
  - To have patients waiting for continuing care placement occupy a maximum of 47 beds in Temporary Level II units.

  In order to reach these goals, the CBDHA developed a rapid assessment team to assess and accelerate the discharge of elderly patients with functional mobility restrictions and to prevent unnecessary admissions; employed scheduled admission plans at inpatient nursing units for the pre-determination of a patient admission to hospital; and increased nursing home beds.

- In Saskatchewan, the Regina Qu'Appelle Health Region developed the Acute Care Access Plan that included opening an ALC unit of the Pasqua hospital. The unit provides 24-hour supportive and personal care to patients awaiting placement in post–acute care settings.

- In some hospitals in Edmonton, Regina and Vancouver, the full capacity protocol (FCP) is being employed in isolation or in combination with a regional plan to reduce ED overcrowding. Originating from research in the U.S., this protocol is a strategy designed to move stable patients up from the ED to the hallway on inpatient units.

In addition, some provinces have recently targeted funding specifically toward strategies to address patient flow from the ED to the inpatient acute care setting and to alternate settings once the acute episode of care is complete.

For example:

- In collaboration with the Ontario MOHLTC, a toolkit has been designed by two pilot hospitals—North York General Hospital and University Health Network —to develop a standardized set of interventions and tools aimed at enabling other hospitals to implement sustainable improvements to patient flow. The interventions included in this toolkit have been implemented, tested and evaluated at the two pilot hospitals. The toolkit also includes diagnostic tools that will assist hospitals with their unique patient flow issues, as well as other supportive elements necessary to sustain change efforts. The toolkit is expected to be launched in the fall of 2007.

- In February 2007, the Ontario government announced $13.7 million to alleviate pressures in hospitals by building capacity in community-based care. The Ontario government and the local integrated health networks made the funding available to increase home care, improve access to community-based services through hospitals, implement geriatric emergency management programs and support transitional beds in select communities for patients awaiting placement in post–acute care settings. This amount followed $15.3 million in funding announced in October 2006 to help increase the capacity of EDs and enhance care to communities with shortages in long-term care and community resources.

- In Quebec in 2006, the Agence de la santé et. des services sociaux de Montréal dedicated a total of $39.9 million to reduce ED wait times and improve performance of EDs in Montréal. Strategies to improve performance included increasing the capacity of intensive home care, transitional care and convalescent care.

- In August 2007, ministers from the Government of New Brunswick announced that the Department of Family and Community Services and the Department of Health had developed initiatives worth over $7 million, designed to prevent and reduce unnecessary hospital admissions. The new initiatives included, among others, the licensing of special-care home beds for regions with high nursing-home placement demands, the provision of emergency-care beds in special-care homes and increased home support services intended to allow those who require assistance to remain at home.

Some, but not all emerging strategies have been formally evaluated. As new strategies are introduced, or existing ones are tried in new settings, there will be opportunity to assess to what extent they contribute to reduced ED wait times and decreased proportions of ALC patients in acute care beds, and qualitative measures of success based on patient feedback.

For More Information

What We Know:

- Many factors come into play when addressing patient flow.
- ED overcrowding is a complex, system-wide problem, with no single factor to explain why it occurs, and no single solution.
- Factors perceived as most important in contributing to efficient patient flow and strategies to address these may vary across hospital size and location.
- Patient flow may be enhanced with coordination among hospital EDs and inpatient wards and other health care providers and settings outside of the hospital.
- Patients within the medical patient service group comprise the largest proportion of patients admitted via the ED and the largest proportion of patients receiving ALC in acute care beds.

What We Don't Know:

- The extent to which ALC rates vary by province and region and why.
- The impact of initiatives under way across Canada to address patient flow and ALC occupancy rates.
- Which investments are most needed to improve patient flow and reduce ED bed wait times? What are the human resources or staffing implications?
- How long a wait in the ED for access to an inpatient bed is too long? Why?
- To what extent do factors such as bed occupancy, scheduling of elective surgical admissions, hospital staffing and infection control affect bed wait times?

What's Happening:

- In an effort to inform the public about ED use, the Agence de la santé et des services sociaux de Montréal and the Agence de la santé et des services sociaux de la Capitale-Nationale post up-to-date statistics related to ED utilization and wait times.

- The Ontario Hospital Association (OHA) has been conducting monthly surveys with Ontario hospitals to obtain a provincial picture of challenges and strategies related to ALC patients, analyze trends and inform the development of solutions. Results are shared with the Ministry of Health and Long-Term Care (MOHLTC) and other health care partners.

Appendix A: Technical Notes

Data Source

Data submitted to CIHI's Discharge Abstract Database (DAD) for 2004–2005 and 2005–2006 comprised the primary data source for this report. The DAD is an administrative database containing information on inpatient and day surgery encounters in hospitals across Canada. As of 2004–2005, the DAD covers general acute inpatient stays in all provinces and territories except Quebec.

Quebec submits data to the Hospital Morbidity Database (HMDB) rather than the DAD. We could not incorporate data from Quebec because HMDB does not contain comparable information on the admission source (that is, ED versus other means), the date and time elements needed to calculate bed wait times and length of stay spent in an alternate level of care (ALC).

Use of DAD data represents a change from the previous reports in the *Understanding Emergency Wait Times* series. The first two reports in the series used data primarily from the National Ambulatory Care Reporting System (NACRS)—a database containing ambulatory care service encounters in (for the most part) Ontario hospitals. However, data on bed wait times and inpatient volume—which are analyzed in this report—can only be derived from the DAD.

Bed Wait Time

"Bed wait time," measured from the time a physician or other authorized health professional decides to admit a patient to the time the patient leaves the emergency department (ED), was the main outcome variable in the analysis. Current literature on ED wait times and hospital utilization have primarily examined the total ED length of stay (LOS), rather than the particular proportion of time spent in the ED (Figure 1).[17, 18, 41] We initially considered using total LOS in the ED, but chose to examine the bed wait time for a number of reasons:

- Until 2007–2008, neither DAD nor NACRS captured the data elements required to calculate total LOS in the ED (Figure 1). Measuring this variable based on the years of data available to us would require linkage between NACRS and DAD. Findings from a linkage assessment we conducted indicated that among 116 hospitals submitting to both NACRS and DAD and meeting bed wait time analysis selection criteria (Figure 3), 97 (84%) achieved linkage rates of 95% or more. These linkage rates allowed for a gap or overlap between ED and acute encounters up to six hours long. Lowering the tolerance for the gap or overlap length decreased the linkage rate substantially.

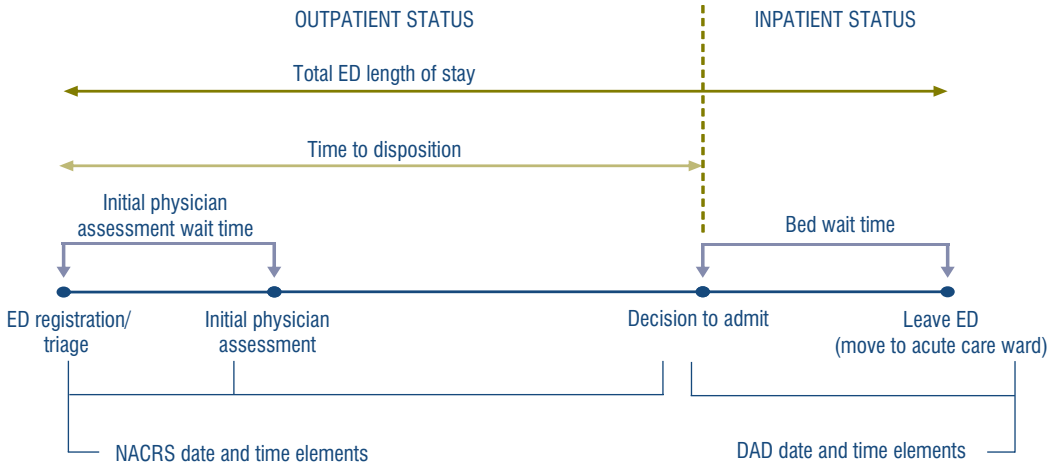
- Using bed wait times allowed us to limit the data source to DAD, which in turn increased the potential number of hospitals that could be included in the analysis. Any use of NACRS data would limit the sample primarily to Ontario hospitals.
- Although total LOS in the ED has been examined in the literature more frequently, bed wait time is also a key indicator of interest for both health care policy-makers and stakeholders.[20, 28, 42]

Bed Wait Time Calculation

In DAD, a bed wait time is calculated as the time from decision to admit to the time of leaving the ED (ED leaving). These, as well as other date and time elements related to ED length of stay are depicted in Figure 1.

1 Breakdown of Total ED Length of Stay for Admitted Patients

A number of events occurring during an ED encounter for admitted patients are time-stamped in NACRS and DAD. The sequence depicted below represents the "typical" case, but sometimes the events occur out of the order indicated. For example, major trauma patients may receive their initial physician assessment before being registered. Note that calculation of total ED length of stay requires date and time elements from both NACRS and DAD. This issue has been resolved in the 2007–2008 release of NACRS, which includes ED-leaving date and time. Additional 2007–2008 changes to both NACRS and DAD include the elimination of decision-to-admit date and time. In NACRS, new data elements cover the disposition date and time for all ED patients, regardless of admission status. In DAD, no new data elements were needed to replace the decision-to-admit concept, since admission date and time already captured the time of decision to admit among patients admitted from the ED.



Decision to admit and ED leaving dates and times were first introduced into the DAD abstract in 2001–2002 as optional data elements. During the years examined in this analysis, Alberta, Ontario, Nova Scotia and Newfoundland and Labrador submissions of decision-to-admit and ED-leaving dates and times were mandatory. In 2005–2006, Manitoba also began mandatory submission of these data elements. A number of hospitals outside these provinces reported the dates and times voluntarily during both 2004–2005 and 2005–2006.

Limitations of Bed Wait Times

To date, the accuracy of the decision-to-admit and ED-leaving date and time data elements in DAD has not been formally investigated using methods such as reabstraction. As a result, bed wait times derived from these data elements should be interpreted with caution.

Based on coding practices readily identifiable in the data and on anecdotal knowledge, three primary limitations should be noted:

- Limited ability of hospitals to record to the minute both the decision-to-admit and ED-leaving date and time for all admissions from the ED;
- Variation in hospital coding practices; and
- Time between decision to admit and ED leaving may not necessarily reflect true bed wait times for hospitals with inpatient units adjacent to the ED.

The distribution of decision-to-admit and ED-leaving times recorded by a hospital is "granular" in the sense that the set of unique times recorded is smaller than the range of every possible time value between 00:00 and 23:59. This property is likely a result of estimating or rounding times, and indicates that we cannot necessarily assume that two bed wait times differing by, for example, less than 15 minutes, are significantly different. In recognition of the difficulty of recording times for all admissions from the ED, hospitals were given the option in 2003–2004 of recording the decision-to-admit time as "unknown," using the value 99:99. The option of using the unknown value was extended to ED-leaving time in 2005–2006.

In addition to missing or estimated values, we can also expect differences in coding practices across hospitals. The date and time of the decision to admit correspond to a physician's order and may therefore be documented in a patient's chart. However, methods used by hospitals to assign a time to this order can vary. For example, one hospital may consistently document the date and time at which the decision to admit order was made, while other hospitals may approximate the decision-to-admit time using the time at which another process occurred, such as the time the hospital created an inpatient chart.

ED leaving occurs when a patient is moved from the ED to an acute care ward. Hospital personnel responsible for recording information may not know the exact time that this happened. As a result, hospitals may also use a proxy event, such as arrival in the ward, to measure this time. In any case, the processes used for time-stamping decision to admit and ED leaving are not strictly defined and are therefore subject to variation among hospitals.

The last known data limitation relates to the coding of admissions to clinical decision units (CDUs) adjacent to the emergency department. In the DAD, many of these cases can be characterized by abstracts in which the ED-leaving date and time coincide with discharge home. Among this group of patients, the time from decision to admit to ED leaving simply indicates their total CDU LOS, not a bed wait time. Within a hospital, these cases represent anywhere from 0% to about 20% of hospital admissions from the ED during 2005.

Given the variety of limitations related to bed wait times available from the DAD, some general rules for data extraction, variable derivation and analysis were applied:

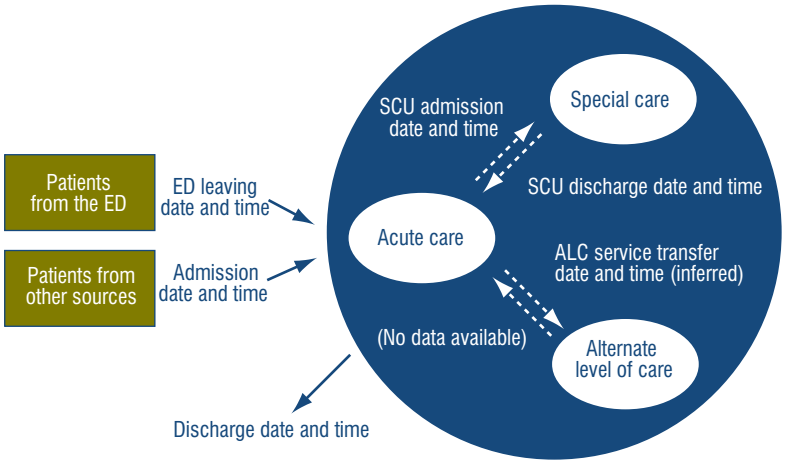
- In calculations related to bed wait time, exclude ED admissions in which ED leaving coincided with discharge home.
- Cross-reference the decision-to-admit and ED-leaving times with other time elements available in DAD.
- Exclude hospitals with more than 5% of bed wait times that are missing, zero or excessively long (that is, greater than 14 days).
- Exclude hospitals that appear to default the decision to admit, ED leaving, admission, discharge, special care unit (SCU) admission and SCU-discharge times to a small set of valid time values (for example, 23:59, 00:00).
- Where possible, stratify results by hospital size and teaching status.

Note that the first rule means that the bed wait time was measured only among patients who spent time in acute care ward, not only in a CDU. Some hospitals may submit data to DAD for "CDU-only" patients as an acute care abstract; however, these patients are substantially different from other patients admitted through the ED. In 2005, patients whose ED leaving coincided with discharge home tended to have fewer health problems than other patients admitted from the ED (mean Charlson Index score 0.55 versus 1.04) and spent less time in hospital (median of 0.8 days versus 3.9 days).

The particular date and time elements used in cross-referencing are depicted in Figure 2. We elaborate further on the hospital inclusion and exclusion criteria in the next section.

2 Additional Date and Time Elements Available in the DAD

In addition to decision-to-admit and ED-leaving dates and times, we used a number of other temporal data elements in the DAD. Movement into an acute care bed is time-stamped by ED-leaving date and time (for patients admitted from the ED) or admission date and time (for patients admitted from other sources). Once inside an acute ward, a patient can receive different levels of care. Time in intensive or step-down care units is captured by SCU-admission and -discharge dates and times. The time a patient begins receiving sub-acute or alternate level of care (ALC) is inferred using the discharge date and time, ALC length of stay and other data elements for verification.



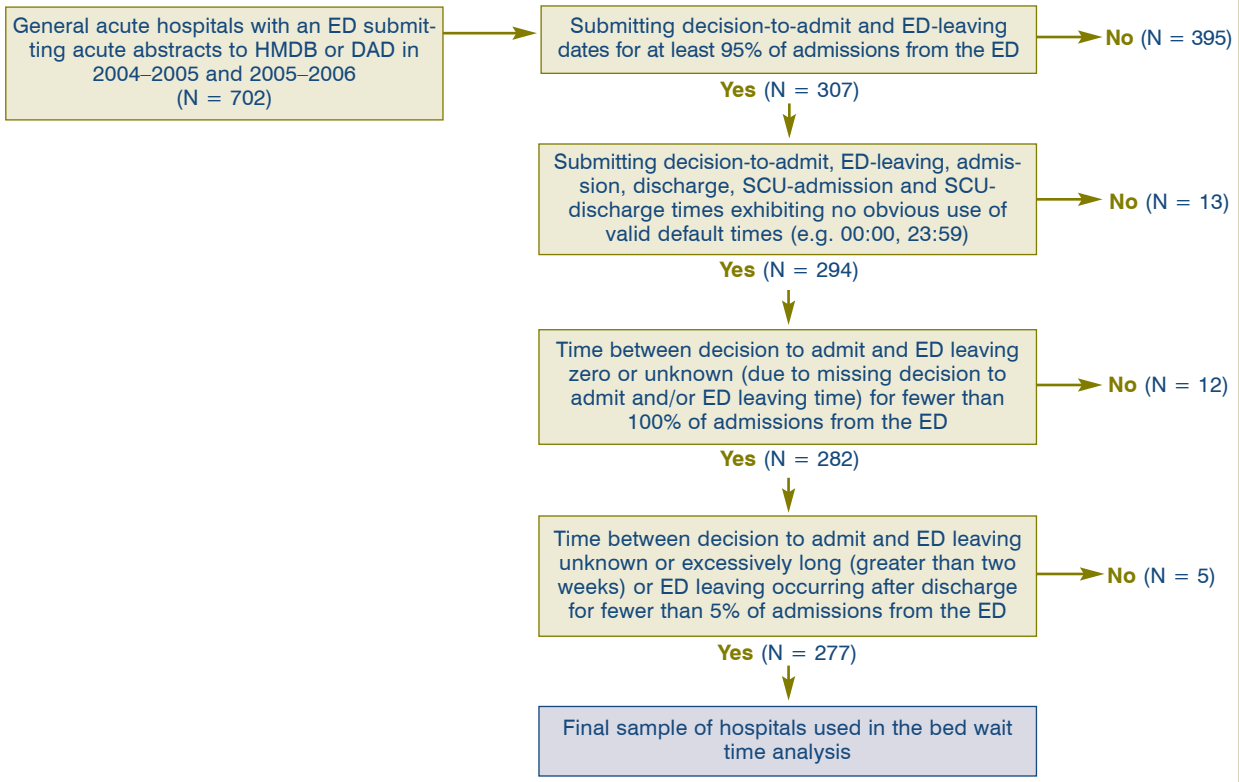
Hospital Selection Criteria

Inclusion and exclusion criteria were initially applied at the hospital level. Hospitals were identified using a submission code assigned by CIHI. For the most part, this identifier uniquely maps to a single-site hospital, but a small number of submission codes refer to two or three hospitals with the same corporate affiliation. Hospital identifiers are subject to change over time. We resolved differences between 2004–2005 and 2005–2006 identifiers using DAD documentation.

To select hospitals, we used the criteria depicted in Figure 3. The sample of hospitals that could potentially be considered for analysis was limited primarily by data availability. As noted above, not all provinces and territories require that hospitals report the decision-to-admit and ED-leaving data elements. Among the 702 general acute hospitals reporting acute care data to CIHI in 2004–2005 and 2005–2006, less than half were actually submitting the decision-to-admit and ED-leaving data elements needed to calculate ED bed wait times. We excluded 30 additional hospitals because of apparent coding anomalies. The final sample included 277 hospitals.

3 Hospital Selection Flowchart

Among the 702 general acute care hospitals submitting acute care data to CIHI in 2005, 307 reported the data elements needed to calculate bed wait time. We excluded 30 additional hospitals due to anomalies we observed in data submitted during a 14-month period (December 2004 to February 2006).



Using data from a select group of hospitals limits the extent to which our findings can be generalized to the entire population of acute hospitals in Canada. In terms of representation by province, the sample covered over 50% of hospitals in Alberta, Ontario and Nova Scotia—three of the four provinces that have currently mandated the submission of decision-to-admit and ED-leaving data elements (Figure 4). Overall, roughly 40% of general acute facilities across Canada are represented in our sample of 277 hospitals, with varying degrees of coverage by province and territory. Figure 5 gives a breakdown of hospital counts by hospital type. We based our hospital type definition on the peer group hospitals report to the Comparison of Hospital Activity Program (CHAP). CHAP incorporates only DAD-submitting institutions, so we can only compare our sample hospital type distribution with what we can consider to be acute care hospitals outside Quebec.

4 Sample Coverage of 277 Hospitals by Province and Territory

Province/Territory	Approximate Number of Acute Care Hospitals in Canada*	Number of Hospitals Included in the Bed Wait Time Analysis (Percent)
British Columbia	82	5 (6)
Alberta†	96	81 (84)
Saskatchewan	65	6 (9)
Manitoba	71	15 (21)
Ontario†	166	116 (70)
Quebec	123	0 (0)
New Brunswick	24	12 (50)
Nova Scotia†	32	28 (88)
Prince Edward Island	7	0 (0)
Newfoundland and Labrador†	30	14 (47)
Yukon Territory	1	0 (0)
Northwest Territories	4	0 (0)
Nunavut	1	0 (0)
Total	702	277 (39)

* Approximated by the number of hospitals submitting acute care abstracts to HMDB or DAD. The count for Quebec gives the number of hospitals submitting acute abstracts with urgent/emergency type to HMDB in both 2004–2005 and 2005–2006. For all other provinces and territories, the number indicated is limited to general acute hospitals with an ED submitting to DAD in both 2004–2005 and 2005–2006.
† Submission of the decision-to-admit and ED-leaving date and time elements was mandatory in both 2004–2005 and 2005–2006.

The hospital counts by hospital type indicate that the sample contains a lower proportion of small community hospitals and a higher proportion of large community hospitals.

5 Hospital Type Distribution

Hospital Type	Approximate Number of Acute Hospitals Outside Quebec*	Number of Hospitals Included in the Bed Wait Time Analysis (Percent)
Small Community (1–49 beds)	361	155 (43)
Medium Community (50–199 beds)	120	64 (53)
Large Community (200+ beds)	54	34 (63)
Teaching and Pediatric	44	24 (55)
Total	579	277 (48)

* Approximated by the number of general acute hospitals with an ED submitting to DAD in both 2004–2005 and 2005–2006.

Patient Groups

For a given reference time, we identified patients within particular groups and measured the size of each group. In this section we describe how these patient groups were defined and the methods used to measure group volume.

Patient Group Definitions

Figure 2 depicts the various locations or stages of care of the inpatient population. We divided the inpatient population into a variety of groups. Criteria used to define each group are summarized in Figure 6.

6 Criteria Defining Patient Groups

Group Description	Criteria
Patient service groups	• Closely follows the definition previously used by CIHI.[6] See Appendix C for details.
Patients waiting in the ED for an acute care bed	• ED as admission source • Decision to admit has occurred • ED leaving has not yet occurred • ED leaving does not coincide with discharge home
Patients whose bed wait times were censored	• ED as admission source • ED leaving coincides with discharge due to transfer, leaving against medical advice or death
Patients admitted, but who received care only in a clinical decision unit	• ED as admission source • ED leaving coincides with discharge home
Patients residing in an acute care bed (that is, bed occupants)	• ED as admission source and ED leaving has occurred OR admitted from another source and admission has occurred • Discharge has not yet occurred
Patients residing in a special care unit	• A SCU admission has occurred • Corresponding SCU discharge has not yet occurred
Patients receiving ALC	• Bed occupants with ALC as their main patient service OR the number of days to discharge is less than or equal to the number of ALC days recorded on their abstract • No SCU encounter occurring during the time from the inferred ALC service transfer to discharge

Patient Group Volume

Our analysis involved measuring the size of selected patient groups with respect to a specific date and time or day in the calendar year. We simply used the number of patients currently in the group as a measure of group volume at a particular point in time.

Patient volume with respect to a specific day is an aggregate measure that can be quantified in a variety of ways. One standard method is "total patient days," defined as the number of inpatients in the hospital that night (also known as the "midnight census") plus the number of same-day discharges.[17, 43] Total patient days is driven exclusively by admission and discharge time. Generalizing total patient days to measure volume within a specific group is therefore not a straightforward process. For example, consider a patient who waited 16 hours for a bed, from 22:00 to 8:00 the following day, and then spent 8 hours on an inpatient ward before being discharged at 16:00 that afternoon. This patient would contribute one day to total patient days. If we were to divide total patient days between patients waiting for a bed and those occupying a bed, it appears we need to consider the number of hours this patient spent in each group. However, total patient days does not directly consider hours in its definition.

For this reason, we used an alternative measure of daily patient volume, referred to as "total patient hours." Total patient hours has been used previously to quantify ED patient volume by level of complexity.[41] Inpatient total patient hours is equal to the total number of hours patients spent in acute care over the course of the day. Total patient hours specific to, for example, patients receiving ALC, can be obtained by simply limiting this sum to only ALC patient hours.

One challenge involved in counting patients, patient days or patient hours is determining how to handle records that overlap, have missing times or have times that conflict. Two duplicate records submitted for the same patient is one example of overlap. Other forms of overlap can occur, but all of them result in some form of over-counting. We resolved cases of overlap, missing times or conflicting times by editing the abstracts using the following rules:

1. If a patient (identified using health card number/chart number, gender and year of birth) has nearly duplicate abstracts or duplicate SCU encounters from the same hospital, then combine them.
2. If the admission date is missing, impute it using the earliest procedure date or SCU-admission date. Or, if the discharge date is missing, impute it using the latest procedure date or SCU-discharge date. If these dates are not recorded, exclude the abstract from analysis.

3. If a patient is recorded as waiting for an inpatient bed after an SCU admission, set the ED-leaving time equal to the SCU-admission time. Unless the decision to admit *precedes* the first SCU admission, set the decision-to-admit time to the SCU time as well.
4. If there is a longer than three-day gap between the decision to admit and the admission date, and the ED-leaving date precedes the admission date by more than one day, close the gap, leaving the wait time as is.[i]
5. If the decision-to-admit time is missing, but the ED-leaving time is available, set the decision-to-admit time equal to the ED-leaving time minus a median wait time specific to the hospital, patient age group, ED leaving month, week day, time of day and whether the patient was admitted directly to SCU. If the ED leaving time is also missing, set the decision-to-admit time to the admission time.
6. If the ED-leaving time is missing or the wait time is longer than two weeks or the patient is recorded as waiting after inpatient discharge, set the patient's wait time equal to a median wait time specific to the hospital, patient age group, decision-to-admit month, week day and time of day.
7. If the decision-to-admit or ED-leaving times still conflict with admission or discharge times, exclude the abstract from analysis.
8. If an SCU encounter has missing admission or discharge time, exclude it from analysis.
9. If the times recorded for an abstract or SCU encounter imply zero length of stay, exclude the abstract or encounter from analysis.

Figure 7 summarizes how frequently these edits were applied. From these results, note that a relatively large proportion of SCU encounters was dropped in some hospitals. This was primarily as a result of coding of encounters with zero SCU length of stay. A few hospitals also had a large proportion of abstracts edited due to conflict in times. The majority of these edits were applied to resolve small conflicts between SCU times with other temporal data elements in DAD.

7 Proportion of Abstracts Excluded or Edited

Edit/Exclusion	Percent of Cases per Hospital*		
	Mean	(SD)	Range
Duplicate abstract combined with another	0.05	(0.06)	0.003–0.239
Duplicate SCU encounter combined with another	0.71	(1.51)	0.015–4.347
Abstract dropped due to temporal conflict or zero LOS	0.12	(0.26)	0.003–1.081
Among admission from ED	0.09	(0.30)	0–1.439
SCU encounter dropped due missing times or zero LOS	0.17	(1.18)	0–15.07
Corrected time conflict or gap	0.54	(1.49)	0–13.70
At least one time imputed	0.13	(0.44)	0–3.242
Decision to admit or ED leaving imputed	0.21	(0.68)	0–4.485

* Proportions related to exclusions are based on the initial counts. Percent edits are based on the final counts, post-exclusions.

i. This edit handles what we presumed to be typographical errors on the decision-to-admit and ED-leaving dates (for example, month and day reversed, year earlier than the admission and discharge year).

Limitations of Patient Groups

As with the bed wait time, results based on patient groups need to be interpreted with some limitations in mind. The first relates to the definition of patient service groups. Aside from SCU encounters, the DAD does not provide information about where an inpatient is physically located in the hospital at any given time. In the analysis, patient service groups were used to group patients receiving similar services. The patient service groups do not directly reflect a patient's physical location in the hospital, such as a bed type or ward.

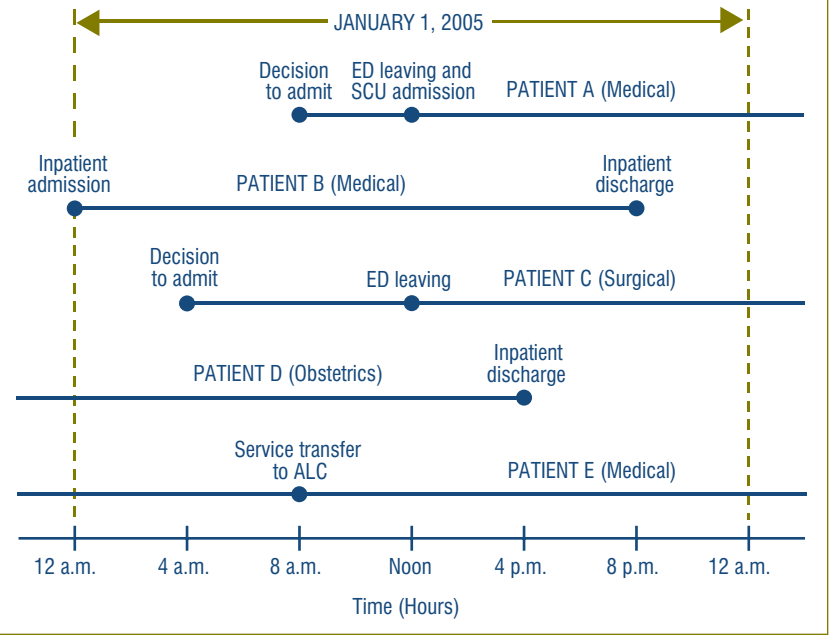
The patient group information is also affected by variation across hospitals, either in terms of coding practices or the variety of services offered. For example, the comprehensiveness in the reporting of ALC days to the DAD varies.[37, 44] The underlying cause for this may relate to differences in the availability of post-acute services. For example, some hospitals offer post-acute inpatient care while others do not. The process of identifying patients whose heath care needs are better met by ALC is also not standardized across Canada or within provinces and territories. Sub-service transfers into ALC therefore reflect the judgments of hospital staff,[37] which can also vary from hospital to hospital.

Example Calculation of Derived Variables

A glossary of the variables derived for analysis is provided in this section. Using hypothetical data depicted in Figure 8, we also demonstrate how these variables were calculated.

8 Hypothetical Inpatient Data

The diagram below depicts inpatient length of stay among five hypothetical patients. The hospital decided to admit patient A at 8 a.m., but was not able to move this patient to SCU until noon. Patient B was a medical case admitted through a source other than the ED at midnight. Patient C was a surgical case who waited from 4 a.m. to noon for a bed in the ED. Patient D was discharged from the obstetrics group at 4 p.m. Patient E was transferred from acute medical to ALC at 8 a.m. to await placement in sub-acute care.



Daily median bed wait time

Definition: The median bed wait time for a given day and hospital is equal to the median bed wait time among patients whose decision to admit occurred on that day and whose ED leaving did not coincide with discharge home.

Example: In Figure 8, two decisions to admit occurred on January 1, 2005 (patients A and C). The wait times for patients A and C were 4 and 8 hours, respectively. Since we have only two bed wait times, the daily median bed wait time is equal to their average, which is 6 hours.

Total patient hours

Definition: The cumulative number of hours in a given day patients spent in acute care. We limited this measure to bed occupants.

Example: In Figure 8, the total patient hours among bed occupants on January 1, 2005, is the sum of patient hours among the five patients: 12 + 20 + 12 + 16 + 24 = 84 hours.

Proportion of total patient hours among ALC patients

Definition: Ratio between total patient hours among patients receiving ALC to total patient hours among all bed occupants.

Example: In Figure 8, patient E spent 16 hours in ALC. The proportion of ALC total patient hours on January 1, 2005, is therefore 16/84 = 0.19, or 19%.

Number of ALC patients at the time of decision to admit

Definition: The number of ALC patients in acute care at the time a given patient began waiting for an acute care bed.

Example: In Figure 8, the decision to admit for patient A was made at 8 a.m. At this same time, patient E was transferred to ALC. The number of ALC patients at the time of the decision to admit for patient A was therefore one. Patient C also had a decision to admit. At that time there were zero patients receiving ALC.

Number of same-group ALC patients at the time of decision to admit

Definition: The number of ALC patients in acute care at the time a given patient began waiting for an acute care bed, limited to the same patient group as this reference patient.

Example: In Figure 8, there was one patient (E) receiving ALC at the time of decision to admit for patient A. However, patient A was eventually moved to SCU from the ED. Since no ALC patients can be in SCU, the number of same-group ALC patients for patient A was zero.

Appendix B: Charlson Index

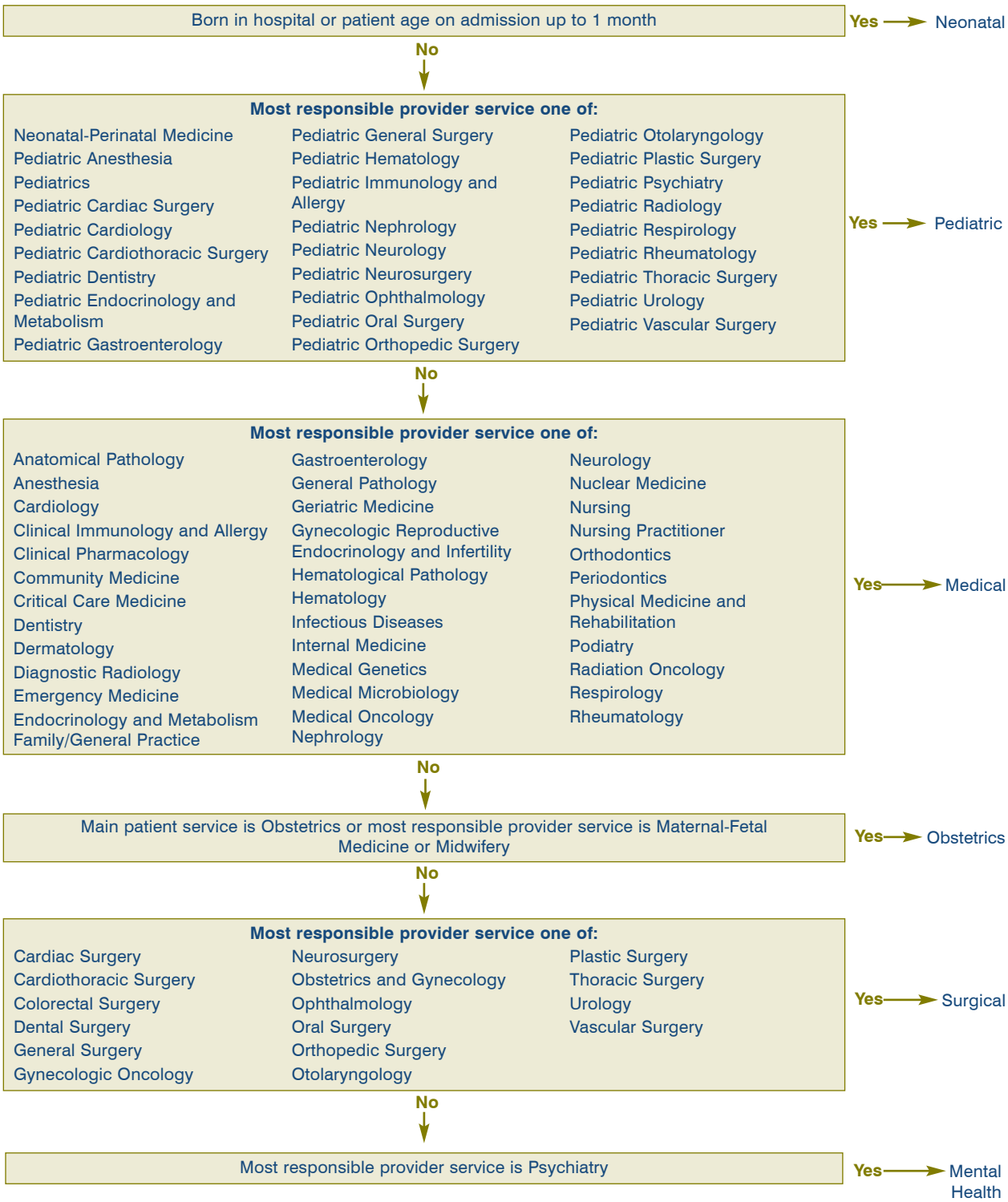
The Charlson Index[8] was measured using classification codes in the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) proposed in a recent article.[7] Where appropriate, we modified the ICD-10 codes to fit the Canadian version of the ICD-10 (ICD-10-CA). For the data we considered, all provinces and territories coded diagnoses in ICD-10-CA. Our application of the index was not with respect to any primary disease and considered all types of diagnoses. The scores obtained were therefore interpreted as an index of the number and severity of diseases identified over the course of hospitalization.

Condition	ICD-10-CA Codes
Myocardial infarction Weight = 1	I21, I22, I25.2
Heart failure Weight = 1	I09.9, I11, I13, I25.5, I42.0, I42.5, I42.6, I42.7, I42.8, I42.9, I43, I50, P29.0
Cerebrovascular disease Weight = 1	G45, G46, H34.0, I60–I69
Dementia Weight = 1	F00, F01, F02, F03, F05.1, G30, G31.1
Peripheral vascular disease Weight = 1	I70, I71, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9
Chronic pulmonary disease Weight = 1	I27.8, I27.9, J40–J47, J60, J61, J62, J63, J64, J65, J66, J67, J68.4, J70.1, J70.3
Rheumatic disease Weight = 1	M05, M06, M31.5, M32, M33.2, M34, M35.1, M35.3, M36.0
Peptic ulcer disease Weight = 1	K25, K26, K27, K28
Mild liver disease Weight = 1	B18, K70.0, K70.1, K70.2, K70.3, K70.9, K71.3, K71.4, K71.5, K71.7, K73, K74, K76.0, K76.2, K76.3, K76.4, K76.8, K76.9, Z94.4
Diabetes without (mention of) chronic complication Weight = 1	E1x.0, E1x.1, E1x.6, E1x.9 (where x is one of 0, 1, 3, or 4)
Diabetes with chronic complication Weight = 2	E1x.2, E1x.3, E1x.4, E1x.5, E1x.7 (where x is one of 0, 1, 3, or 4)
Hemiplegia or paraplegia Weight = 2	G04.1, G11.4, G80.1, G80.2, G81, G82, G83.0, G83.1, G83.2, G83.3, G83.4, G83.9
Renal disease Weight = 2	I12, I13, N03.2–N03.7, N05.2–N05.7, N18, N19, N25.0, Z49, Z94.0, Z99.2

Condition	ICD-10-CA Codes
Any malignancy, except skin cancer other than melanoma Weight = 2	C00–C97 (excluding C44 and C77–C80)
Moderate to severe liver disease Weight = 3	I85.0, I85.9, I86.4, I98.2, K70.4, K71.1, K72.1, K72.9, K76.5, K76.6, K76.7
Metastatic solid tumor Weight = 6	C77, C78, C79, C80
AIDS/HIV Weight = 6	B24

Appendix C: Patient Service Groups

Patient service groups were assigned using information on mode of admission, birth date, discipline of the most responsible care provider and discipline of the care service. The figure below depicts the algorithm used to assign group status.



References

1. S. Daly, D. A. Campbell and P. A. Cameron, "Short-Stay Units and Observation Medicine: A Systematic Review," *Medical Journal of Australia* 178, 11 (2003): pp. 559–563.
2. Canadian Institute for Health Information, *Canadian MIS Database Hospital Financial Performance Indicators: 1999–2000 to 2003–2004* (Ottawa: CIHI, 2006).
3. Public Health Agency of Canada, *Population Health: What Determines Health?* (2007), [online], from <http://www.phac-aspc.gc.ca/ph-sp/phdd/determinants/index.html>.
4. D. Cloutier-Fisher, M. J. Penning, C. Zheng and E. B. Druyts, "The Devil Is in the Details: Trends in Avoidable Hospitalization Rates by Geography in British Columbia, 1990 to 2000," *BMC Health Services Research* 6 (2006): p. 104.
5. M. D. Lougheed, N. Garvey, K. R. Chapman, L. Cicutto, R. Dales, A. G. Day, W. M. Hopman, M. Lam, M. R. Sears, K. Szpiro, T. To, N. A. M. Paterson and the Ontario Respiratory Outcomes Research Network, "The Ontario Asthma Regional Variation Study: Emergency Department Visit Rates and the Relation to Hospitalization Rates," *Chest* 129 (2006): pp. 909–917.
6. Canadian Institute for Health Information, *Inpatient Hospitalizations and Average Length of Stay Trends in Canada, 2003–2004 and 2004–2005* (Ottawa: CIHI, 2005).
7. H. Quan, V. Sundararajan, P. Halfon, A. Fong, B. Burnand, J. C. Luthi, L. D. Saunders, C. A. Beck, T. E. Feasby and W. A. Ghali, "Coding Algorithms for Defining Comorbidities in ICD-9-CM and ICD-10 Administrative Data," *Medical Care* 43, 11 (2005): pp. 1130–1139.
8. M. E. Charlson, P. Pompei, K. L. Ales and C. R. MacKenzie, "A New Method of Classifying Prognostic Comorbidity in Longitudinal Studies: Development and Validation," *Journal of Chronic Diseases* 40, 5 (1987): pp. 373–383.
9. R. A. Deyo, D. C. Cherkin and M. A. Ciol, "Adapting a Clinical Comorbidity Index for Use With ICD-9-CM Administrative Databases," *Journal of Clinical Epidemiology* 45, 6 (1992): pp. 613–619.
10. Institute of Medicine, *Hospital-Based Emergency Care: At the Breaking Point (Committee on the Future of Emergency Care in the United States Health System Board on Health Care Services)* (Washington, D.C.: The National Academies Press, 2006), pp. 1–296.
11. B. R. Asplin, D. J. Magid, K. V. Rhodes, L. I. Solberg, N. Lurie and C. A. Camargo, Jr., "A Conceptual Model of Emergency Department Crowding," *Annals of Emergency Medicine* 42, 2 (2003): pp. 173–180.
12. M. J. Schull, M. Vermeulen, G. Slaughter, L. Morrison and P. Daly, "Emergency Department Crowding and Thrombolysis Delays in Acute Myocardial Infarction," *Annals of Emergency Medicine* 44, 6 (2004): pp. 577–585.
13. J. M. Pines, J. E. Hollander, A. R. Localio and J. P. Metlay, "The Association Between Emergency Department Crowding and Hospital Performance on Antibiotic Timing for Pneumonia and Percutaneous Intervention for Myocardial Infarction," *Academic Emergency Medicine* 13, 8 (2006): pp. 873–878.
14. Institute for Healthcare Improvement, *Optimizing Patient Flow: Moving Patients Smoothly Through Acute Care Settings* (Boston, MA: IHI, 2003), pp. 1–8.
15. B. H. Rowe, K. Bond, M. B. Ospina, S. Blitz, M. Afilalo, S. G. Campbell and M. Schull, *Frequency, Determinants, and Impact of Overcrowding in Emergency Departments in Canada: A National Survey of Emergency Department Directors* (Ottawa: Canadian Agency for Drugs and Technologies in Health, 2006).
16. R. J. Blendon, C. Schoen, C. M. DesRoches, R. Osborn, K. Zapert and E. Raleigh, "Confronting Competing Demands To Improve Quality: A Five-Country Hospital Survey," *Health Affairs* 23, 3 (2004): pp. 119–135.

17. A. J. Forster, I. Stiell, G. Wells, A. J. Lee and C. van Walraven, "The Effect of Hospital Occupancy on Emergency Department Length of Stay and Patient Disposition," *Academic Emergency Medicine* 10, 2 (2003): pp. 127–133.

18. N. K. Rathlev, J. Chessare, J. Olshaker, D. Obendorfer, S. D. Mehta, T. Rothenhaus, S. Crespo, B. Magauran, K. Davidson, R. Shemin, K. Lewis, J. M. Becker, L. Fisher, L. Guy, A. Cooper and E. Litvak, "Time Series Analysis of Variables Associated With Daily Mean Emergency Department Length of Stay," *Annals of Emergency Medicine* 49, 3 (2007): pp. 265–271.

19. A. Bagust, M. Place and J. W. Posnett, "Dynamics of Bed Use in Accommodating Emergency Admissions: Stochastic Simulation Model," *British Medical Journal* 319, 7203 (1999): pp. 155–158.

20. Physician Hospital Care Committee, *Improving Access to Emergency Care: Addressing System Issues* (Toronto: OHA, OMA, MOHLTC, 2006).

21. M. Schull, P. M. Slaughter and D. A. Redelmeier, "Urban Emergency Department Overcrowding: Defining the Problem and Eliminating Misconceptions," *Canadian Journal of Emergency Medicine* 4, 2 (2002): pp. 76–83.

22. D. M. Fatovich, Y. Nagree and P. Sprivulis, "Access Block Causes Emergency Department Overcrowding and Ambulance Diversion in Perth, Western Australia," *Emergency Medicine Journal* 22, 5 (2005): pp. 351–354.

23. B. Chan, M. Schull and S. Schultz, *Emergency Department Services in Ontario* (Toronto: ICES, 2001).

24. N. C. Proudlove, K. Gordon and R. Boaden, "Can Good Bed Management Solve the Overcrowding in Accident and Emergency Departments?," *Emergency Medicine Journal* 20 (2003): pp. 149–155.

25. V. H. Menec, N. P. Roos, D. L. Nowicki, L. MacWilliam, G. Finlayson and C. Black, *Seasonal Patterns of Winnipeg Hospital Use* (Winnipeg: Manitoba Centre for Health Policy and Evaluation, 1999), pp. 1–83.

26. L. Frost, S. P. Johnsen, L. Pedersen, S. Husted, G. Engholm, H. T. Sorensen and K. J. Rothman, "Seasonal Variation in Hospital Discharge Diagnosis of Atrial Fibrilation: A Population-Based Study," *Epidemiology* 13, 2 (2002): pp. 211–215.

27. K. J. Fullerton and V. L. Crawford, "The Winter Bed Crisis—Quantifying Seasonal Effects on Hospital Bed Usage," *QJM* 92, 4 (1999): pp. 199–206.

28. Canadian Association of Emergency Physicians, *Position Statement on Emergency Department Overcrowding* (Ottawa: CAEP, 2007).

29. K. Bond, M. B. Ospina, S. Blitz, C. Friesen, G. Innes, P. Yoon, G. Curry, B. Holroyd and B. Rowe, *Interventions to Reduce Overcrowding in Emergency Departments* (Ottawa: CADTH, 2006).

30. United States General Accounting Office, *Hospital Emergency Departments: Overcrowded Conditions Vary Among Hospitals and Communities* (2003).

31. D. Cass, "Once Upon a Time in the Emergency Department: A Cautionary Tale (Editorial)," *Annals of Emergency Medicine* 46, 6 (2005): pp. 541–543.

32. A. Jokovic, A. Baibergenova, K. Baldota and K. Leeb, "Alternatives to Acute Care?," *Health Care Quarterly* 9, 2 (2006): pp. 22–24.

33. C. Haraden and R. Resar, "Patient Flow in Hospitals: Understanding and Controlling It Better," *Frontiers of Health Services Management* 20, 4 (2004): pp. 3–15.

34. Capital Health, *Improving Flow in the QEII and DGH Emergency Departments: Update on Ongoing Improvements* (Nova Scotia: Capital Health District, 2005), pp. 1–10.

35. Hôpital Régional de Sudbury Regional Hospital, *Alternate Level of Care: Beyond Beds* (Presentation to HRSRH Board of Directors October 2006) (2006), [online], cited February 9, 2007, from <http://www.hrsrh.on.ca>.

36. Ottawa ALC Strategic Committee, *From Alternative to Appropriate Levels of Care Ottawa ALC Strategic Committee—Report of Recommendations* (2006), pp. 1–28, [online], cited February 19, 2007, from <http://www.ocsa.on.ca>.

37. Ontario Hospital Association, Ontario Association of Non-Profit Homes and Services for Seniors, Ontario Association of Community Care Access Centres and Ontario Long-Term Care Association, *Alternate Level of Care—Challenges and Opportunities* (Toronto: OHA, 2006).

38. C. Damba and M. Vahabi, *Toronto Local Health System Monitoring Report* (Toronto: Toronto District Health Council, 2002), pp. 1–249.

39. S. Bruce, C. DeCoster, J. Trumble-Waddell and J. Burchill, "Patients Hospitalized for Medical Conditions in Winnipeg, Canada: Appropriateness and Level of Care," *Healthcare Management Forum* Winter Supplement (2002): pp. 53–57.

40. British Columbia Medical Association, *BCMA Policy Backgrounder: Emergency Department Overcrowding* (2006), [online], cited May 29, 2007, from <http://www.bcma.org/public/news_publications/publications/policy_backgrounders/EmergencyDepartmentOvercrowding.asp>.

41. M. J. Schull, A. Kiss and J. P. Szalai, "The Effect of Low-Complexity Patients on Emergency Department Waiting Times," *Annals of Emergency Medicine* 49, 3 (2007): pp. 257–264.

42. Agency for Healthcare Research and Quality, *Emergency Department Performance Measures and Benchmarking Summit: The Consensus Statement* (Rockville, MD: AHRQ Quality Indicators, 2006).

43. Ministry of Health and Long-Term Care, Finance and Information Management Branch, *Daily Census Summary Instruction Guide* (Ontario: MOHLTC, 2006).

44. Canadian Institute for Health Information, *Coding Variations in the Discharge Abstract Database (DAD) Data* (Ottawa: CIHI, 2003).