

## ORIGINAL RESEARCH

# Presenting with Chest or Abdominal Pain: Evaluation of Emergency Department Wait-time Intervals and Factors Influencing Length of Stay

Adnan Qureshi, MSc  
Mark Morreale, MSc  
Dara Klisowsky, MSc  
Joyce Lock, MD, MSc

## ABSTRACT

**Purpose:** With more than 14 million emergency department visits in Canada each year, there is substantial interest in providing timely access to care. This study investigates Canadian Triage and Acuity Scale (CTAS) level 2 and 3 patients presenting in the emergency department with a chief complaint relating to abdominal or chest pain, a cohort found to experience the longest time from registration to discharge. The purpose of this study was to evaluate the time required for each component of routine care provided to the study population, and to identify independent variables that influence length of stay within the emergency department.

**Results:** Patients with chest pain complaints were on average evaluated by a physician 40 minutes before patients with abdominal pain complaints; however, chest pain patients spent an additional 154 minutes within the emergency department. Four factors contributed to increased length of stay for all patients in the study: (1) emergency department congestion, (2) consultant response time, (3) diagnostic imaging, and (4) repeat laboratory investigations.

**Conclusions:** This paper describes sources of delays for patients whose care exceeds 360 minutes. Alleviating congestion can be done by building capacity through resource reallocation or through addition of key human resources. Improvement of consultant response time may be achieved through implementation of time-based performance measures, initiating consultations earlier in the care process, and through acute care models. The contribution of diagnostic imaging to delaying disposition decisions requires the availability of preliminary results to the treating physicians. Awareness of the necessity of repeating laboratory investigations (e.g., troponin) provides evidence that exceptions are necessary when evaluating emergency department care times.

## INTRODUCTION

Each year there are more than 14 million emergency department (ED) visits in Canada, of which nearly 5 million are in Ontario.<sup>1,2</sup> On arrival to the ED, the Canadian Triage and Acuity Scale (CTAS) is used across Ontario emergency departments to categorize patients based on severity of presentation. Table 1 summarizes the significance of each CTAS level. The Ontario Hospital Emergency Department and Ambulance Effectiveness Working Group (HED&AE) recommends that 90% of ED patients should be assessed and receive an ED stretcher (evaluation room) within 30 minutes of arrival, and be discharged within 360

minutes.<sup>3</sup> A patient's length of stay (LOS) is defined as time from registration to discharge. Despite recommendations, data collected from an Ontario hospital servicing a community of 200,000 found that patients who were assigned CTAS level 2 or 3 had a mean LOS of 8.6 and 11.6 hours, for walk-in and ambulance-arriving patients, respectively. Diagnostic and therapeutic interventions required by the patients to achieve a diagnosis and appropriate acute care are key components to ED length of stay.<sup>4,5</sup> These interventions may include: (1) assessments by nursing and physician staff, (2) laboratory investigation, (3) diagnostic imaging, (4) therapeutic interventions, and (5) specialist consultation.

LOS has also been found to be influenced by access to stretcher, time of registration and day of week.<sup>6-8</sup> Although the use of medical directives (routine laboratory tests ordered prior to physician assessment) has been encouraged by the Working Group, there is no literature to support that this process improves patient flow.<sup>3</sup> Measuring the wait-time of each of the subcomponents of the patient care timeline, evaluating the impact of medical directives on LOS, and identifying resource factors associated with increasing LOS provide the groundwork for a pragmatic approach to reducing wait times.

The findings from this study will provide evidence for potential sources of delays for patients who are at greatest risk for exceeding benchmark times for ED care. Although this study collected data from one hospital, the care processes represent usual care and are applicable to other EDs.

The objectives of this study were to: (1) determine the time required by each component of care that forms the entire length of stay, as well as (2) the extent each component contributes to the duration of care, and (3) to identify independent variables that influence LOS.

**Table 1.** Canadian Triage and Acuity Scale (CTAS)<sup>9</sup>

CTAS Level	Description
<b>1 – Resuscitation</b>	<b>Time to physician: immediate</b> Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions
<b>2 – Emergent</b>	<b>Time to physician: ≤15 minutes</b> Conditions that are a potential threat to life, limb or function, requiring rapid medical intervention or delegated acts
<b>3 – Urgent</b>	<b>Time to physician: ≤30 minutes</b> Conditions that could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living
<b>4 – Less Urgent</b>	<b>Time to physician: ≤1 hour</b> Conditions that related to patient age, distress, or potential for deterioration or complications would benefit from intervention or reassurance within 1 to 2 hours
<b>5 – Non-Urgent</b>	<b>Time to physician: ≤2 hours</b> Conditions that may be acute but non-urgent as well as conditions which may be part of a chronic problem with or without evidence of deterioration. The investigation or interventions for some of these illnesses or injuries could be delayed or even referred to other areas of the hospital or health care system

## METHODS

### Setting

The study was performed in a 37-stretcher ED (44,000 visits annually) of a 260-bed urban, community hospital in Burlington, Ontario, that services a population of approximately 200,000. During 2007, the hospital received 45,000 visits to the emergency department. Physician coverage consisted of 32 scheduled hours on weekdays, and 34 scheduled hours on holidays and weekends. Patients assessed as CTAS levels 4 and 5 were diverted to a fast-track setting for four hours on weekdays and seven hours on weekends; the remainder of patients were competing for a similar group of rooms, with respect to wait-times. The department did not have predetermined care decision rules for clinical presentations because investigations and therapies were left to the treating physician. Use of medical directives by nursing staff to expedite investigations shortly after triage or primary nurse assessment was encouraged but not used uniformly. Canadian Emergency Department Information System (CEDIS) coding for the presenting complaint had not yet been instituted.

### Selection of Participants

Patients were included in the study if they met the following inclusion criteria: (1) identified by the triage nurse as either being CTAS level 2 or 3; (2) 16 years of age or older; and (3) primary complaint was related to either abdominal pain (AP) or chest pain (CP). Patients with a chief complaint related to AP and CP were chosen as the presenting complaints of interest for the following reasons: (1) they are frequent chief complaints (35% CTAS level 2 and 22% of CTAS level 3 at the study site); (2) the care pathways for AP and CP include common ED investigations including laboratory and diagnostic imaging; and (3) the consulting services include medicine and surgery. Patients were excluded if they left the ED before receiving care or if they left prematurely against medical advice.

### Data Collection and Measurement

Patient data were collected from hard copy charts and hospital electronic databases for visits from June 1 to July 16, 2007. Nurses and physicians recorded information such as diagnosis, assessment times, treatment plan, consultation and disposition requests on hard copy charts, which was consistent with usual care processes. Electronic medical records provided information on registration, laboratory investigations, diagnostic imaging and staffing complement. The hospital utilizes Picture Archiving and Communication System (PACS) to electronically store medical records in addition to physical charts. Study data were kept on a secure server with limited access to those involved in the study.

Data from patients' hard copy charts and the hospital electronic database were entered into a separate study database by a researcher who was unaffiliated with the hospital. Data entry was performed by a single person to ensure standardization of data collection methods. Consecutive patients who met the study inclusion criteria were identified from the electronic medical records database. Data collection from patients within a few days following ED admission allowed for feedback to ED staff to reinforce manual recording of service times to limit missing data. Real-time data collection was not done because it may have delayed patient care by disrupting the availability of charts to care providers.

Troponin and amylase laboratory investigations were chosen as representative indicators because they were frequently requested for patients that presented in the ED with a chief complaint of either CP or AP, respectively. Because not all patients required a troponin or amylase test, a complete blood count (CBC) lab time interval was included in the analysis. Laboratory investigation times were recorded from the patient charts, which indicated the time the lab was ordered by the physician to when the report was printed and available to the ED physician. Diagnostic imaging times were obtained from the electronic medical record utilized exclusively by the radiological department; these times reflected when the radiological report was available, but not when the pertinent results were communicated to the ED physician. X-ray imaging results were routinely interpreted by the ED physician and did not necessitate a radiologist for interpretation in all cases; this made it difficult to determine the time when results were available to the ED physician. Similarly, precise computer tomography (CT) and ultrasound (US) reporting times of when the ED physician received the results were not available. Therefore, diagnostic imaging service delivery times were not analyzed.

Twenty-three variables were recorded from each patient's chart and electronic record (Table 2). These variables were chosen to provide demographic and wait-time information reflecting ED processes as well as independent covariates to reflect availability of patient care resources. The two variables that were used to reflect access to stretchers were maximum ED census (maximum number of patients presenting to the ED on a single day), and hours-over-capacity (the number of hours patient census exceeded 37 stretchers). Physician complement was stable throughout the study and was not measured as independent variable.

Health care providers involved in the study were aware of the study but were unaware that the study sample was restricted to a select cohort of patients. The study was supported solely by funds from the hospital operating budget and received ethics approval from the hospital ethics committee.

**Table 2.** Data collected from patient charts and electronic medical records

Domain	Data points collected
<b>Demographics</b>	Age Sex
<b>Triage-registration</b>	Presenting complaint Canadian Triage and Acuity Scale (CTAS) level Arrival method Arrival time Triage time Registration time Discharge time
<b>Bed availability &amp; assessment</b>	Time of room assignment Nurse assessment time Physician assessment time Medical consultant request and service time
<b>Laboratory</b>	Lab (blood and/or urine) collection time Complete blood count (CBC) laboratory complete time Troponin laboratory complete time(s) Amylase laboratory complete time
<b>Diagnostic</b>	Ultrasound order and complete time Computed Tomography (CT) scan order and complete time
<b>Internal process</b>	Number of hours over maximum daily census Maximum emergency department (ED) census Nursing staff complement

### Outcome Measures

Eight wait-time intervals were analyzed by CTAS level to determine mean, median, and 90<sup>th</sup> percentiles for each interval time (Table 3). No imputation method was used to account for missing data. Using unpaired, two-sample t-tests, two comparisons were made. The mean time intervals were compared between CTAS levels 2 and 3 (stratified by clinical presentation) to determine if CTAS level assignment influenced LOS (Table 4). Cases with a total LOS of less than 360 minutes were compared to cases with a total LOS greater than 360 minutes to determine if any specific subordinate interval significantly impacted LOS (data not shown).

Regression analysis was used to determine factors associated with increased LOS. Analysis was done separately for CP and AP because care pathways and the services commonly consulted for patient care differ for the two presentations. A Box-Cox transformation for non-normal data was performed. Multivariate regression was used to fit the model with response variable total LOS in the ED using the following covariates: (1) weekday of arrival; (2) nursing complement (actual nursing hours divided by scheduled nursing hours); (3) request of second troponin lab test; (4) specialist consultation; (5) medical directive ordered; (6) maximum

ED census; and (7) registration time. This regression model was reduced to include only those factors, covariates and interaction terms which were found to be significant. The residuals were analyzed using plots to confirm an appropriate fit of the model to the data. This model was then reduced to remove any factors and covariates which did not significantly impact the response variable.

## RESULTS

Data were collected from 500 patients who visited the ED and met the inclusion criteria over the 46 days of data collection. There were three patients with discharge time missing, and were therefore removed from the analysis, leaving 497 patients. The mean age of the patients was 49.3 years (SD=19.9) and 58.5% (n=291) were female. There were 26.9% (n=134) patients assigned as CTAS level 2 and the remaining 73.1% (n=363) of patients were assigned to CTAS level 3. Upon conclusion of the ED visit, 87.3% (n=434) of the patients were discharged, while 12.7% (n=63) were admitted as an inpatient to another department within the hospital.

The results of the wait-time intervals for the sample of patients are reported in Table 3. In summary, the mean LOS in the ED was 414.2 minutes (SD=355.7). Of the 19.6% (n=78) of patients that arrived to the ED by ambulance, there was a mean time of 17.5 (SD=35.4) minutes between arriving and receiving a room. Patients with a chief complaint of CP arriving by ambulance required 20.7 minutes (SD=43.3, n=38) compared to 11.8 minutes (SD=13.0, n=22) for those with AP. For all methods of arrival to the ED, the mean time from patient triage to receiving a room (stretcher) was 21.2 minutes (SD=40.2), then an additional mean time of

25.1 minutes (SD=24.2) until a nurse assessment. The time between a nurse's assessment and physician visit had a mean of 56.7 minutes (SD=61.3). Patients arriving by ambulance waited 50.4 minutes (SD=51.3) from nursing assessment to physician visit, compared with 58.0 minutes (SD=63.3) for walk-in patients. There were several significant differences in the wait-times experienced by patients who had a chief complaint related to AP (60.8%, n=304) compared to CP (39.2%, n=196). A summary of wait-time results categorized by chief complaint is shown in Table 4.

A greater proportion of CP patients arrived by ambulance (19.4%, n=38) but spent an average of an additional 8.9 minutes waiting from arrival to receiving a room compared to AP patients (7.2%, n=22). Irrespective of arrival method, those presenting with AP complaints were found to take on average 14.0 minutes longer from triage time to receiving a room, as opposed to CP-presenting patients (confidence interval [CI]=6.8–21.2, p<0.01). Similarly, compared to CP patients, AP patients waited an average of 10.3 additional minutes (CI=5.7–14.9, p<0.01) for nurse assessment and 16.0 minutes (CI=4.1–27.9, p<0.01) for physician assessment, when comparing successive time intervals. Despite these differences between room and assessment times, the LOS for patients with CP was greater than those with AP by a mean time of 159.4 minutes (CI=89.9–228.9, p<0.01). Patients who arrived by ambulance had a LOS of 609.2 minutes (SD=508.1) compared to 377.1 minutes (SD=306.9) for walk-in patients.

When stratifying patients' ED visit duration based on the 360-minute benchmark, 59.6% (n=296) were below benchmark, while 40.4% (n=201) were above the benchmark time. There were two factors related to an internal care process that

**Table 3.** Wait-time intervals

Wait-time interval (minutes)	N	Mean	SD	Median	90 <sup>th</sup> Percentile
Paramedic off-load time (arrival time to room time)	78	17.5	35.4	9.0	42.1
Triage time to room time	415	21.2	40.2	10.0	51.6
Room time to nurse assessment time	387	25.1	24.2	20.0	50.0
Nurse assessment time to physician assessment time	386	56.7	61.3	40.0	136.5
Lab time					
CBC	441	35.9	16.9	32.0	60.0
Troponin 1	140	64.0	35.5	54.0	101.2
Troponin 2	46	60.5	45.3	43.0	95.0
Amylase	210	58.4	42.7	45.0	106.1
Diagnostic imaging					
X-Ray	265	1206.9	487.9	1211.0	1908.2
Ultrasound	41	466.4	547.0	230.5	1491.0
CT Time	45	675.2	528.2	532.0	1397.6
Consultant time	49	272.4	270.1	170.0	648.0
Maximum ER census	500	53.8	7.8	54.0	63.0
Hours over maximum ER census	493	10.9	5.2	12.0	17.0
Nursing hours staffed (scheduled)	500	0.75	13.5	0.25	11.3
Total length of stay ER time	497	414.2	355.7	302.0	861.6

**Table 4.** Wait-time intervals by chief complaint

Description	Abdominal Pain		Chest Pain	
	n	Mean (SD)	n	Mean (SD)
Triage time to room time (ambulance patients)	22	11.8 (13.0)	38	20.7 (43.3)
Triage time to room time (walk-in patients)	240	27.1 (46.5)	175	13.1 (27.6)
Room time to nurse assessment time	225	29.4 (26.5)	162	19.1 (19.3)
Nurse to physician	232	63.1 (65.9)	154	47.1 (52.5)
Lab time				
CBC	268	34.9 (16.4)	173	37.5 (17.8)
Troponin 1	22	74.4 (50.5)	118	62.1 (31.9)
Troponin 2	4	48.0 (12.7)	42	61.7 (47.2)
Amylase	169	54.4 (32.4)	41	74.8 (69.0)
Diagnostic imaging				
Ultrasound	38	470.7 (558.5)	3	412.0 (458.0)
CT Time	38	711.9 (530.4)	7	476.0 (506.0)
Consultant time	28	312.5 (259.5)	21	219.0 (281.1)
Maximum ER census	304	53.6 (7.7)	196	54.2 (7.9)
Hours over maximum ER census	297	10.73(5.18)	196	11.1 (5.3)
Total length of stay (LOS)	304	352.3 (273.5)	193	511.7 (439.5)
Paramedic off-load time (arrival time to room time)	22	11.8 (13.0)	38	20.7 (43.3)
Triage time to room time	240	27.1 (46.5)	175	13.1 (27.6)
Room time to nurse assessment time	225	29.4 (26.5)	162	19.1 (19.3)

were found to be significantly different when analyzed by a paired t-test; these factors were (1) census (hours over capacity) ( $p < 0.01$ ) and (2) the maximum ED census ( $p < 0.01$ ). The maximum hours over daily census is the number of hours over a 24-hour period that the ED had patients registered beyond capacity (based on total number of stretchers). The regression analysis also found that each additional patient in the ED increased total LOS by 3%, irrespective of the chief complaint (log estimate=0.03,  $p < 0.01$ ).

The differences in number of patients dichotomized by if they exceeded the 360-minute benchmark are shown for the following four services (>360 minutes vs. <360 minutes): (1) second lab troponin test ( $n=5$  vs.  $n=40$ ); (2) ultrasound scan ( $n=8$  vs.  $n=33$ ); (3) CT scan ( $n=11$  vs.  $n=34$ ); and (4) consultant request ( $n=19$  vs.  $n=29$ ). It was found that 88.8% ( $n=40$ ) of patients with a second troponin test exceeded the benchmark time. The regression model for CP patients found that a second troponin test increased LOS by 19% ( $p=0.05$ ). Of those requiring a consultation, 60.4% ( $n=29$ ) were found to have exceeded the wait-time benchmark. The regression analysis found that a request for a consultant would likely increase the LOS for patients presenting with AP and CP by 50% ( $p < 0.01$ ) and 27% ( $p < 0.01$ ), respectively.

## DISCUSSION

Summarizing the efficiency of the management of patients presenting to the emergency department with AP or CP depends on the measure being considered. Evaluating health outcomes was beyond the scope of this article and may be excellent despite increased LOS in the ED. If considering the benchmark times outlining emergency

department LOS times, both AP and CP patients are managed poorly compared to other patients; they were selected for this study because they were found to have the longest LOS. Considering the media attention and public awareness of emergency department LOS, there has been emphasis on reducing care times. With this in mind, we should seek to improve the management of patients presenting to the ED with AP or CP.

There were 500 patients included in the study, of which 40.4% ( $n=201$ ) had exceeded 360-minute HED&AE benchmark from triage to disposition. When comparing front-end care processes (from registration to physician assessment), patients presenting with AP experienced greater delays in (1) receiving an ED room, (2) having nurse and (3) physician assessment. These differences meant that those presenting with AP waited on average an additional 40 minutes before they were assessed by a physician. Perhaps this difference is because CP symptoms are suggestive of an urgent condition such as an acute ischemic cardiac event requiring timely administration of medication to prevent irreversible cardiac or systemic damage. Despite this front-end delay for those presenting with AP, however, these patients were discharged an average of 154 minutes in advance of patients with CP. This suggests that front-end times are not responsible for ED delays but rather, the delays are the result of care processes subsequent to the initial physician assessment.

Patients presenting with CP may have had a troponin test ordered to help diagnose an acute myocardial infarction. The mean time to analyze and report this test was 64.9 (SD=35.9) minutes. The troponin test may be repeated 6 to 12 hours later, which was the case for 23.3% ( $n=45$ ) of

patients that presented with chest pain ( $n=193$ ). The delay necessitated by repeating the troponin test, rather than the lab's response time, was found to delay 88.8% ( $n=40$ ) of patients beyond the benchmark time.

A greater number of patients requiring CT or US imaging studies exceeded the benchmark times compared to those that did not require these services. The time interval between ordering and receiving the radiological report did not appear to be predictive of exceeding the benchmark time. Although CT and US use were associated with a greater LOS, it was not possible to measure their contribution in the delay because the reported duration of the procedure was from the time it was ordered to when it was transcribed; this is well after when the ED physician would have the information available to inform the care of the patient.

The maximum daily census and maximum ED census were found to be significant covariates when stratifying patients based on an ED LOS of 360 minutes. That both of these variables are significant in contributing to LOS signifies that the ED functioning beyond capacity impairs care processes, resulting in extended LOS in the ED for patients. Although it can be safely hypothesized that ED congestion strains physical and human resources in the ED, the precise components that are most impacted by congestion requires further study.

When a consultant was requested by the ED physician ( $n=49$ ), there was a mean wait-time of 272 (SD=270) minutes from the consult request to its completion. Patients with LOS times that exceeded 360 minutes experienced a mean consult response time that was 131.2 minutes longer compared to those with a LOS within the benchmark wait-time. The regression analysis similarly found that consultant response time significantly increased the total LOS. When comparing only patients requiring a consultant, it was found those with AP had a 45% higher probability of having an increased LOS compared to those presenting with CP. This difference in consultant response time may be attributed to the type of consultant required, but not the length of investigations that each specialty requires. In general, CP patients were consulted by internists, whereas AP patients were consulted by general surgeons.

When comparing patients by method of arrival, the 60 patients that arrived by ambulance were found to have a LOS which was 232.1 minutes longer in duration compared to those who were walk-in patients. This difference in LOS for patients arriving by ambulance can be explained by the fact that a greater proportion of these patients were presenting with CP rather than AP.

Despite differences between the hospital used in this study and other hospitals that may impair generalizability (similar staffing, diagnostic services, response times and patient population), this study informs policy makers of potential time intervals that should be investigated as they may be contributing to increased LOS in the ED.

## Limitations

Data were obtained for patients who presented to the ED from June 1 to July 16, 2007. It can be argued that this may not be representative of other times of the year. However, patients were selected based on presenting symptoms that are not dependent on time of year. Furthermore, the care processes and clinical decisions would be similar despite occurring at other times of the year, although other types of patient presentations requiring the same resources may differ. Another limitation is that the time of day that the care processes occurred were not adjusted for nor analyzed. This posed a challenge for implementing a model to interpret the data because each component of care would need to be adjusted for, not simply the arrival time and day of week; these additional variables would require an extremely large sample size for meaningful results, which was not feasible in this study.

Re-admission rates were not collected in this study, but it would have been interesting to consider if LOS corresponds to re-admission rates. These data were not gathered for two main reasons. Firstly, we would not be able to determine if patients presented to another emergency department, thereby limiting the validity of these data. Secondly, these data did not contribute to answering our original research questions. Collecting re-admission rates would be vital for further studies investigating quality of care or health care resource utilization.

## CONCLUSIONS

This paper informs clinical practice and policy makers in two predominant ways. First, this study illustrates the care processes used routinely by the ED to diagnose and manage patients at risk of exceeding the benchmark care times. Second, this paper describes the sources of delays for patients whose emergency department LOS exceeded the 360-minute benchmark. These delays were from ED congestion, the need to repeat troponin laboratory investigations, diagnostic imaging and consultant response time. This information can be used to focus on building capacity through resource reallocation or through employing additional human resources. Considering alterations in laboratory procedures, which require advances in methods to obtain similar findings with reduced time (i.e., repeating troponin for diagnosing myocardial infarction). Until improved test methods replace comparing serial troponin measurements, the need for repeated laboratories investigations can be used to explain extended duration of ED care for certain patients to policy makers and the public.

Consultant requests significantly contributed to patients' experiencing a much greater LOS. To respond to this there needs to be greater emphasis in emergency departments on improving consultant response times. This can be achieved by implementing consultant response times as a performance measure and pursuing methods to reduce extended delays.

These methods can include redistribution of resources, such as an acute care surgery model, or the implementation of protocols that standardize the evaluation of abdominal and chest pain patients and initiate a request for consultants earlier in the care process.

Although diagnostic imaging times were not reported in this study, patients having an imaging study were more likely to have exceeded the benchmark times. To determine the contribution of imaging studies to LOS, there needs to be a tracking of the time from ordering an imaging study to the availability of preliminary report from the radiologist. These data will allow greater understanding of the contribution that imaging studies have to LOS, and inform decisions of whether emergency department processes would benefit from changes to the ordering or reporting of imaging studies.†

## REFERENCES

1. Canadian Institute for Health Information (CIHI). Hospital Financial Performance Indicators. Ottawa, 2005.
2. Carriere G. Use of hospital emergency rooms. *Health Rep* 2004; 16: 35-39.
3. Hospital Emergency Department and Ambulance Effectiveness Working Group. Improving Access to Emergency Services: A System of Commitment. Ontario Ministry of Health and Long-Term Care, 2005.
4. Yoon P, Steiner I, Reinhardt G. Analysis of factors influencing length of stay in the emergency department. *Can J Emerg Med* 2003; 5: 155-61.
5. Storrow AB, Chuan Z, Gaddis G, et al. Decreasing lab turnaround time improves emergency department throughput and decreases emergency services diversion: A simulated model. *Acad Emerg Med* 2008; 15: 1130-35.
6. Asaro PV, Lewis LM, Boxerman SB. The impact of input and output factors on the emergency department throughput. *Acad Emerg Med* 2007; 14: 235-42.
7. Bickell NA, Hwang U, Anderson RM, et al. What affects time to care in emergency room appendicitis patients. *Med Care* 2008; 46: 417-22.
8. Lambe S, Washington DL, Fink A, et al. Waiting times in California's emergency departments. *Ann Emerg Med* 2003; 41: 35-44.
9. Beveridge R, Clarke B, Janes L, et al. Canadian emergency department triage and acuity scale: implementation guidelines. *Can J Emerg Med* 1999; 1(suppl 3): S1-24.

### Author Biographies

**Adnan Qureshi** has completed a Masters degree in Health Research Methodology at McMaster University and has further training in Health Services and Policy Research with the Ontario Training Centre. Adnan is currently completing his MD training.

**Mark Morreale** has completed a Masters degree in Community Health and Epidemiology. Mark is a professor at McMaster University. He serves as a lead consultant to healthcare clients providing information management and analysis expertise to use data more efficiently, as well as a way to understand and communicate performance to their customers.

**Dara Klisowsky** has completed a Masters degree in Statistics and is working within decision support at Joseph Brant Memorial Hospital, Burlington, Ontario.

**Joyce Lock** is an emergency medicine physician and has completed Masters degree in Health Research Methodology from McMaster University. Dr. Lock is the chief of the Department of Emergency Medicine at Joseph Brant Memorial Hospital.

## Choose New Brunswick!

Be Successful in Your Profession  
Achieve balance in Your Life  
[www.gnb.ca](http://www.gnb.ca) Keyword: physicians

## Choisissez le Nouveau-Brunswick!

Ayez du succès dans votre profession  
et un équilibre dans votre vie  
[www.gnb.ca](http://www.gnb.ca) Mot-clé : médecins



  
New **Brunswick** Nouveau  
Be...in this place • Être...ici on le peut

## DEPARTMENT OF ANESTHESIA

Faculty of Health Sciences  
McMaster University

The **Department of Anesthesia** is integrally involved in undergraduate medical education, including a simulation based clerkship instructional program. Postgraduate residency training prepares the specialist for a wide range of clinical practice, and fellowship training is available in chronic pain management, pediatric, cardiac and neurosurgical anesthesia. Our expanding simulation program will include critical evaluation of both technical and non-technical skills as well as instructional techniques. We are currently expanding our academic focus through support of advanced degree studies as an adjunct to postgraduate training. Please contact us for further information about available programs and your interests.

### DEADLINE FOR APPLICATION

for **July 1, 2011 Fellowships:**  
**August 31, 2010**

Further Information is available on the website:  
[www.fhs.mcmaster.ca/anaesthesia/education](http://www.fhs.mcmaster.ca/anaesthesia/education)

or from: Mary Gahagan, Office of the Chair  
Department of Anesthesia  
McMaster University  
1200 Main St. West, Hamilton, ON L8N 3Z5  
Tel: 905-521-2100 Ext. 75166  
Fax: 905-523-1224  
email: [gahaganm@mcmaster.ca](mailto:gahaganm@mcmaster.ca)



*Englehart and District*

**Family Health Team**

### Join our Family Health Team!

Two positions available to complete our complement of six physicians.

#### Benefits:

Hospital owned and operated Medical Clinic  
High-income salaried position  
One-in-six, Scott Sessional  
No obstetrics  
Eight weeks paid leave for vacation/CME  
Generous hospital and underserved area incentives including housing.

#### Our Community:

Excellent schools  
Recreational facilities  
Organized activities

#### Contact:

Lois Kozak, CEO, at 705 544-2321 or email  
[lakozak@edhospital.on.ca](mailto:lakozak@edhospital.on.ca)