

Description of Ambulance Diversions in the Edmonton Region

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Abbreviations:

ALS = advance life support
BLS = basic life support
EMS = emergency medical services

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Abstract

Background: Diversion of ambulances by hospital emergency departments has become a day-to-day occurrence in many jurisdictions within Canada. Yet, despite the increasing prevalence of this phenomenon, its impact on transported patients, on the EMS system, and on the health care system overall has not, to date, been well quantified. Despite the increasing sophistication and capabilities of North American EMS systems, it is difficult to argue with the principle that unstable or potentially unstable patients are best served by expeditious transport for definitive care to acute care facilities. To this end, this study represents an effort to assess the systemic and patient care impacts of ambulance diversions.

Methods: Patient-care and corresponding ambulance trip records for all patients transported by this EMS system for a five week period were abstracted to identify those patients in which an ambulance was diverted from its initial destination. Adverse events include hypotensive episodes, airway compromise, changes in level of consciousness, and the onset of violent behavior. Response and transport times also were abstracted, comparisons utilized student's t-test and 95% Confidence Intervals.

Results: Ambulance diversions increased EMS response times and prehospital transport times. Adverse medical events occurred during 4.3% of diverted ambulance runs. Patients, when faced with the prospect of transport to other than their hospital of choice, not infrequently cancelled EMS transport and sought other means of transport. Subsequent interfacility transport was required for 4.3% of the diverted patients.

Conclusions: Diversion of ambulances impacts the EMS system by increasing response and transport times; the region, by generating subsequent interfacility transports; and patients, as adverse medical events can occur during the diverted transport.

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Introduction

"Hospital Destination" policies or guidelines, for emergency medical services (EMS) systems, are based upon geographic proximity, patient preference, and/or the most appropriate facility for the patient condition. In Edmonton, ambulances initially transport their patients to the nearest hospital emergency department; to the hospital requested by the patient;

or to a hospital supplying the regionally designated service. The EMS crews assess and stabilize the patient and determine the patient's medical needs. Subsequently, the crews transport patients to the nearest, or patient preferred hospital.

Diversion of an ambulance by one emergency department to an alternate destination, is an increasingly

	Diverted Trips (minutes)	Non-diverted Trips (minutes)
Response Time (95% CI)	5:51 (5:31–6:11)	4:56
Transport Time (95% CI)	17:41 (16:45–18:37)	12:33

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Table 1—Comparisons of elapsed time between diversion and non-diversions (09 April–15 May, 1998) Ci = Confidence Interval)

Patient	Circumstances of Adverse Event
1	Patient with gastro intestinal hemobase, developed supraventricular tachycardia, and became hypotensive
2	Violent patient
3	Unconscious, unable to protect airway, unable to intubate, several blocks from nearest hospital
4	Stab wound to chest, hypotensive (BP-80/40mmHg)
5	Cardiac arrest, diverted from nearest hospital
6	Intoxicated, verbally and physically aggressive requiring restraints
7	Intracerebral event requiring intubation to protect airway
8	Progressive desaturation of hemoglobin, chronic obstructive pulmonary disease exacerbation
9	Overdose, unable to protect airway requiring intubation, diverted from hospital 8 blocks away
10	Hypotensive, bradycardia
11	Lung cancer in respiratory distress, desaturation of hemoglobin
12	Cardiac chest pain unrelieved with nitroglycerin
13	Shortness of breath, renal patient diverted from hemodialysis centre
14	Shortness of breath, hypotensive, chest pain

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Table 2—Adverse events in patients diverted (BP = blood pressure)

common phenomenon in Canadian jurisdictions.¹ Canadian emergency departments have experienced increased workloads and overcrowding over the past decade. Regionalization of healthcare as the population increase, inaccessibility of primary care providers, and an aging population with multiple medical problems represent some of the reasons for the congestion of our emergency departments. As emergency departments become saturated with patients awaiting care, with patients awaiting the results of investigation and treatment, and by admitted patients awaiting the availability of inpatient beds, the ability to accommodate further incoming ambulances becomes constrained. In these situations, emergency departments often adopt a redirect policy, forcing incoming ambulances to find another destination hospital.¹

Despite the frequent occurrence of ambulance diversions in Canada, very little is known about its impact. In California, Redelmeier demonstrated that ambulance diversions did not increase mortality.² However, it seems that increasing the prehospital transport time would place the patient at increased risk. A moving vehicle is not an optimum environment in which to treat and/or monitor an

unstable or potentially unstable patient. In addition, increasing the duration of “lights and siren” transport, exposes the patient, the EMS providers, and the community to a greater risk of accidental vehicle collision.³

The impact of ambulance diversions was examined from three perspectives: 1) The impact on the patients by identifying all of the adverse medical events that occurred during diverted transports; 2) the number of times that a subsequent interfacility transport was required for more definitive care of the patient; and 3) the response times and prehospital transport times were assessed from the perspective of the EMS system.

Methods

The City of Edmonton is a large urban center in Canada with a population >600,000. Prehospital emergency care is provided by the Emergency Response Department. The Capital Health Authority is the regional health authority that includes Edmonton and the surrounding communities. It is comprised of large tertiary referral centers, community health centers, and a large number of long-term care facilities. Regionalization has had a significant impact

Number of Patients	Circumstances Necessitating Inter-facility Transfer
3	Required procedure not available at initial facility
2	Required surgical procedure not provided at initial facility
2	Required transfer to facility with psychiatry services
2	Required admission to inpatient service, bed not available
1	Required transfer for dialysis
1	Required critical care bed not available at initial facility
1	Required cardiac catheterization not available at initial facility
1	Required transfer for endoscopic procedure not available at initial facility
1	Required neurological consultation not available at initial facility

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Table 3—Diverted patients requiring subsequent inter-facility transport to the initial destination hospital

Patient	Circumstances for Cancellation
1	Patient with back pain, wanted to go to own hospital and cancelled conveyance when informed of diversion
2	Patient with leg pain, wanted to go to own hospital and cancelled conveyance when informed of diversion
3	Patient with malaise, wanted to go to own hospital and cancelled trip when informed of diversion
4	Patient with chest pain, declined ambulance conveyance when informed of diversion; decided to drive to hospital on own

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Table 4—Patient-initiated cancellations of conveyances

on the healthcare delivery system, with a reduction in acute-care beds and the regionalization of specialized services. Many services only are offered at a few sites (i.e., trauma, obstetrics/gynecology), and ambulance crews often triage patients to regionalized centres based upon their clinical impressions.

The EMS system is a tiered, Basic Life Support (BLS)/Advanced Life Support (ALS) service that responds to >50,000 requests per year. Prioritization of the requests is accomplished at the dispatch level using the Advanced Medical Priority Dispatch System (AMPDS Inc., Salt Lake City, Utah USA). The BLS units are equipped with automatic external defibrillators (AEDs), as are the first-responding fire units.

Study approval was obtained from the University of Alberta Health Research Ethics Board. The study encompassed five weeks, and included all patients transported by Edmonton EMS during this period. The EMS patient-care records and the corresponding trip records generated by the dispatch computer were reviewed to identify all of those instances in which an ambulance was diverted from the destination initially indicated by the "Hospital Destination Guideline". The records for all of the diverted transports were scrutinized independently by two of the investigators in order to identify the occurrence of adverse medical events during transport. In the event of discrepant views, a third investigator reviewed the records and provided an opinion.

An adverse medical event was defined as an acute change in the condition of the patient requiring active intervention by the EMS crew. Such events include hypotensive episodes, airway compromise, changes in level of consciousness, and the onset of violent behavior. Response times and transport times were obtained from the dispatch computer that automatically records all of the times. Finally, the diverted cases were cross-referenced with the database from the Regional Transport Office, which coordinates all of the inter-facility transports, in order to identify those cases that generated a subsequent inter-facility conveyance for more definitive care.

Statistical descriptions and analysis were done using RMS Integraph. Comparisons were made using Student's *t*-test and 95% Confidence Intervals (CI).

Results

A total of 3,603 patient transports occurred during this study period. Of the 3,603 patient transports, 326 (9.1%) were diverted.

Response and transport times

Response times and transport times both were impacted negatively by the diversions (Table 1). A statistically significant increase in response times for those transports that ultimately were diverted from their intended destination (5:51 minutes (min.) vs. 4:56 min.; 95% CI = 5:31–6:11

min.) was identified. There also was a statistically significant increase in transport times for those ambulance transports that were diverted from their initial intended destination (17:41 min. vs. 12:33 min.; 95% CI = 16:45–18:37 min.).

Adverse medical events

The adverse medical events that occurred during the diversions are summarized in Table 2. Adverse medical events occurred during 4.3% (14/326) of these transports. The events included cardiac arrest, loss of an adequate airway, increasing dyspnea or chest pain, hypotension, aggressive, and violent behavior.

Subsequent inter-facility transfers

Subsequent inter-facility transfers were defined as conveyance from the actual receiving hospital to another hospital that should have been the original receiving facility. An interfacility transfer occurred for 4.3% (14/326) of these patients. The reasons for these transfers are summarized in Table 3. Generally, the transfers were made in order to obtain a procedure or service that was not available in the initial receiving facility.

Cancellations

Finally, an interesting additional phenomenon observed during the course of the study, was that patients not infrequently cancelled their request for EMS transport when it became apparent to them that they could not be transported to their hospital of choice. The reasons for these cancellations are summarized in Table 4. This occurred in 1.2% of the reported diversions (4/326).

Discussion

Ambulance diversions may negatively impact transported patients, the EMS system, and the regional health authority. Ambulance diversions were a frequent occurrence during the study period, occurring in 9% (326/3,603) of ambulance transports. Because of the increased transport times and the increased hospital times when hospitals are on a redirect status, there effectively are fewer units available to respond to new calls. Response times usually are increased when there are fewer units providing city-wide coverage.

Ambulances usually transport patients to the nearest hospital, or the hospital the patient requests unless the patient requires a regionalized service such as are available in major trauma centers. Therefore, ambulances that are diverted would be required to travel longer distances during transport.

Adverse events occurred during 4.3% of the diverted transports (14/326). A moving ambulance, with one EMS provider attending to the patient, is not an optimal environment in which to manage an unstable patient. Diversion of ambulances delays transport to definitive care. Although ALS-EMS providers have advanced skills, it is technically difficult to monitor patients and carry-out procedures in a moving ambulance. Factors such as lighting and restricted space contribute to decreased success rates for psychomotor skills.^{4,5}

Transport of critically ill patients has inherent risks. The literature documents the increased mortality and morbidity

associated with the inter- and intra-hospital transfer of critically ill patients.^{6,7} Therefore, increasing ambulance transport times for critically ill patients could place these patients at increased risk for adverse events in an environment that is not optimal for management of these events. Also, the patient care compartment of a moving ambulance is not conducive to managing a violent patient, placing both the patient and the EMS providers at increased risk for injury. Monitoring of the restrained patient also is more difficult within the confines of an ambulance.

Finally, there is evidence to suggest that responses using “lights and siren” increases the likelihood of that ambulance or other vehicles being involved in a motor vehicle accident.³ Therefore, increasing ambulance transport times potentially increases the risk to the patient, the EMS providers, and the public-at-large.

An interesting here before not described phenomenon was observed during this study: Patients cancelled or refused ambulance transport when it was made apparent to them that they could not be transported to their hospital of choice. Although the majority of these patients appeared to have minor complaints, this is a disturbing phenomenon that poses significant and potential medico-legal ramifications. For example, one of the patients who refused ambulance transport, electing instead to use private transportation to the hospital of choice, had a complaint of “chest pain”. If the pain represented an acute ischemic coronary event, this decision was not in the patient's best interest.

Subsequent inter-facility transfers generated by these ambulance diversions was required for 4.3% (14/326) of these diverted patients. The cost of these inter-facility transfers is borne by the regional health authority, and poses an additional financial burden. The significant delay in definitive treatment for many of these patients potentially could contribute to increased patient morbidity and mortality. In particular, in-patients requiring surgical services that were not available in the hospital to which the patient had been diverted, could experience delay in getting operative emergent or urgent interventions. Given the evidence that inter-facility transfers increase mortality and morbidity, and given these delays in definitive treatment, it is apparent that all stakeholders should become increasingly concerned about the implications of ambulance diversions.

There are several limitations to this study. The study represented a retrospective, descriptive analysis of ambulance diversions in a large metropolitan center over a relatively short period of time of five weeks. There was no control group with which to compare the incidence of adverse events. This was a descriptive analysis of a problem in this region, and was considered to be a pilot study to elucidate whether more detailed study was required. The absence of a control group is not unusual in observational prehospital studies. For example, Steill *et al* have not used a control group in their large multicentre Ontario Prehospital Advanced Life Support (OPALS) study examining whether an advantage exists between Advanced Life Support versus Basic Life Support ambulance services.^{8,9} Although three independent reviewers were used to determine the occurrence of adverse events, there still was an element of subjectivity. The information obtained suggests

that it may be worthwhile to conduct a prospective trial over a longer period of time to obtain a larger sample size. This may be prudent particularly given the widespread prevalence of ambulance diversions in Canadian health-care jurisdictions.

Conclusions

Ambulances are diverted at a significant rate in this region and adverse medical events occur during these diverted transports. This practice results in increased response times and increased transport times for the EMS system. A small

percentage of patients, when told that they could not be transported to their hospital of choice, cancelled or refused ambulance transport. A significant number of diverted patients required a subsequent inter-facility transfer for definitive care that was not available in the facility to which they were diverted.

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