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Emergency Department Overcrowding
in Canada: What are the Issues and
What can be Done?



Supporting Informed Decisions

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Canadian Agency for Drugs and Technologies in Health

Emergency Department Overcrowding in Canada: What are the Issues and What can be Done?

May 2006

This overview was created from four longer reports authored by The University of Alberta Evidence-based Practice Centre.

This Overview is based on four Technology Reports commissioned by CADTH: Ospina MB, Bond K, Schull M, Innes G, Blitz S, Friesen C, Rowe BH. *Measuring overcrowding in emergency departments: A call for standardization*; Rowe BH, Bond K, Ospina MB, Blitz S, Schull M, Sinclair D, Bullard M. *Data collection on patients in emergency departments in Canada*; Rowe BH, Bond K, Ospina MB, Blitz S, Afilalo, M, Campbell SG, Schull M. *Frequency, determinants, and impact of overcrowding in emergency departments in Canada: A national survey of emergency department directors*; Bond K, Ospina MB, Blitz S, Friesen C, Innes G, Yoon P, Curry G, Holroyd B, Rowe BH. *Interventions to reduce overcrowding in emergency departments* [Technology reports issues 67.1, 67.2, 67.3, 67.4]. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2006.

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Emergency Department Overcrowding in Canada: What are the Issues and What can be Done?

Issue and Methods

Emergency department (ED) overcrowding is a situation in which the demand for emergency services exceeds the ability to provide care within a reasonable time. CADTH's series of four reports on ED overcrowding examine the issues and explore solutions.

Implications for Decision Making

- **Overcrowding is a frequent and significant occurrence across Canada.** Among respondents to an ED director survey, 62% reported overcrowding as a major or severe problem in 2004 and 2005. Major or severe overcrowding is more likely to occur in an ED with 50,000 or more visits annually, communities with a population of at least 150,000, university-affiliated hospitals, trauma centres, and EDs with 30 or more treatment spaces.
- **Lack of beds may lead to overcrowding.** Most respondents (85%) perceived a lack of admitting beds to be a major or serious cause of overcrowding.
- **Measures of ED overcrowding and their collection require consistency.** Inconsistent methods of collecting, defining, and measuring information related to overcrowding, create a confusing picture of the issues facing EDs.

The percentage of patients in the ED who have been admitted, but have not been transferred to a hospital ward because of a lack of bed availability, is perceived as the most important measure of overcrowding, but is infrequently collected.

- **Electronic collection of data and contributions to a national data system should be considered.** Electronic ED information systems are available in Canada, but only 39% of ED directors surveyed reported using them. Contributions to an established national data system are limited, and if improved, would be valuable for policy makers.
- **Fast track systems can reduce overcrowding.** Evidence suggests that fast tracking patients with minor injuries or illnesses can reduce ED length of stay, waiting time, and the number of patients who leave without being seen.
- **Ambulance diversion strategies, short stay units, staffing changes, and system-wide complex interventions should also be further explored.** Limited evidence suggests that these interventions to address overcrowding should be encouraged and monitored.
- **No evidence of effectiveness could be identified for many broadly adopted interventions in Canada.** These include float nurse pools, senior ED physician flow shifts, home or community care workers assigned on site to the ED, overcensus on wards, orphan clinics, "coloured" codes to decongest ED, and "overload" units for in-patients.

1 Introduction

This overview summarizes four CADTH reports that together provide a comprehensive picture of the state of overcrowding in Canadian emergency departments (EDs), the capability of EDs and health regions to measure and document ED overcrowding, and the existing evidence for effective interventions to alleviate it. The four reports describe the results of five rigorously conducted studies:

- a national survey of ED directors to identify the perceived frequency, determinants, and impact of ED overcrowding
- a survey of provincial and territorial ministries of health, a national health organization, ED directors, and emergency department information systems (EDIS) vendors, to determine the data elements and methods of EDIS data collection at the provincial and national levels, and the information systems in use or available for use in Canada
- a Delphi study, a consensus method, of Canadian ED experts to identify a set of relevant measures for documenting ED overcrowding
- a systematic review of the scientific literature to identify measures and indicators used to document the phenomena of ED overcrowding
- a systematic review of the scientific literature to identify and assess interventions designed to reduce or control ED overcrowding.

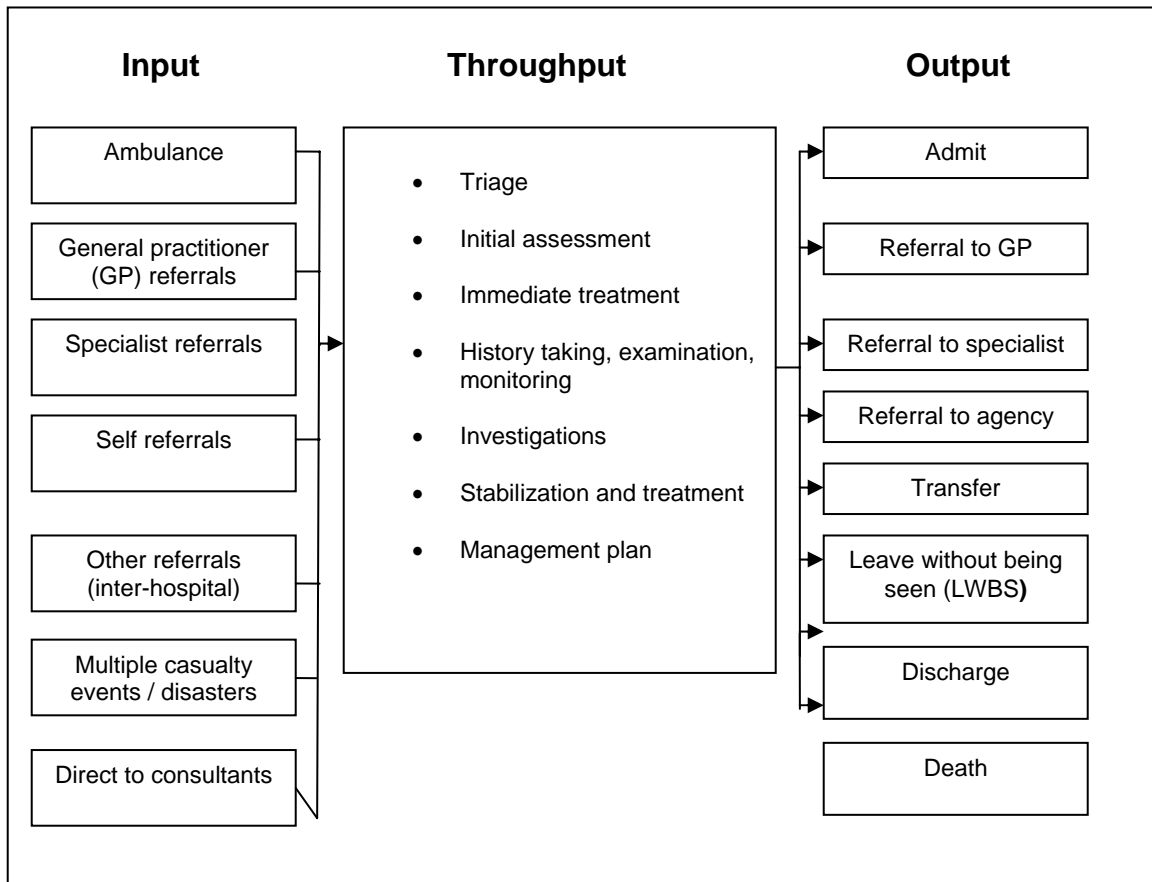
Every year, approximately 14 million Canadians go to EDs for care. Visits to EDs have been increasing, and approximately 3.3 million Canadians reported that they visited an ED for a serious injury in 2003.^{1,2}

In Canada, as in other countries, ED overcrowding is recognized as a system-wide problem with multiple causes, and no simple or immediate solutions.³ The fact that hospitals differ according to the communities they serve and the services they offer, and the fact that there are a variety of demands on emergency services, makes overcrowding a complex problem. To address the problem, the flow of patients through the ED, and the effectiveness of the many possible interventions must be accurately assessed.

ED overcrowding has a myriad of negative effects on quality of care, patient and staff satisfaction, and other patient-related outcomes.³ A proportion of patient morbidity and mortality can be attributed to delays in early diagnosis and treatment, especially with time-sensitive diagnoses such as myocardial infarction, pneumonia, sepsis, and stroke.⁴ ED congestion impairs the ability to deliver timely care in EDs, and was a contributing factor to the disturbing consequences of the severe acute respiratory syndrome (SARS)⁵ in many parts of the world, particularly in Toronto.⁵ ED overcrowding may contribute to the spread of other communicable diseases, such as influenza and tuberculosis. Medical errors have also become an increasingly frequent issue in the frenetic environment of the overcrowded ED.⁴

An ED overcrowding model (Figure 1) has been used to conceptualize ED processes, and to identify strategies for measuring and reducing overcrowding.⁶ This model groups ED processes into three categories: input, throughput and output. Input refers to processes that influence the number of patients who present and are admitted to the ED. Diversion of ambulances or

Figure 1: Input-throughput-output conceptual model of ED overcrowding (adapted from Asplin *et al.*⁶ and Fatovich⁷)



education programs that emphasize the use of primary care physicians are examples of interventions used to reduce input issues. Throughput refers to processes related to medical decision making, such as prioritization of care, registration, assessment, diagnostic testing, and treatment. Output refers to processes that affect the flow of patients out of the ED to in-patient beds, to other care facilities, or to their home. By focusing on the processes from the ED's perspective, this model allows for a comprehensive view of the multidimensional nature of the problem, and clarifies the operations in the ED that may be changed to alleviate overcrowding.

2 Overcrowding in Emergency Departments in Canada

National Survey of Emergency Department Directors

As the prevalence and severity of problems associated with overcrowding have grown, so have the number of descriptive studies documenting the factors and contributing causes of ED overcrowding. National surveys of ED directors in the US have gathered evidence about the extent of overcrowding, the type of EDs most affected, the perception of causes, and the adverse effects.⁸ The problem has also been well described in Australia, the UK, Spain, and Taiwan.⁹ Yet

ED overcrowding in Canada remains poorly understood, as few scientific studies of overcrowding in Canadian EDs have been undertaken.

To address this knowledge gap and to provide a background against which other studies may be understood, a national survey of ED directors working in hospitals located in Canadian municipalities that have a population greater than 10,000 inhabitants was conducted. It was assumed for this study that ED overcrowding occurs rarely, if at all, in smaller municipal populations. The objectives of this study were to describe the frequency, determinants, and impact of ED overcrowding in Canada, to explore the views and perceptions of ED directors about their facility's state of overcrowding, to determine whether there are regional differences in the frequencies, determinants, and impact of overcrowding, and to explore the potential association between overcrowding and site characteristics.

a) Study Population and Survey Instruments

Using Statistics Canada's 2001 census data, 410 Canadian municipalities with a population greater than 10,000 were identified.¹⁰ From these, 211 municipalities that have local hospitals were selected. Researchers identified 243 ED directors from 276 hospitals that provide ED services in these municipalities.

Between March and June 2005, a 54-question English and French language survey was distributed to the directors by e-mail and post to collect data on ED characteristics, frequency of ED overcrowding during the past year, episodes of ambulance diversion and boarding of patients, ED staffing, definitions of overcrowding, and the perceived causes and effects of ED overcrowding.

b) Results

Of the 243 ED directors who were sent the survey, 158 responded (65%). Most directors who completed the survey were from Ontario (38%) or Québec (27%), with the remainder from British Columbia (11%), Alberta (11%), Nova Scotia (4%), Manitoba (4%), Saskatchewan (2%), New Brunswick (1%), Newfoundland and Labrador (1%), and the Northwest Territories (1%). There were no respondents from Prince Edward Island, or the Yukon. Nunavut was excluded, because no municipalities there contain 10,000 or more inhabitants.

Most ED directors (85%) thought that overcrowding could be characterized as "a situation where the demand for emergency services exceeds the ability to provide care in a reasonable amount of time." More than half of the directors (62%) reported that overcrowding in their facilities was a major or severe problem during the past year. At least one daily episode of overcrowding occurred in 35% of directors' departments in the last three months, and 36% said that the problem occurred more than once every week.

Overcrowding was attributed to a lack of admitting beds by 85% of directors. Other perceived causes included the increased length of stay of admitted patients in the ED (63%), the increased complexity and acuity of patients' symptoms (54%), and the occupancy rate of ED stretchers (52%). Most ED directors (82%) perceived that ED overcrowding increases stress among nurses, and makes the recruitment and retention of nurses more difficult (68%).

Overcrowding was also perceived as having a major or serious impact on ED waiting times (79%), the boarding of admitted patients in the ED while waiting for beds (67%), and ED staff satisfaction (66%); and increasing stress among physicians (65%). Of the ED directors surveyed, 51% thought that ED overcrowding has a major or serious impact on the number of patients who leave without being seen (LWBS). The impact of ED overcrowding was also perceived to be evident in the delayed improvement of patients' physical, emotional, and mental well-being (54%), and in the risk of poor outcomes (52%).

Communities with a population of 150,000 or greater were four times as likely to report major or severe overcrowding as communities with populations less than 150,000. EDs located in university hospitals or university-affiliated hospitals were four times more likely to report major or severe overcrowding than EDs self-described as community hospitals. The severity of overcrowding did not seem to be related to resident coverage or shortages in physician or nurse staffing. ED directors reported the same leading causes and impacts of overcrowding, regardless of the number of ED visits annually. Busy EDs (with an annual ED census of more than 50,000) were three times more likely to report being overcrowded at least once per week than lower-volume EDs. EDs with 30 or more treatment spaces were five times more likely to report major or severe overcrowding than those EDs with fewer treatment spaces.

c) Limitations

The results of this survey are limited to centres with a median municipal population of 150,000, and hospitals with a median ED census of 50,000 patient visits annually. The researchers made several assumptions that may have led to an overestimation of ED overcrowding, for example, it was assumed that ED directors have a good idea of the operational pressures in the ED, that estimations of ED census and patient data (e.g., patients who LWBS) were largely correct, and that subjective perceptions of the frequency, causes, and impact of overcrowding were trustworthy. A non-respondent bias may have contributed to an overestimation of the problem.

d) Conclusions

The results of this study suggest that ED overcrowding is a serious and frequent problem across Canada. It is neither limited to large urban centres, nor to academic and teaching hospitals. Most ED directors perceive access block, or an insufficient number of in-patient beds, to be the main cause of overcrowding. They believe that overcrowding lowers the quality and accessibility of emergency care, and increases the stress levels and turnover of ED staff. This perspective reinforces the need for more research regarding effective policies and interventions to reduce ED overcrowding.

Data Collection on Patients in Emergency Departments

The ability of local, provincial, territorial, and national organizations to quantify ED activity, and report on measures of ED overcrowding depends on good quality, accessible information. Though data sources are available (e.g., mortality data, hospitalization data, physician billing data, ED patient data in hospital databases, and electronic ED information systems), most are of limited value in providing data for assessing ED overcrowding. The inconsistent reporting of ED data at institutional, provincial, and national levels impairs governments' abilities to quantify ED

use and overcrowding, and hinders attempts to study the causes, characteristics, and effects of ED overcrowding, and to develop effective solutions.

To assess the ability to collect and share information on ED activity and ED overcrowding, researchers surveyed ED directors to identify the common EDIS used in Canada. Between May and September 2005, EDIS vendors were contacted to determine the options available to Canadian EDs, and their level of use. Provincial and territorial ministries of health and a national health organization were surveyed to determine the data elements and methods of EDIS data collection at the national level, and the accessibility of provincial data on ED visits.

a) Study Population and Survey Instruments

Eleven EDIS vendor representatives from software companies in Canada and the US were asked to complete a one-page questionnaire about the use of EDIS products in Canada, and the availability of standard EDIS tools (e.g., maps or triage function) and added features (e.g., patient order entry and electronic charting).

Fourteen representatives were contacted: 10 provincial, three territorial, and one representative from the Canadian Institute for Health Information (CIHI) who coordinates the National Ambulatory Care Reporting System (NACRS). Each were e-mailed the one-page questionnaire about the methods of ED data collection, annual reporting, triage recording, data elements, expected future changes to information collection systems, and contributions to the NACRS.

b) Results

Overall, 57 (39%) ED directors reported using an electronic EDIS system. A small number of EDIS vendors provide products to these Canadian EDs: iSOFT (21%), SIURGE (19%), Cerner (16%), and MEDITECH (18%). Triage was conducted in 146 (99%) EDs, with the Canadian Triage and Acuity Scale (CTAS) being the most commonly reported scale used [138 EDs (95%)]. Electronic triage was available in 28 (19%) EDs.

All 11 vendors completed the survey (100%). Seven (64%) vendors reported that their software was in use in Canadian EDs, with most providing a similar package of basic EDIS options (100% tracking and mapping functions, 91% electronic triage). While options for triage varied, eight (73%) provided a CTAS option. More advanced informatics (e.g., electronic charts, discharge information, and order entry) were less commonly available, or were available only as add-on features.

The survey was completed by all Ministry of Health representatives (100%). Nine (69%) jurisdictions reported collecting specific ED information. Seven (54%) reported obtaining all or part of their data from searching through medical records not necessarily designed to measure ED overcrowding. Three (23%) claimed to produce an annual ED report (Ontario, Québec, Nunavut), and three (23%) claimed to have a comprehensive, jurisdiction-wide ED database (Alberta, Yukon, Ontario).

All representatives reported the ability to determine total ED volumes, although the methods and the ease of access varied. Outcome data are variably linked to the ED registration data: nine (69%) jurisdictions can access admission status; eight (62%) can access death records; five

(38%) reported collecting triage data; three (23%) collected presenting complaint data; and two (15%) collected data about the reason for the visit. Jurisdictions also reported that they were capable of collecting a variety of measures of ED overcrowding: length of ED stay for admitted patients [eight (62%)], ED patients who LWBS [six (46%)], and length of stay for discharged patients [six (46%)]. Fewer jurisdictions reported the ability to provide data on episodes of ambulance diversion [four (31%)] or waiting times in the ED [three (23%)].

Two jurisdictions (Ontario, Yukon) reported providing comprehensive ED data to a national database; at least one other jurisdiction (Alberta) reported collecting these data without providing them to CIHI's NACRS. Six (46%) jurisdictions expected changes in ED data collection within the next two years.

c) Limitations

These results appear generalizable to all parts of Canada. Recent changes may have made some of these data obsolete, and the dynamic nature of data collection may limit the generalizability of these findings in the future.

d) Conclusions

The evidence highlights the limitations of local, provincial, and federal efforts to accurately document the degree of ED activity and ED overcrowding in Canada. Many institutions do not track patients in their EDs using electronic methods. Three jurisdictions (Alberta, Yukon, and Ontario) have a comprehensive population-based ED database, and Ontario and the Yukon contribute to the national ED database (NACRS). Variations exist among provinces regarding the type of data collected. This limits their ability to contribute and compare across borders or subgroups.

Without more knowledge about the activity in EDs, and a better understanding of overcrowding pressures, there will be little evidence with which to evaluate the interventions designed to reduce overcrowding. Current data repositories are of limited value to policy makers, clinicians and patients, except in Ontario, the Yukon, and Alberta. There is an urgent need for local governments, and provincial and territorial ministries of health to collaborate on expanding the role of information systems in Canadian EDs. Likewise, provinces and territories need to consider the value of contributing to a national ED database.

Measuring Overcrowding in Emergency Departments

The meaning of ED overcrowding can vary from one organization to another, depending on the local context and the information available. This lack of a uniform definition has made it difficult to study the causes, characteristics, and effects of ED overcrowding, and to develop effective solutions.^{6,11-14} Several publications¹⁵⁻¹⁹ have tried to develop standard definitions of ED overcrowding, and a list of proxy measures or indicators, but these definitions have not been widely accepted because of the many attributes of overcrowding, and the absence of methods to develop appropriate indicators. There is an urgent need for a rigorous assessment of the measures being used in ED overcrowding research. As a result, the systematic identification of measures and indicators that have been used to document ED overcrowding is the first step toward finding meaningful measures for documenting ED overcrowding and developing ways to alleviate it.

a) Methods

Relevant published literature was obtained by searching 24 electronic databases using the core terms “crowding” and “emergency departments.” Researchers also searched manually for unpublished studies and abstracts presented to scientific meetings from 2000 to 2004. The searches were performed in November 2004, with two updates using additional terms conducted in December 2004.

A formal statement that included the terms “crowding,” “overcrowding,” or other synonyms (e.g., increased or increasing patient volumes, increasing number of visits, increasing ED census, ED congestion, or high demand of ED services) was required in the title, introduction, or methods sections for a study to be considered relevant. Studies were also required to refer to ED overcrowding as the main objective, or as a prominent reason for the study. All study designs were eligible for inclusion.

b) Results

From over 12,000 citations and 632 eligible studies, 169 studies (published between 1973 and 2004) that reported data on 735 measures to document ED overcrowding were identified. Most studies were conducted in the US (79), Canada (36), Australia (20), the UK (12), and Spain (9). A few studies were performed in Hong Kong, Sweden, Taiwan (two studies each), and Greece, Israel, New Zealand, Pakistan, Singapore, Switzerland, and Turkey (one study each).

Measures of throughput processes were most commonly reported [499(67.8%)], followed by input [143 (19.5%)], and output [87 (11.8%)]. Six measures (0.8%) that documented aspects related to overall ED processes were classified as system measures.

Most measures [292 (39.7%)] focused on delays in the process of ED care and included overall times (e.g., total times in the ED), times needed for steps in ED care (e.g., time from registration to consultation with an ED doctor), and waiting times for an action or event in the ED (e.g., time waiting to be seen). A lack of uniform intervals prevented further categorization.

The overall volume of ED patients was reported in 85 measures (11.6%), and included variables such as the total number of ED visits within a given interval, ED census, number of patients registered, and number of ambulances that arrived at a particular time. Another volume-related measure identified was patient waiting volumes [65 (8.8%)], which referred to measures that described the number of patients in the queue at different stages of receiving care (e.g., the proportion of patients waiting before being seen by a doctor).

Measures categorized as ED administration [59 (8.0%)] included those describing aspects related to ED capacity and resources (e.g., ratio of ED beds to ED patients), staff-related issues (e.g., ratio of physicians and nurses to waiting room patients), ED management decisions (e.g., temporary ED closures), and measures related to quality improvement (e.g., number of times the total number of patients in the ED equalled or exceeded the bed capacity).

The category of ED patient volumes [56 (7.6%)] referred to those measures describing the proportion of patients seen at different stages in the process of care (e.g., the proportion of patients seen within a specified time).

Measures categorized as access block [52 (7%)], ambulance diversion [52 (7%)], number of patients who LWBS and who leave against medical advice [40 (5.5%)], and ED length of stay [31 (4.2%)] were less commonly reported.

c) Limitations

The strict eligibility criteria may have excluded relevant studies that measure ED processes. Given the comprehensiveness of the search strategies and the volume of literature examined, it is unlikely that this would bias the results.

d) Conclusions

The results highlight the limitations of current research on the measurement of ED overcrowding. Many measures and indicators have been used, and there has been little agreement on how to develop standard definitions and measures that account for regional variations and differences among EDs. The inconsistent use of definitions, indicators, and measures of ED overcrowding has created a contradictory research base. Without more knowledge about the operating characteristics and properties of measures used for ED overcrowding, results will remain difficult to interpret, and will be of limited value to policy makers, clinicians, and patients. Identifying meaningful measures would help to ensure that data collected on ED patients and processes can be used to help guide decision making about overcrowding, develop standard approaches, and allow for comparisons among EDs of different sizes and capacities.

Measures to Document Overcrowding: A Delphi Study

To develop a Canadian consensus on the relevance of a set of measures to document ED overcrowding, researchers conducted a Delphi study involving Canadian ED physicians, nurses, and administrators from jurisdictions across Canada. The Delphi technique is a research tool developed to obtain consensus among experts on a complex problem through an iterative process of answering questionnaires, receiving feedback regarding group responses, and revising opinions in light of the feedback.²⁰ A secondary objective of the study was to develop an inventory of clinically relevant common measures of ED overcrowding based on expert opinion.

a) Study Population and Survey Instruments

Between February and April 2005, a two-round modified Delphi study involving a group of 38 Canadian ED experts was conducted. The group was composed of ED administrators, directors, physicians, and nurses who have a known or stated interest in ED overcrowding. Participants were sent a questionnaire that asked them to rank a set of 36 measures to document ED overcrowding. The resulting top 10 measures were then ordered according to their relative importance.

b) Results

The first round was completed by 32 experts (84% response rate), and the second round by 33 (87% response rate). The annual ED census of their institutions ranged from 25,000 patients to 210,000 patients (median 60,000; interquartile range 50,000, 70,000).

The rank ordering of the 10 measures selected by the Delphi group to document ED overcrowding was:

1. percentage of ED occupied by in-patients (output)
2. total ED patients (throughput)
3. total time in ED (throughput)
4. percentage of time when ED is at or above its capacity (throughput)
5. overall bed occupancy (throughput)
6. time from bed request to bed assignment (throughput)
7. time from triage to emergency physician (EP) (throughput)
8. medical doctor satisfaction (system)
9. time from bed ready to transfer to ward (output)
10. number of staffed acute-care beds (throughput)

c) Limitations

There are three limitations to this study. First, the Delphi group was predominantly composed of EPs. Second, all the indicators are proxy measures of overcrowding; whether they truly measure overcrowding depends on how strongly they are associated with it.²¹ Third, the choice of measures was not based on the ability of institutions to collect information about them. This omission may make it difficult for policy makers to implement the 10 measures for the reporting of ED overcrowding.

d) Conclusions

The measures selected by the Delphi group represent factors affecting the ability of EDs to cope with the incoming flow of patients (throughput), and those affecting the ability of the in-patient and ambulatory care systems to provide care after ED discharge (output). These results could begin to guide future research and development on a consistent set of measurements for ED overcrowding. The variety of responses highlights the fact that what is perceived to be the main indicator or cause of overcrowding varies across jurisdictions and over time. Jurisdictions may want to vary measures over time to reflect the changing nature of overcrowding and its specific context.

Interventions to Reduce Overcrowding in Emergency Departments

Initiatives to address overcrowding have been undertaken in many countries, including Canada and the US. Standards, guidelines, and strategies, however, will have limited influence without high quality evidence regarding the effectiveness of interventions to control or reduce ED overcrowding. Although there is an increasing interest in addressing the problem of ED overcrowding, little is known about the influence that interventions have had on ED overcrowding. In a study of 243 Canadian ED directors, 62% (98) of 158 respondents reported having tried at least one intervention to address ED overcrowding, and 30% (29 of 98) indicated that the intervention was unsuccessful. No systematic evidence-based approach has been used to identify and compare the effects of these types of interventions.

The main objective of this report was to systematically review the effects of interventions designed to reduce or control overcrowding in the ED. The secondary objectives were to provide an overview of all studies assessing interventions to reduce or control overcrowding, and to evaluate their relative value based on reported outcomes.

a) Methods

Relevant published literature that had been obtained for an earlier component of this study was subjected to additional scrutiny. For this report, researchers applied the following selection criteria to the 169 studies that reported measures of ED overcrowding: relevant studies must have reported on interventions designed to reduce or control ED overcrowding, studies must have provided a comparison or control population, and studies were required to report data for measures or indicators used to document events related to ED overcrowding. Experimental and observational study designs with control groups were eligible for inclusion.

b) Quality Assessment and Statistical Analysis

Two reviewers assessed the methodological quality of the studies using assessment scales and checklists appropriate to the study designs. Because of the heterogeneous reporting of outcomes, traditional meta-analytic techniques were not used in the statistical analysis. Outcomes from before and after periods of intervention and control groups were extracted, and the per cent change from the before period or control group was calculated for each intervention.

c) Results

Of the 169 eligible studies, 66 reported interventions to reduce or control ED overcrowding. The studies were published between 1990 and 2004, and were conducted in the US (29), Canada (13), the UK (nine), Australia (five), and Spain (three), with a few studies conducted in Hong Kong, Israel, New Zealand, Singapore, Sweden, Switzerland, and Turkey (one study each). A variety of methodological approaches were used: before-and-after designs (50), controlled trials (seven), cohort studies (seven), and randomized controlled trials (RCTs) (two).

The single interventions studied were fast track systems (23), staffing (eight), triage (six), ambulance diversion strategies (four), physician order entry (three), short stay units (two), and a group of interventions that did not fit into any of these categories (eight). Some multi-faceted interventions were also studied (12). Improvements were reported in all studies for almost all outcomes of interest.

Despite being heterogeneous in their characteristics, the studies had some commonalities; 11 interventions were designed to influence input processes. Some of these were minor modifications to the ambulance operating system (e.g., managing ambulance transfers through dispatch), whereas others were aimed at strengthening the collaboration with other primary care and outpatient services (e.g., opening a medical day clinic for Canadian Triage Acuity Scale 4 and 5 patients). Among the interventions, 61 were designed to influence throughput in the ED. Most aimed to increase or improve the workforce in the ED (e.g., additional nursing or medical staff); 47 interventions were designed to influence output by changing the practices of care in the hospital (e.g., cancelling elective surgeries) to create “overload” units for in-patients waiting for admission to the hospital. Six interventions combined approaches to target throughput and output

processes (e.g., having a medical doctor coordinator in the ED and in admissions). Seventeen interventions were implemented on a system-wide level (e.g., formal decongestion plans and administrative actions at the hospital level).

Overall, the methodological quality of the included research was low. Two weaknesses were inappropriate randomization and a lack of double-blinding. The ethical and methodological difficulties of structuring a randomized, double-blinded trial in emergency care may prevent researchers from using this study design in single-centre trials; cluster randomization should be possible.

d) Limitations

The complexity of the studies precluded the use of common approaches for combining data such as a meta-analysis or comparisons of odds ratios. Because of a lack of comparative studies, researchers could not determine the relative benefits of one group of strategies compared with another.

There is a possibility of bias in this review, because successful interventions are more likely to be reported or published. It is also possible that hospitals institute policy changes or implement interventions without designing, implementing, and reporting on a formal study of the improvement or deterioration that occurred as a result. Most studies explored common overcrowding outcomes, and could not comment on changes in patient outcomes.

e) Conclusions

Many interventions of varying complexity, intensity, and duration have been applied in an attempt to alleviate or control ED overcrowding. Most of these have had a positive effect on the overcrowding outcome measured, but it is difficult to determine the relative value of these interventions or to say which ones work best.

The results suggest that efforts to address overcrowding at an institutional level should be encouraged and monitored — all have a high chance of success. The results can help hospital and ED administrators and policy makers determine what might work in their environments. There is a need for more studies on the effects of a variety of interventions, and how they might affect the quality of care, patient outcomes, and costs. Better reporting is required on the setting characteristics, study design, treatment description, and outcome measures, to improve the synthesis of evidence on interventions to reduce overcrowding.

3 Conclusions

The results of these studies provide a comprehensive assessment of the state of overcrowding in Canadian EDs, and the local, provincial, and national abilities to document ED activities. They also provide the first systematic, evidence-based approach to assess the evidence on measures and interventions for ED overcrowding.

The findings of these studies have implications for health care policy makers, ED and hospital administrators, and health care research.

Health Care Policy Makers

These studies suggest that overcrowding is a frequent and significant occurrence across Canada, akin to the results of similar studies conducted in the US.^{22,23} The findings suggest that overcrowding is neither limited to large urban centres, nor is it limited to academic and teaching hospitals; the higher volume hospital EDs seem to experience major or severe overcrowding more often.

Of ED directors, 62% saw overcrowding as a major or severe problem in 2004 to 2005.

Most ED directors perceive access block, or an insufficient number of in-patient beds, to be the main cause of overcrowding. They believe that ED overcrowding adversely affects the quality and accessibility of emergency care, and increases stress levels and staff turnover.

The results of these reports show that a consistent application of the early warning indicators requires an accepted definition of ED overcrowding, which is lacking in Canada. Without a greater knowledge of the measurement properties of ED overcrowding indicators, study results will remain difficult to interpret, and will be of limited value to policy makers, clinicians, and patients.

There are limitations to local, provincial, and federal efforts to accurately document the degree of ED activity and ED overcrowding in Canada. The variations among provinces regarding the type of data collected limits interprovincial comparisons.

Adopting a common definition of ED overcrowding in Canada will assist all levels of the health care system in appropriately identifying and tracking the issue. A definition supported by most ED directors surveyed is: “a situation where the demand for emergency services exceeds the ability to provide care in a reasonable amount of time.”

A common set of measures would help in identifying, tracking, and reducing ED overcrowding. This report outlines common measures that could help policy makers and hospital administrators. The percentage of the ED occupied by in-patients was perceived by ED directors to be the most important measure of ED overcrowding.

ED and Hospital Administrators

These studies suggest that policies intended to control overcrowding may need to be revisited. While more than half of ED directors surveyed reported that their hospitals have ED overcrowding policies, 67% thought they had little or no effect. A variety of interventions have also been reported in the published literature. The evidence indicates that fast tracking those with minor injury or illness can reduce overcrowding. Ambulance diversion strategies, short stay units, staffing changes, and system-wide interventions should also be explored, according to limited evidence. While triage is an important process to prioritize patient care, its influence on overcrowding is inconclusive.

Most respondents (82%) perceived that ED overcrowding had a serious or major negative impact on the stress level among nurses, nursing staff recruitment and retention (68%), ED staff satisfaction (66%), and stress among physicians (65%).

Some results suggest that administrators may need to revisit how overcrowding is measured. The number of ED nurses, attending EPs, and staffed acute-care beds were not perceived to be important measures of ED overcrowding by ED experts.

Health Care Research

There is a need for more investigations of high methodological quality on the specific effects of these interventions, and how they might affect the quality of care and patient outcomes. Without a greater knowledge of the activity in EDs, and a better understanding of appropriate measures of flow and capacity pressures, there will be little evidence with which to evaluate interventions designed to reduce ED overcrowding.

4 References

1. Carriere G. *Health Rep* 2004;16(1):35-9.
2. Canadian Association of Emergency Physicians and the National Emergency Nurses Affiliation. *CJEM* 2001;3(2):82-4.
3. Derlet RW, et al. *Ann Emerg Med* 2000;35(1):63-8.
4. Trzeciak S, et al. *Emerg Med J* 2003;20(5):402-5.
5. Borgundvaag B, et al. *CMAJ* 2004;171(11):1342-4.
6. Asplin BR, et al. *Ann Emerg Med* 2003;42(2):173-80.
7. Fatovich DM. *BMJ* 2002;324(7343):958-62.
8. Lewin Group. *Emergency department overload: a growing crisis. The results of the AHA survey of emergency department (ED) and hospital capacity*. Falls Church (VA): American Hospital Association; 2002. Available: http://www.hospitalconnect.com/aha/press_room-info/content/EdoCrisisSlides.pdf.
9. Graff L. *Am J Emerg Med* 1999;17(2):208-9.
10. *2001 census: population and dwelling counts*. Ottawa: Statistics Canada; 2002. Available: <http://www12.statcan.ca/english/census01/products/standard/popdwell/Table-CSD-PS.cfm>.
11. Reeder TJ, et al. *Acad Emerg Med* 2003;10(5):529.
12. Hwang U, et al. *Acad Emerg Med* 2004;11(10):1097-101.
13. Bernstein SL, et al. *Acad Emerg Med* 2003;10(9):938-42.
14. Drummond AJ. *CJEM* 2002;4(2):91-7.
15. Schull MJ, et al. *CJEM* 2002;4(2):76-83.
16. Richards JR, et al. *West J Med* 2000;172(6):385-8.
17. Solberg LI, et al. *Ann Emerg Med* 2003;42(6):824-34.
18. Derlet RW, et al. *Acad Emerg Med* 2002;9(5):366.
19. Miro O, et al. *Eur J Emerg Med* 1999;6(2):105-7.
20. Crisp J, et al. *Nurs Res* 1997;46(2):116-8.
21. Weiss SJ, et al. *Acad Emerg Med* 2004;11(1):38-50.
22. Derlet R, et al. *Acad Emerg Med* 2001;8(2):151-5.
23. *Hospital emergency departments: crowded conditions vary among hospitals and communities. GAO report to the ranking minority member, Committee on Finance, U.S. Senate*. Washington: United States General Accounting Office; 2003. GAO-03-460. Available: <http://www.gao.gov/new.items/d03460.pdf>.