Urban emergency department overcrowding: defining the problem and eliminating misconceptions

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ABSTRACT

Study objective: To develop an operational definition and a parsimonious list of postulated determinants for urban emergency department (ED) overcrowding.

Methods: A panel was formed from clinical and administrative experts in pre-hospital, ED and hospital domains. Key studies and reports were reviewed in advance by panel members, an experienced health services researcher facilitated the panel's discussions, and a formal content analysis of audiotaped recordings was conducted.

Results: The panel considered community, patient, ED and hospital determinants of overcrowding. Of 46 factors postulated in the literature, 21 were not retained by the experts as potentially important determinants of overcrowding. Factors not retained included access to primary care services and seasonal influenza outbreaks. Key determinants retained included admitted patients awaiting beds and patient characteristics. Ambulance diversion was considered to be an appropriate operational definition and proxy measure of ED overcrowding.

Conclusion: These results help to clarify the conceptual framework around ED overcrowding, and may provide a guide for future research. The relative importance of the determinants must be assessed by prospective studies.

Key words: emergency department, crowding, administration, ambulance diversion

RÉSUMÉ

Objectif de l'étude : Établir une définition opérationnelle et une liste parcimonieuse de déterminants postulés pour l'encombrement des urgences en milieu urbain.

Méthodes : Des experts en médecine clinique et administrative des domaines pré-hospitalier, hospitalier et de l'urgence formèrent un comité. Des études et rapports clés furent passés en revue à l'avance par les membres du comité. Un chercheur dans le domaine des services de santé qualifié agit à titre de modérateur pour la discussion et une analyse formelle du contenu des enregistrements audio fut menée.

Résultats : Le comité examina les déterminants de l'encombrement du point de vue communautaire, du patient, de l'urgence et de l'hôpital. Parmi 46 facteurs postulés dans la littérature, 21 ne furent pas retenus par les experts comme étant des déterminants potentiellement importants de l'encombrement. Les facteurs non retenus comprenaient l'accès aux services de soins primaires et les épidémies saisonnières de grippe. Les déterminants clés retenus comprenaient les patients hospitalisés en attente d'un lit et les caractéristiques des patients. Le détournement des ambulances fut considéré comme une définition opérationnelle et un outil de mesure indirecte adéquats de l'encombrement des urgences.

Conclusion : Ces résultats contribuent à clarifier le cadre conceptuel entourant l'encombrement des urgences et pourraient servir de guide pour des recherches ultérieures. L'importance relative des déterminants doit être évaluée à l'aide d'études prospectives.

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Introduction

Acute illness and traumatic injury strike unexpectedly, and frequently outside regular hospital hours. As a result, access to timely emergency medical care is an essential part of most health systems.[1,2] There are over 100 million emergency department (ED) visits annually in the US,[3] and 9 million in Canada.[4] Widespread reports of overcrowding in these and other countries have raised doubts about the capacity of emergency services to provide dependable and rapid emergency care.[1,2,5–18] Several deaths are thought to be related to the problem.[19–21] In the United States, surveys report ED overcrowding in almost every state,[22–25] with 10% to 30% of surveyed hospitals reporting daily overcrowding.[23,25]

Only a handful of publications have looked into the causes, and none have been prospective. Most are consensus statements without mention of the methodology used,[2,6–8,22,26–28] others are based on staff surveys or self-reports.[10,29–32] Often, the definition of "overcrowded" remains vague, and no distinction is made between urban and rural EDs despite the likelihood that factors may vary in their importance in these settings.

Public anxiety and intense media attention have resulted in widespread speculation, by politicians, journalists, administrators and medical personnel, about causes of overcrowding.[7,12,18,24,33–38] Proving a factor is an important cause of ED overcrowding requires prospective studies. However, the extensive and eclectic range of factors presently postulated, along with the absence of a standard definition, hampers research into this problem. Prospective studies must be selective in data collection, and careful evaluation is necessary to assess which items merit priority. Eliminating popular misconceptions would help simplify study planning. The goal of this article is to clarify the conceptual framework of ED overcrowding to aid in the design of future studies. The specific objectives are to develop a standard definition of overcrowding and a parsimonious list of important determinants.

Methods

The study was conducted according to standard qualitative research methodology.[39,40] The expert panel was composed of "key informants" — individuals with differing backgrounds and experiences who were willing to articulate their experiences.[39] The investigators contacted a range of prehospital, emergency and in-patient personnel to involve individuals knowledgeable about workload, process and administration issues. These individuals were chosen by the principal investigator (M.J.S.) based on their demonstrated prior interest and expertise in ED overcrowding, as evidenced by publications on the topic, participation in task forces or through personal recommendations made to the principal investigator. This investigator was not aware of the opinions of any of the individuals on ED overcrowding prior to the panel's meeting.

Participants were invited based on a sampling strategy of maximum variation, which allows the emergence of common thoughts and description of ideas not attributable simply to the homogeneity of the group.[40] Participants formed a heterogeneous group in order to provide researchers with varied, detailed information unique to the subject.[40] Individuals who are "expert" within a discipline but have diverse roles within its framework are helpful in research projects.

Eleven individuals from 4 hospitals (community and tertiary) in 2 southern Ontario cities (Toronto and Hamilton) along with prehospital personnel from Toronto Ambulance Services were invited to participate; all 11 accepted. One ED physician subsequently withdrew due to a scheduling conflict. The final composition was 2 ED nurses, 2 ED physicians (including an ED director), 1 paramedic, 1 ambulance dispatch coordinator, 2 ED nurse managers and 2 hospital administrators.

Expert panel preparation and proceedings

Participants were mailed preparatory materials 6 weeks prior to the panel meeting. Materials included summaries of selected studies[2] on ED overcrowding,[10,26,41–44] a schematic model of ED overcrowding (Figure 1), a comprehensive list of postulated determinants and a list of questions to guide the panellists when considering determinants.

The comprehensive list of postulated determinants was developed after an extensive review of the literature. Studies were selected by the principal investigator following a MEDLINE literature search from 1985 to 1999 using the key words "overcrowding," "emergency medical services" and "ambulance diversion" (as headings or text words as appropriate). Additional publications were sought by a manual search of the bibliographies of articles retrieved. We also reviewed the publication lists of 5 health services research institutes and retrieved all relevant publications. Finally, we requested unpublished reports or policy papers on overcrowding from the American College of Emergency Physicians and the Canadian Association of Emergency Physicians (CAEP). Media reports were not utilized for development of the comprehensive list of factors. Study summaries were prepared by a medical student not involved in the study.

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On the day the expert panel convened, members were asked to identify factors they believed to be important causes of ED overcrowding and to consider operational definitions of the problem. The starting point of discussion was a conceptual model (Fig. 1) of ED overcrowding that divided causes into 4 domains (i.e., community, patient, ED and hospital). The model was developed based on the literature review and was used to create a framework for

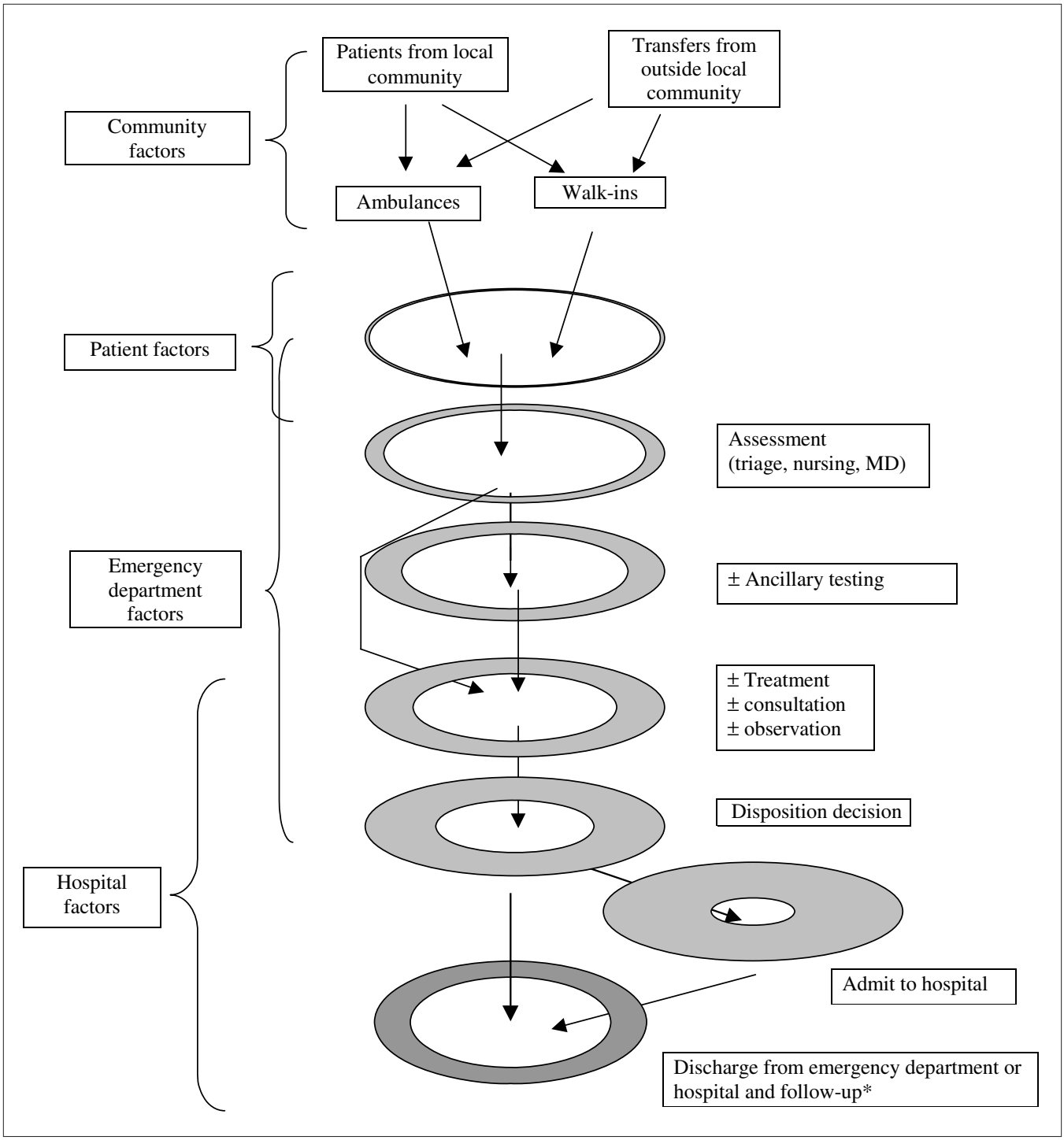

Fig. 1. Conceptual model of emergency department (ED) overcrowding and ambulance diversion, and the 4 groupings of causes. Each grey ring represents a constraint that may slow the process of care, and the ring thickness reflects the relative degree of delay it may cause.
***Community factors also play a role in determining how easily a patient is discharged from the ED or hospital.**

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the discussion, to categorize postulated determinants, and to ensure that the overall context remained clear while the experts discussed individual factors. For each domain, a list of specific factors was developed from prior literature. Panel members were encouraged to propose and discuss others factors or domains not listed. Factors were not retained if they were not believed to be important determinants, if the definition was very uncertain, or they exerted their impact through factors already included (e.g., inpatients discharge practices reflected in hospital bed occupancy rates). The experts were asked to identify an operational definition of ED overcrowding.

Responses that were particularly rich or novel were explored further. An experienced health services researcher facilitated the expert panel, another person observed the interaction among participants and made notes of important points, and a third managed tape changes and observed the proceedings. To minimize bias, the facilitator had no prior expertise in ED overcrowding issues, and the principal investigator did not participate in the discussions other than to occasionally clarify a few points.

The expert panel was not intended or expected to come to consensus on all factors; rather, the aim was to maximize participation and the input of ideas to provide as much information as possible to the research team. Proceedings were audiotaped with the permission of all participants, and confidentiality was ensured by not attributing comments to any participants in notes or the transcript (prepared by an independent transcriptionist). This study was exempt from research ethics board approval.

Analysis

A content analysis[45] was conducted: the notes and transcript were reviewed independently by the facilitator and the investigator for errors or bias, then reviewed again together for themes that would guide the research. Data were gathered in order to become sensitive to the issues, and common threads were organized into themes. Both researchers reviewed the data and then discussed the findings and their interpretation. Using more than 1 data analyst increases the consistency and reliability of the analysis, and researchers can be confident the information is representative.[46] Issues perceived at the study inception as important but not articulated by the panel may be rejected as marginal or personal, rather than generalizable. Issues that seem peripheral to the data can be debated until all members of the team are satisfied that the findings are representative. The information provided by members of the panel, including perspectives and meanings, is potentiated by these discussions.

Results

Community factors

The availability of alternate sources of primary care other than EDs was not retained as an important cause of overcrowding because ambulatory ED patients are "not the plug … [they don't] cause ambulance diversion." The types of ED patients leading to overcrowding are those who would be referred to the ED even if alternate sources of primary care are available (e.g., those with chest pair). Community education about local primary care resources was not retained as a factor, and patient preference for a specific ED was not retained because it applies to a minority of patients associated with a specific program (e.g., oncology). Seasonal outbreaks of infectious diseases were considered to cause sporadic increases in patient volumes, but this was not considered an important determinant of the overall increase in overcrowding.

There was strong support for these 3 community factors: access to home care resources, availability of alternate level of care beds (community-based) and the ambulance diversion status of nearby EDs (Table 1).

Patient factors

The following 6 patient factors were believed to be of major importance: age, urgency (based on triage code), discharge diagnosis, disposition, time and day of arrival in the ED. Combination of the first 4 factors was believed to be a good estimate of ED patient complexity. Other measures of patient comorbidity were not felt to add significant additional information. Day and time of day were retained as important predictors because many EDs have surges in volume based on these factors.

Emergency department factors

The total volume of patients presenting to EDs was not believed to be an important predictor because in many regions total volumes have actually decreased while overcrowding has worsened. However, intermittent, unpredictable surges in arrivals was felt to be an important factor leading to temporary overcrowding. Access to laboratory testing was not retained as a factor because it is believed to be adequate in most urban EDs. Similarly, staff morale was not felt to be an important factor behind increased frequency of ambulance diversion in urban areas. There was agreement that use of ambulance diversion is an attempt to control workload, but there was wide agreement that, in recent years, ambulance diversion is used according to established guidelines.

The following ED factors were retained by the expert

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panel: number of admitted patients held in the ED, intermittent surges in number of newly arriving ambulances and ambulatory patients, ED physician staffing (physician-hours/day), ED physician characteristics (i.e., individual physician variation in decision-making, use of ancillary resources and pace of work), ED nurse staffing (nurse-hours/day), ED nurse profiles (i.e., dedicated ED nurses versus substitutes), availability of ED social work and geriatric teams, response times to ED consult requests, the enforcement of ED consultation timeliness policies, ED design (e.g., number of stretchers and cardiac monitors, size of department), and availability of radiological imaging off-hours (especially ultrasound).

Hospital factors

Factors not retained included hospital policies regarding the sharing of in-patient beds assigned to different services, consultant physician characteristics, availability of consultants 7 days per week to discharge in-patients, an active in-patient discharge planning service, and the presence of a designated physician responsible for dealing with acute ED overcrowding.

The following hospital factors were retained as important predictors of overcrowding: number of staffed acute care beds (especially critical care and medical), overall bed occupancy rate, length of stay of admitted patients, and occupancy rate of acute beds by alternate level of care patients.

Operational definitions of urban ED overcrowding

Several possible operational definitions of ED overcrowding were discussed, including ambulance diversion, ED workload measures, length-of-stay (LOS) of admitted patients in

Table 1. Factors postulated* to be associated with emergency department (ED) ambulance diversion

Grouping	Factors retained	Factors not retained
Community	Local home care service availability Alternate level of care bed availability Nearby EDs diverting ambulances	Alternate sources primary care Patient preference for ED Ambulance preference for ED Evening/night closures of nearby EDs Weather or season related Community education about ED and local primary care
Patient	Age Urgency (Triage code) Discharge diagnosis Disposition Time of day Day of week	Co-morbidities/complexity Distance from hospital to home
Emergency department	No. of admitted patients held in the ED Intermittent surges in no. of newly arriving ambulance and ambulatory patients ED physician staffing (physician-hours/day) ED physician characteristics ED nurse staffing (nurse–hours/day) ED nurse profile (dedicated ED nurses or fill-in/agency) Availability of social work and geriatric teams in the ED ED consult response times ED consult policies ED design (no. of stretchers and monitors, size of department) Access to radiological tests off-hours	Total volume of ED visits Access to laboratory testing Availability of consultants to ED (24/7, other) Staff morale
Hospital	Number of critical care and acute hospital beds (especially medical) Overall bed occupancy rate In-hospital length of stay Occupancy rate of acute beds by alternate level of care patients	Distribution of hospital beds by service Physician managed admission Consultant physician characteristics Availability of consultants 7 d/wk to discharge in-patients Active in-patient and ED discharge planning Hospital bed-sharing policies Physician responsible for dealing with acute ED overcrowding situations Hospital nursing staffing (non-ED) Temporary bed closures, reduced staffing related to season

*Includes factors proposed by the research team initially or spontaneously by panel members

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the ED, patients with urgent triage codes who leave without being seen, average times before being seen by a nurse or physician (stratified by triage score), and occupancy rate of ED stretchers. Panel members expressed the view that workload measures alone were inadequate because overcrowding reflects an imbalance between workload and resources and not simply increased workload alone. Indicators such as LOS may be useful, although it may not differentiate between periods of more severe overcrowding that compromise the ability to care for newly arriving critically ill patients. The experts believed that ambulance diversion was an appropriate and readily measured proxy for ED overcrowding in urban areas. It was considered an objective measure that, in the great majority of cases, was invoked according to standard guidelines in situations of significant ED overcrowding.

Discussion

We have clarified the conceptual framework of ED overcrowding by developing an operational definition and eliminating 21 of 46 factors suggested in the literature as potentially important determinants. The panel highlighted several factors it retained as particularly important overcrowding determinants, and concluded that ambulance diversion was an appropriate definition and proxy measure of urban ED overcrowding.

One factor not retained by the expert panel as a determinant was access to primary care. In settings of universal medical insurance, such as exist in Canada, restricted access to primary care was not considered an important determinant of overcrowding because patients whose problems can be managed in primary care settings were not believed to be the ones leading to overcrowding. This factor has been postulated in US studies,[22,36,47] but not in a Canadian report,[8] which may reflect differences between health care systems or definitions of overcrowding. For instance, if overcrowding is taken to mean "increased volume of patients seeking emergency care," then poor access to primary care may well be an important factor, without necessarily compromising the EDs ability to treat acutely ill patients.

For similar reasons, the panel also did not retain influenza outbreaks as an important determinant. One study[48] has suggested that seasonal outbreaks exacerbate hospital overcrowding and may also contribute to ED overcrowding. A second study examined the relationship between influenza outbreaks and ED overcrowding and found they were associated with brief exacerbations.[49]

The total volume of patients was believed to be an important determinant only if significant increases were occurring over time. In Canada, evidence suggests that although total ED visits across regions have been stable or declining slightly in recent years,[2,50] hospital closures and restructuring have resulted in increased average volume per site at remaining EDs.[50] In contrast, US studies show an increasing trend in overall ED utilization.[3,51] The panel also postulated that the rate of arrival of ED patients can contribute to overcrowding even in the absence of an overall increase. An uneven rate of arrival was believed to contribute to overcrowding, especially if staffing was not appropriately distributed to cover peak periods. This determinant has not previously been documented in the literature.

Admitted patients held in the ED, the availability of home care services and alternate level of care beds in the community were all believed to be very important determinants; these conclusions agree with previous observations.[42] Patient characteristics were also considered important determinants. Only 1 study[43] looked at the impact of patient factors, and it found that patient age, sex, day and time of arrival, acuity and comorbidity were significant predictors of ED LOS. Numerous reports suggest that older and sicker patients contribute to overcrowding by virtue of higher acuity and admission rates.[2,8,22] The panel concluded that an ED patient's complexity could be adequately characterized by a combination of age, urgency (triage code), discharge diagnosis and disposition decision.

As in previous reports,[2,8,22,52,53] the experts believed that the single most important hospital factor was the availability of staffed acute and intensive care beds. Other factors relating to the administrative control of beds, admission and discharge policies, and hospital nurse staffing were either not felt to be significant contributors, or did so only via their impact on staffed hospital bed availability.

The definition of ED overcrowding is elusive. CAEP[8] defines it as "a situation in which demand for service exceeds the ability to provide care within a reasonable time, causing physicians and nurses to be unable to provide quality care." Although this definition has intuitive appeal, it is difficult to operationalize for research purposes. Similarly, a survey of US ED directors suggested 5 different possible definitions: patients wait >60 minutes to see physician; all ED beds filled >6 hours/day; patients placed in hallways >6 hours/day; emergency physicians feel rushed >6 hours/day; and waiting room filled >6 hours/day.[32] Each of these is problematic: some are difficult to measure (e.g., sensation of being rushed) and others do not clearly represent a threat to timely and quality emergency care (e.g., a full waiting room or a patient placed in a hallway for >6 hours). Workload measures alone are likely insufficient, since overcrowding represents a situation where the workload exceeds the resources available, and the indicator must capture both aspects of the problem.

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Our panel considered ambulance diversion an appropriate operational definition of urban ED overcrowding because it reflects the ability of an ED to fulfill its prime mandate: the provision of rapid medical care to acutely ill patients. Since this depends on rapid ambulance transport to an ED with available resources, delays or disruption in this link may compromise health in the community.[2,7,19,20,41,54] This definition is readily measured, is supported by other studies,[10,25,41,55] and reflects the practices of some governments and hospital associations.[2]

Limitations and future questions

Our study relied on "key informants" — individuals with differing backgrounds and experiences willing to share their experiences.[39] It is possible the panel was not sufficiently inclusive or geographically diverse and that other medical specialists, patient-advocates or government officials might have brought important information to the group. As well, the selection of individuals may be open to some inclusion biases, but the process was designed to eliminate these as much as possible. Our sample size was consistent with most qualitative work, and participants formed a heterogeneous group, therefore providing varied and detailed information unique to the topic.[46] To create a heterogeneous group we followed a sampling strategy of maximum variation; this promoted the emergence of common thoughts and ideas not attributable simply to the homogeneity of the group.[40]

It is unclear how broadly our results are generalizable. Although many of the factors we identified have been suggested as causes in North America, different factors may play greater or lesser roles in other emergency medical systems. For example, differences in access to primary care or in trends in patient volumes may result in differences in overcrowding determinants between Canada and the US.[2,24] Furthermore, our results reflect the experience in urban areas and are likely less readily generalizable to rural settings. Only prospective studies in different settings can definitively answer this question. The use of ambulance diversion as a definition and measure of ED overcrowding will only be valid in communities with systems for ambulance diversion, and comparisons will be sensible only if diversions are invoked based on similar criteria. No single definition is likely to fulfill perfectly the divergent goals of capturing all facets of overcrowding, being readily measured and widely generalizable. Our panel was held in the fall of 1999, and it is possible that the importance of some factors relating to overcrowding will have changed over time. However, this is unlikely because major changes happen slowly in complex systems.

Research on a complex administrative problem, like that on a complex disease, must begin by determining key definitions, concepts and parameters. Our study has done so by way of informed expert opinion, a focused approach followed in much of health services research. Results are efficiently gathered and often insightful, yet they may leave little room for serendipitous findings or sudden reversals of theory. Hence, it is possible that in laying the groundwork for future research, our results may eventually be challenged. Nonetheless, we have succeeded in codifying current knowledge about ED overcrowding.

Conclusions

Emergency department overcrowding is a serious and growing problem in many countries,[7,8,18,24,25,32,56–58] but the widespread attention paid to the problem has resulted in more rhetoric than research. CAEP has called for a scientific approach to the problem,[8] and we believe that by carefully evaluating determinants and helping to standardize definitions, our results will help guide future researchers and provide a bridge between individual opinion and rigorous evidence.

Competing interests: None declared.

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