Emergency Department Overcrowding in Asia

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What is ED Overcrowding?


D

Where I work……

“I shall not today attempt further to define the kinds of material I understand to be embraced within that shorthand description ["hard-core pornography"]; and perhaps I could never succeed in intelligibly doing so.

But I know it when I see it, and the motion picture involved in this case is not that.”

The definition

“a situation in which the demand for emergency services exceeds the ability to provide quality care within a reasonable time”

Canadian Association of Emergency Physicians and National Emergency Nurses Affiliation. Joint position statement on emergency department overcrowding. CJEM. 2001;3:82-4.

ACAD EMERG MED • October 2004, Vol. 11, No. 10 • www.aemj.org

BRIEF REPORTS

Care in the Emergency Department: How Crowded Is Overcrowded?

Ula Hwang, MD, MPH, John Concato, MD, MS, MPH

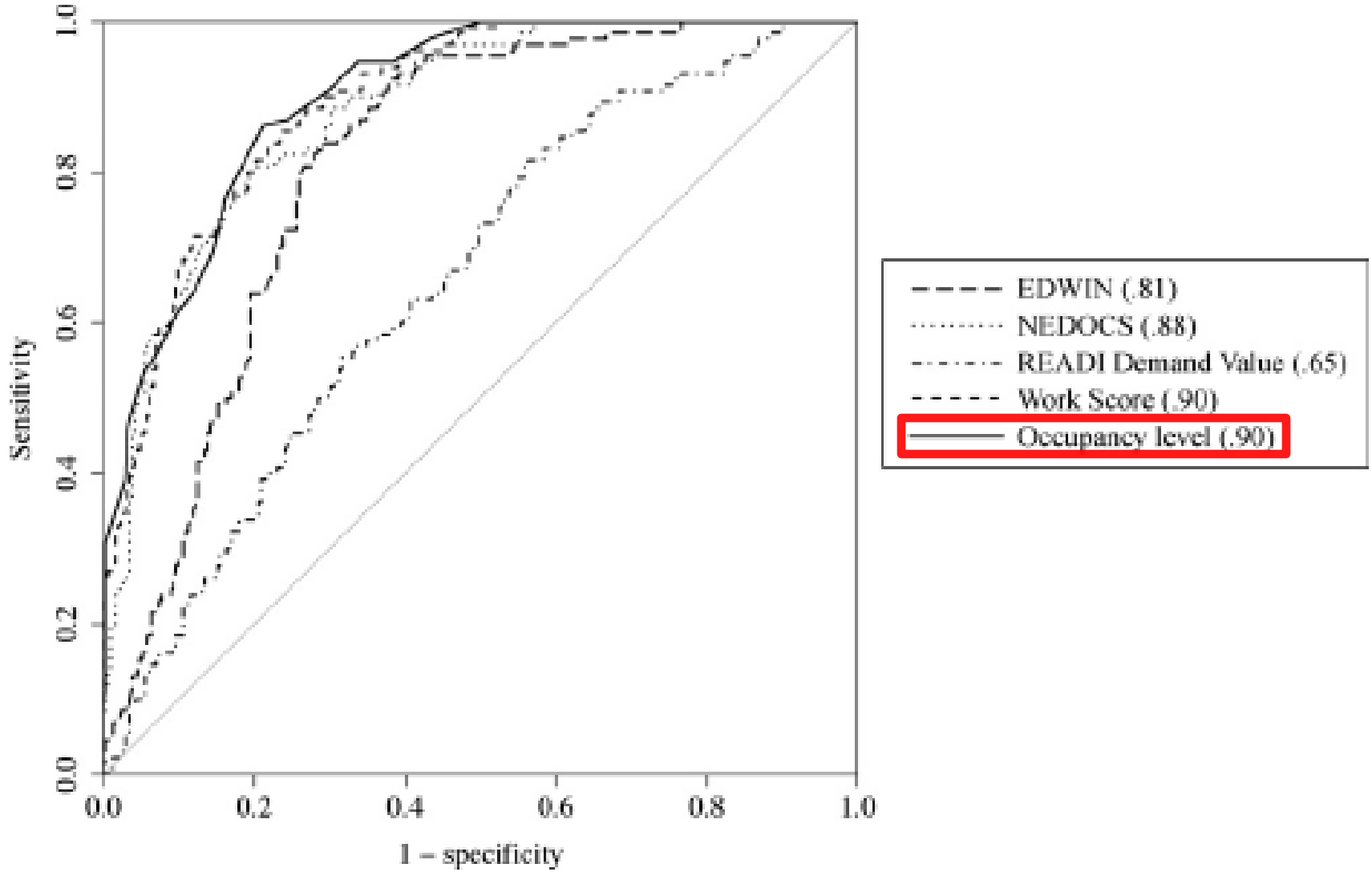
Crowding Index

- **Real-time Emergency Analysis of Demand Indicators (READI)**
  - **DV = (BR + PR) X AR** *Reeder et al. Acad Emerg Med. 2001;8:1070-1074.*
- **Emergency Department Work Index(EDWIN)**
  - $\sum n_i t_i/(N_a \text{ X } (B_t - P_{board})$ *Bernstein et al. Acad Emerg Med. 2003;10:938-942.*
- **National Emergency Department Overcrowding Scale (NEDOCS)**
  - **(Pbed/Bt) X 85.8 + (Padmit/Bh) X 600 + Wtime X 5.64 + Atime X 0.93 + Rn X13.4 – 20**

Weiss et al. Acad Emerg Med. 2004;11:38-50.

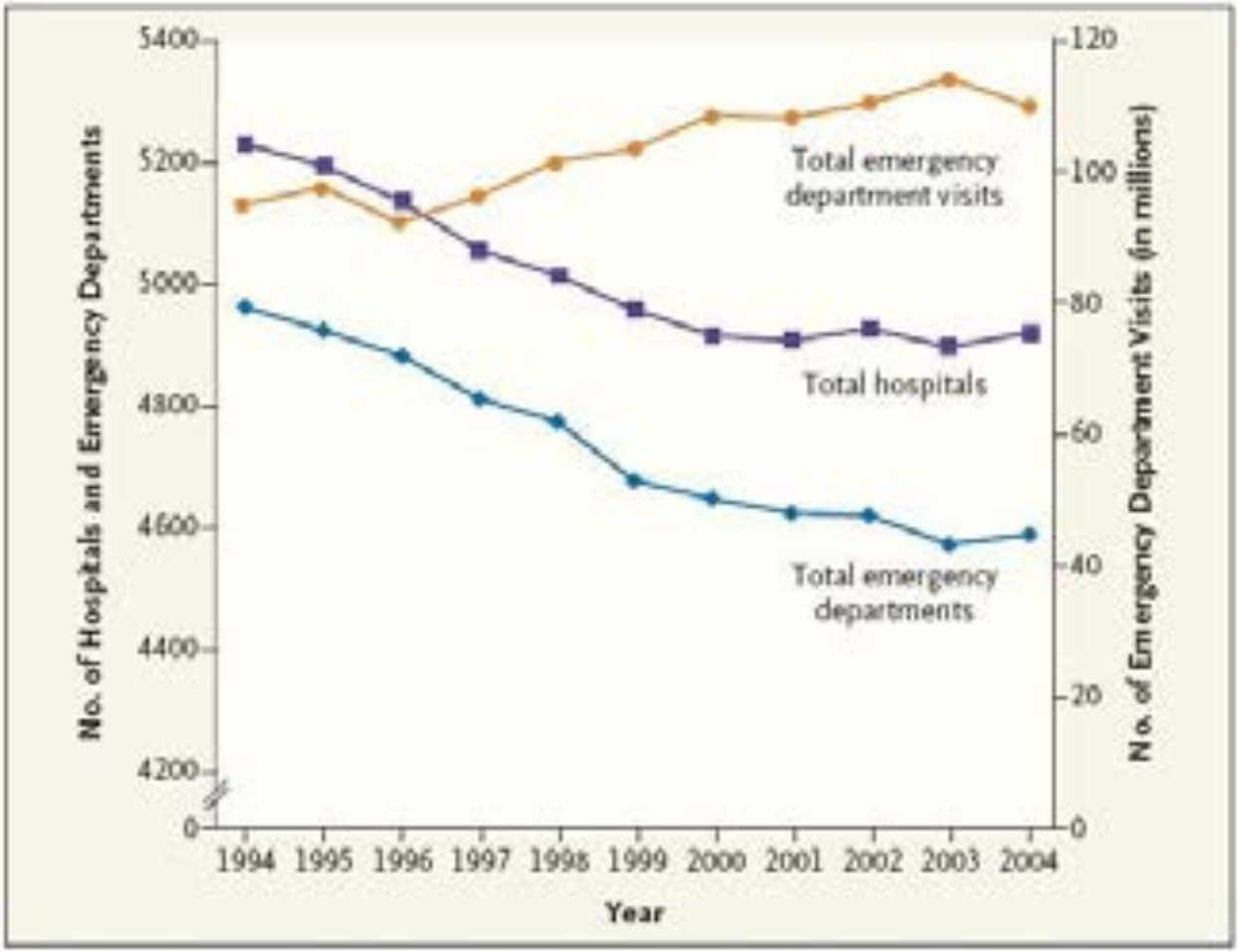
- **Work Score**
  - ***3.23 X Pwait/Bt + 0.097 X ∑ niti/Nn + 10.92 X Pboard/Bt***

Epstein et al. Acad Emerg Med. 2006;13:421-426.



Hoot et al. Ann Emerg Med 2007;49:747-55.

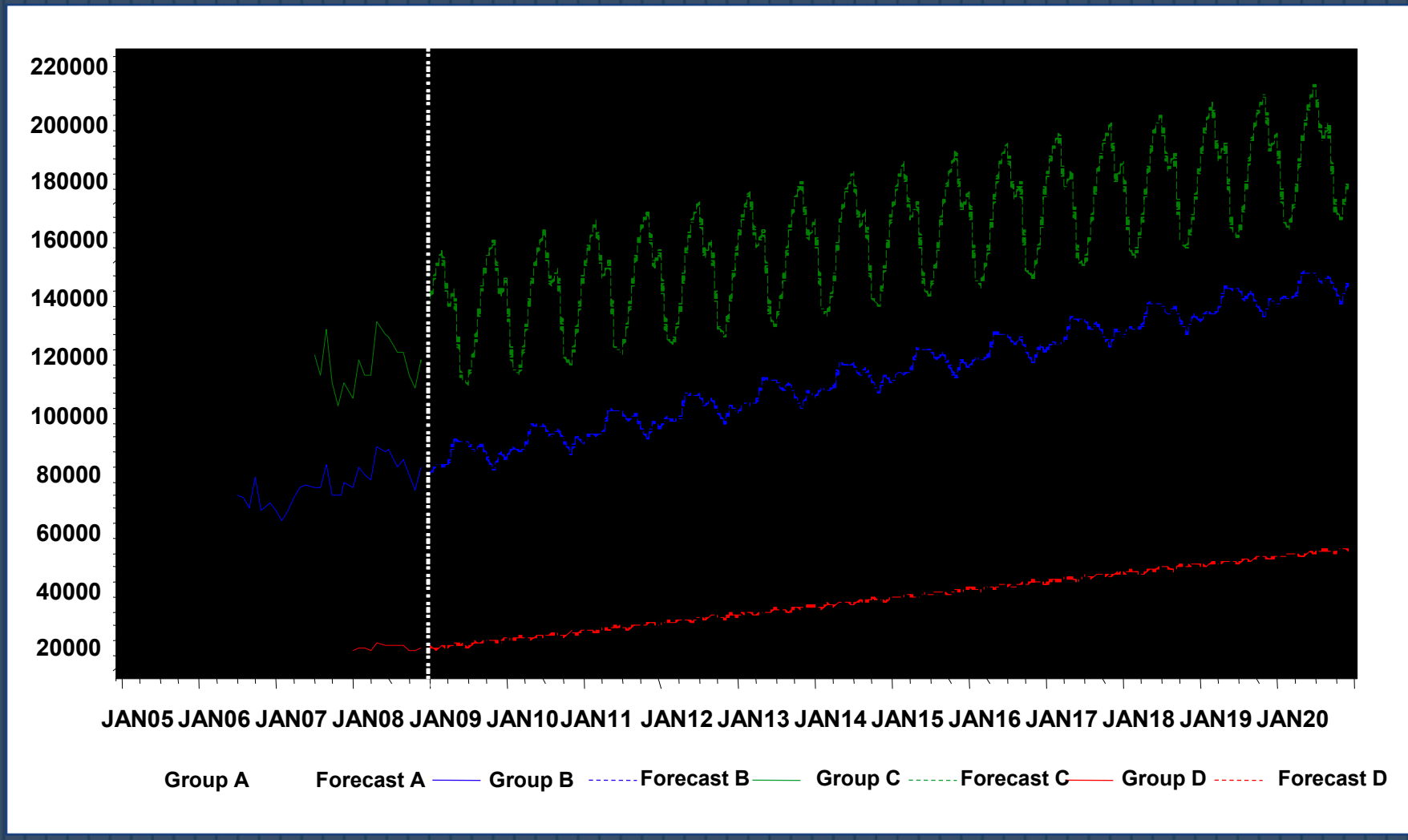
Why is it happening?



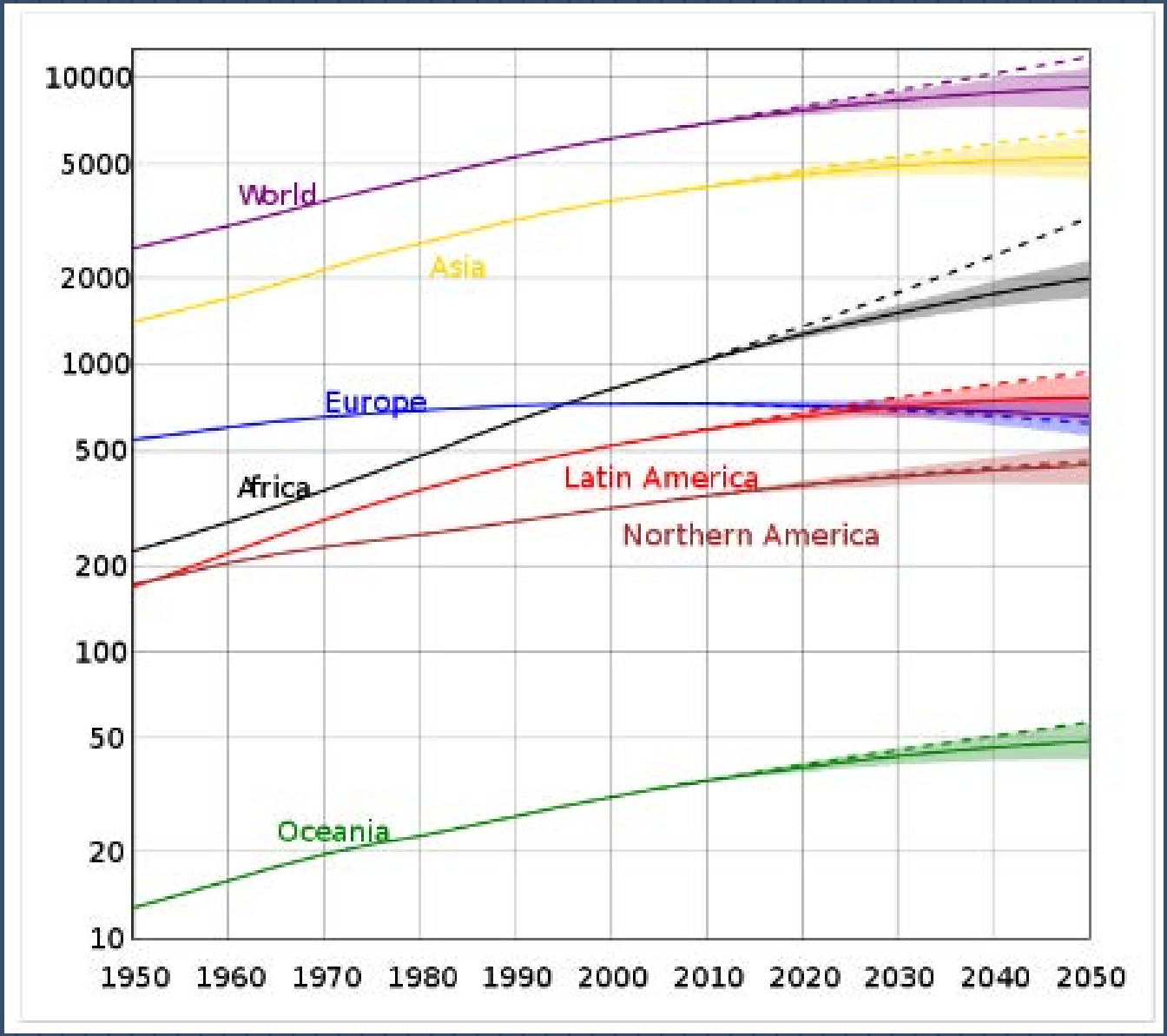
Trends in Emergency Department Visits, Number of Hospitals, and Number of Emergency Departments in the United States, 1994–2004.

Visits to the emergency department represent about 10% of all outpatient visits in the United States. Data are from the National Health Policy Forum.

Kellermann AL. Crisis in the emergency department. NEJM 2006;355(13):1300-3.



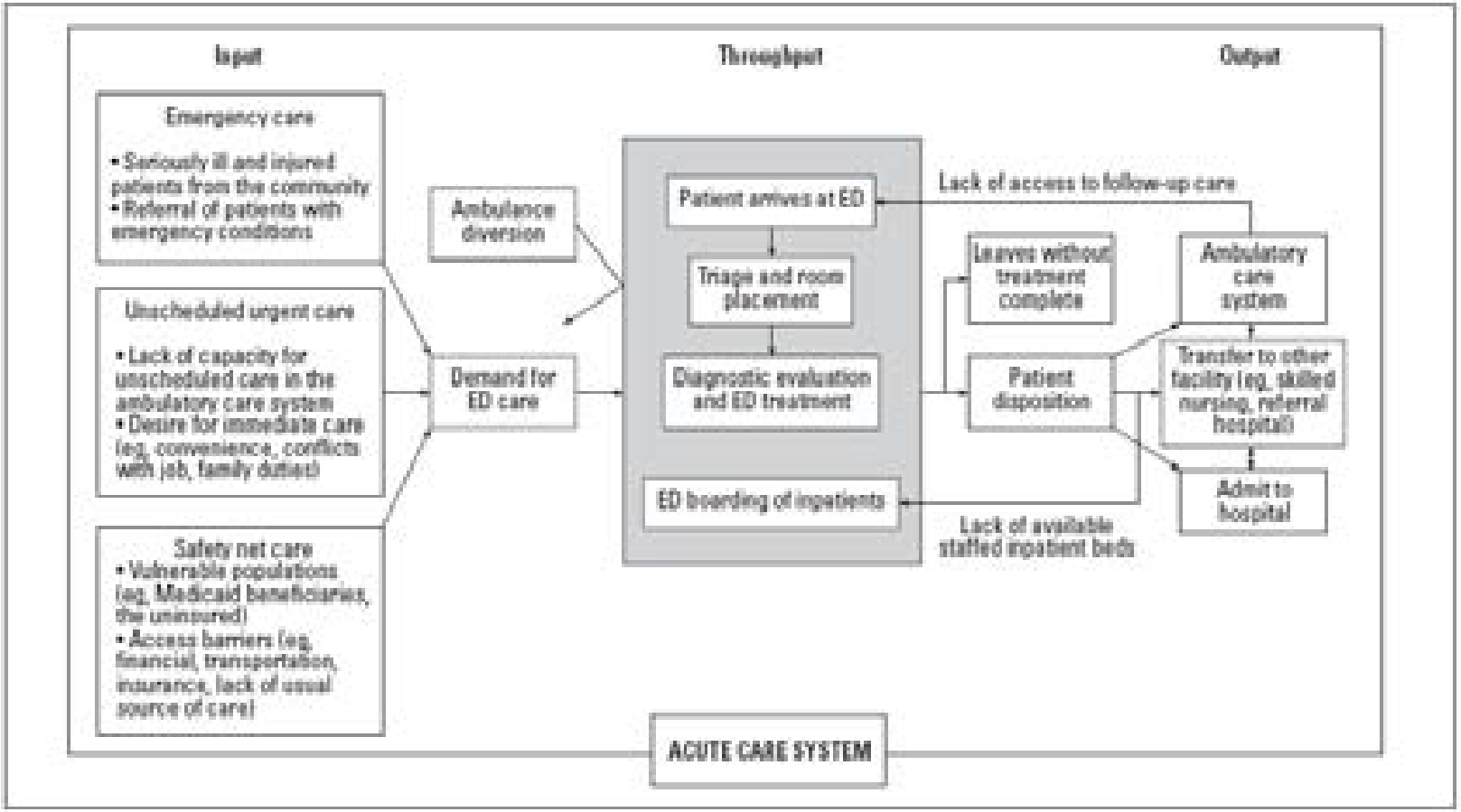
JE Kim et al. Predicting the number of emergency patients in 2020. Presented at ACEM 2009, Busan.



David Sasaki. But What about shrinking cities? – adopted from http://www.80plus1.org/blog/but-what-about-shrinking-cities

Figure 2.

The input-throughput-output conceptual model of ED crowding.



Asplin et al. A conceptual model of emergency department crowding. Ann Emerg Med 2003;42:173-80.

Input factors

- Non urgent visits
  - "Primary Care and Public Emergency Department Overcrowding"

Am J Public Health 1993;83:372-8.

- Frequent flyers
  - "The heavies repeat users of an inner city emergency department are not general practice patients"

Emerg Med 2003;15:322-9.

- "Influenza season"
  - "Community influenza outbreaks and emergency department ambulance diversion"

Ann Emerg Med 2004;44:61-7.

TABLE 4—Predictors of Appropriate Emergency Department Use

	Coefficient	Standard Error	Odds Ratio (95% CI)
Regular source of care (yes = 1)	0.871*	0.305	2.390 (1.32, 4.34)
Employed	0.097	0.337	1.100 (0.57, 2.13)
No insurance	−0.082	0.405	0.921 (0.42, 2.04)
Medicaid	−0.216	0.533	0.805 (0.28, 2.29)
Private or other insurance	Referent		
Age (y)	−0.002	0.011	0.998 (0.98, 1.02)
Sex (male = 1)	−0.319	0.299	0.727 (0.40, 1.31)
General health	−0.006	0.006	0.998 (0.98, 1.01)
Income	0.045	0.122	1.046 (0.82, 1.33)
Race (White = 1)	0.451	0.301	1.570 (0.86, 2.87)
Intercept	−1.976		

Note. The dependent variable is acuity score = 2. n = 489; $\chi^2 = 14.1$ ($df = 10$); −2logL = 338.01.
CI = confidence interval.
*$P < .01$.

Grumbach et al. Am J Public Health 1993;83:372-8.

Input factors

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Am J Public Health 1993;83:372-8.

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Table 1. Demographic data and characteristics of frequent and non-frequent attenders

Characteristic	Frequent attenders (n = 12 940)	Other patients (n = 110 905) (non-frequent attenders)	P-value
Demographic data			
Age median (range)	50 years (21–95)	43 years (0–103)	< 0.001
Sex % female [95% CI]	43.5 [42.6, 44.3]	38.5 [38.2 38.8]	< 0.001
Characteristics (percent [95% CI])			
Referred by GP or community provider	11.4 [10.9, 12.0]	22.0 [21.7, 22.2]	< 0.001
Admitted/transferred	20.1 [19.4, 20.8]	26.4 [26.2, 26.7]	< 0.001
ED observation > 4 h	17.1 [16.5, 17.8]	2.3 [2.2, 2.4]	< 0.001
Home within 4 h from time seen	48.3 [47.4, 49.2]	64.5 [64.2, 64.8]	< 0.001
Self discharge (includes left before being seen)	14.5 [13.9, 15.1]	6.7 [6.5, 6.8]	< 0.001

Table 2. Percentage of patients in each triage category: frequent attenders compared to all other St. Vincent's Hospital Melbourne (SVHM) ED patients and statewide averages. Percentages shown with 95% confidence intervals

Triage category*	% of presentations by frequent attenders (12 940 presentations)	Percent of presentations by remaining patients (153 546 presentations)	Statewide ED triage category†
1	1.0 [0.8, 1.1]	1.6 [1.54, 1.66]	0.90 [0.87, 0.92]
2	6.0 [5.6, 6.4]	7.6 [7.47, 7.73]	5.2 [5.14, 5.26]
3	28.1 [27.3, 28.9]	38.1 [37.9, 38.3]	25.3 [25.2, 25.4]
4	48.7 [47.8, 49.6]	46.3 [46.1, 46.5]	47.6 [47.5, 47.7]
5	16.2 [15.6, 16.8]	6.4 [6.28, 6.52]	21.0 [20.9, 21.1]

**Australasian Triage Scale; †Source: Department of Human Services. Hospital Services Reports, 1999 State of Victoria sample of 483 389. Available from URL: http://dhs.vic.gov.au/ahs/pub.htm/*

Dent et al. Emerg Med 2003;15:322-9.

Input factors

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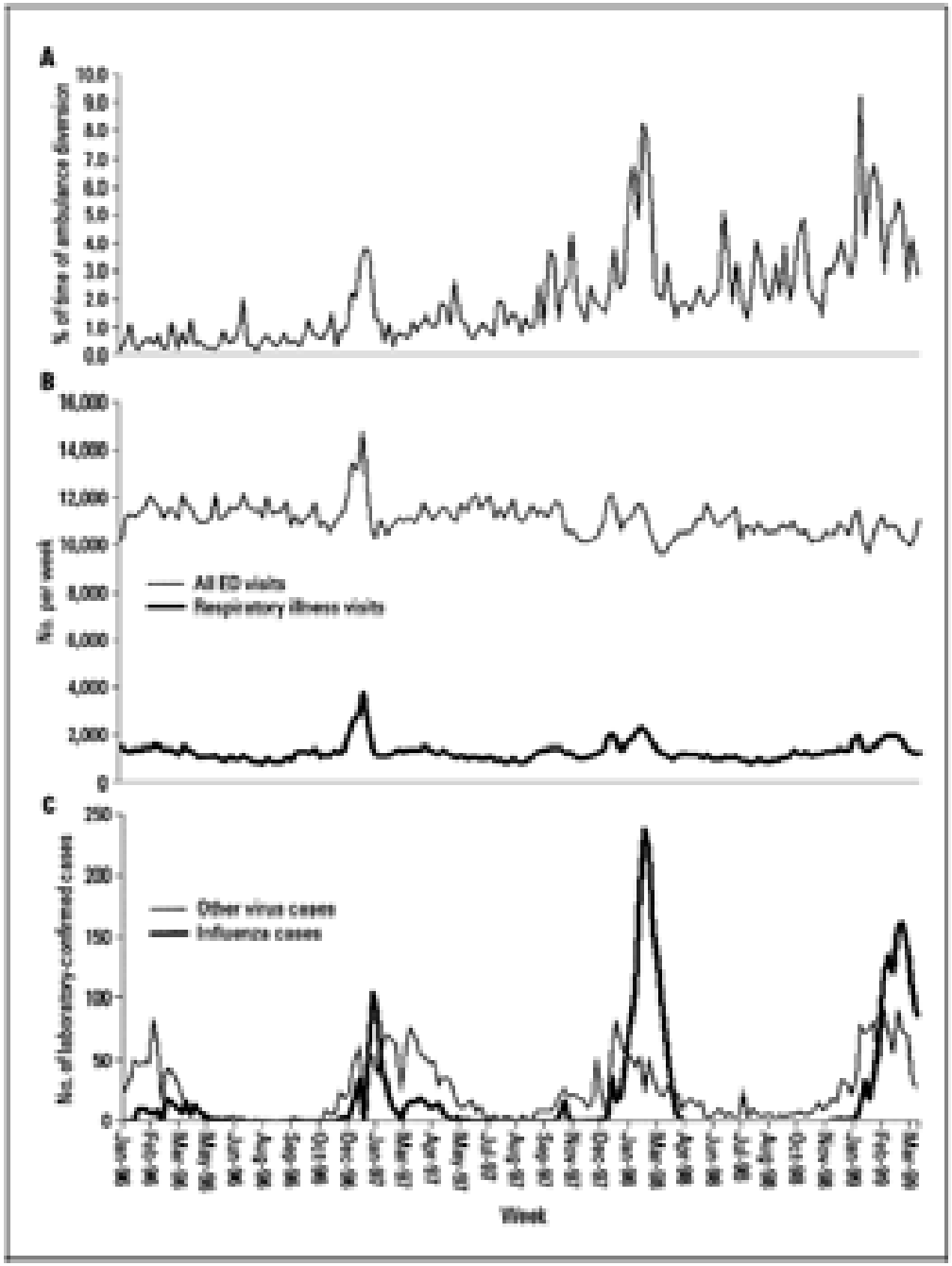
Figure.

A, Time series of weekly ED ambulance diversion (percentage of time on critical-care bypass averaged across all EDs); B, weekly number of visits at all EDs for all complaints and specific respiratory illnesses (pneumonia, acute bronchitis, chronic lung disease exacerbations, congestive heart failure, and acute upper respiratory infections); and C, weekly number of laboratory-confirmed influenza and other respiratory virus cases in the community.



Shull et al. Ann Emerg Med 2004;44:61-7.

Throughput factors

Table 2.
Independent predictors for hospital characteristics of mean waiting times[A] in minutes.[T]

Predictors	Model Adjusting for Hospital Characteristics Only (N=1,167)[B]		Model Adjusting for ED Characteristics Only (N=1,167)[B]		Model Adjusting for Both Hospital and ED Characteristics (N=1,167)	
	Coefficient[C]	*P* Value	Coefficient	*P* Value	Coefficient	*P* Value
Hospital characteristics						
Per capita income (in $10,000) in hospital zip code[E]	−10.1	.02	—	—	—	NS[D]
Percentage of total 1999 visits that were nonurgent[E]	—	NS[D]	—	—	−0.5	.002
ED characteristics						
Ratio of triage nurses to ED patients[E]	—	—	—	NS[D]	−28.8	.02
Ratio of emergency physicians to ED patients[E]	—	—	—	NS[D]	−62.0	.04
Ratio of ED patients waiting for inpatient beds to ED patients[E]	—	—	—	NS[D]	−64.1	.03

[A] Waiting time is defined as the interval from ED arrival to first contact with an emergency physician.

[B] Each model was adjusted for hospital characteristics (ownership, proximity to closed ED, teaching status, trauma designation, per capita income of residents within the hospital zip code, percentage of residents >65 years within the hospital zip code, percentage of urban areas within the hospital zip code, annual ED visits, and average annual patient severity level), ED characteristics (ratios of emergency physicians to patients, emergency nurses to patients, ED beds to patients, triage nurses to ED patients, patients waiting for on-call physicians to all ED patients, and patients waiting for inpatient beds to all ED patients), or both.

[C] We include only those visits made by study patients for whom complete data were available.

[D] Values are expressed as regression coefficients. Coefficients represent the mean number of additional minutes patients waited beyond the average for all EDs (56.6 minutes). For example, for each $10,000 decrement in per capita income in that zip code, waiting times were 10.1 minutes longer.

[E] NS indicates $P \geq .05$. Only comparisons with $P < .05$ are presented.

Lambe et al. Ann Emerg Med. 2003;41:35-44.

Output factors

- Inpatient boarding
  - "Access block causes emergency department overcrowding and ambulance diversion in Perth, Western Australia"

Emerg Med J. 2005;22:351-4.

- Hospital bed shortages
  - "Emergency department overcrowding following systematic hospital restructuring- trends at twenty hospitals over ten years"

Acad Emerg Med. 2001;8:1037-43.

  - "The effect of hospital occupancy on emergency department length of stay and patient disposition"

Acad Emerg Med. 2003;10:127-33.

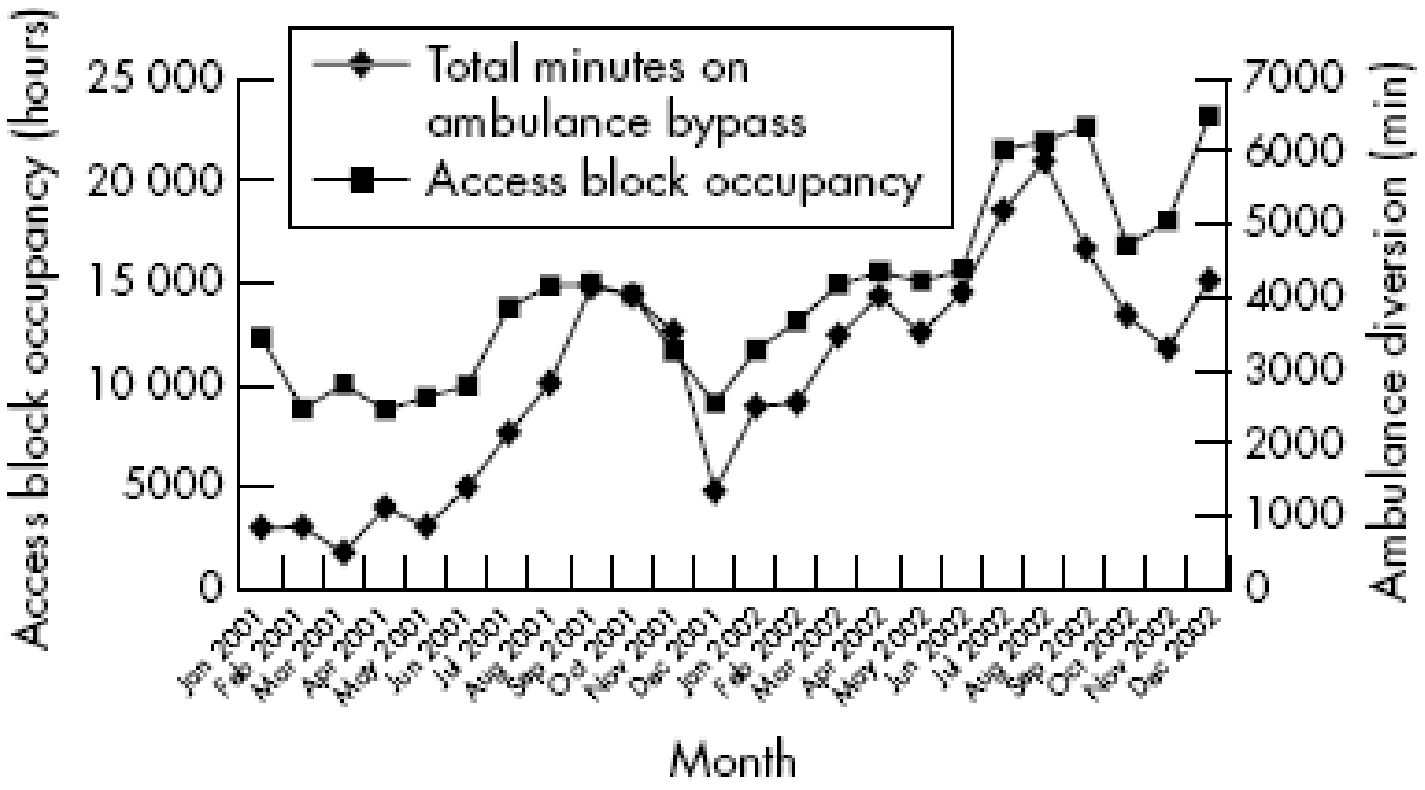


Figure 2 Relationship between access blocked patient occupancy and ambulance diversion.

Fatovich et al. Emerg Med J. 2005;22:351-4.

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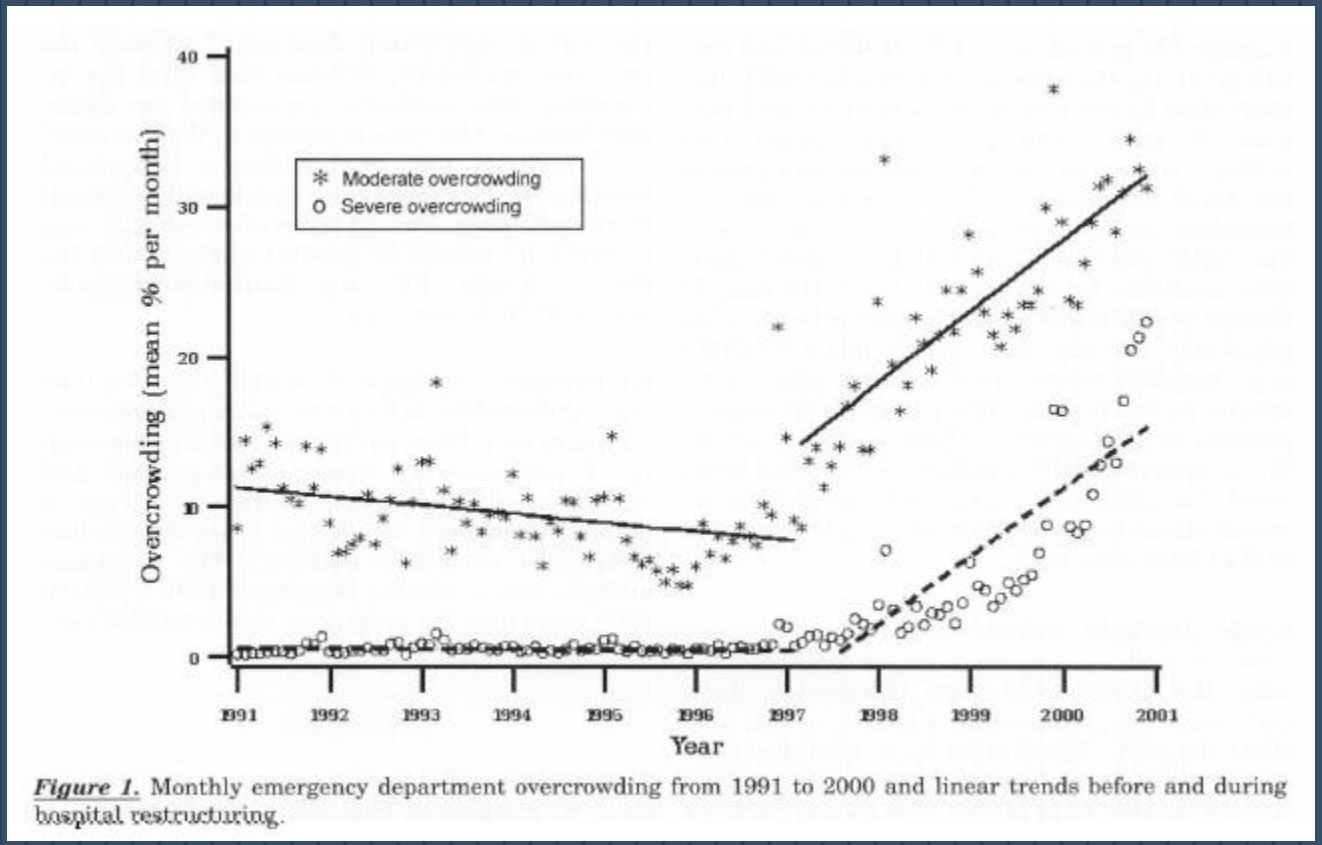


Figure 1. Monthly emergency department overcrowding from 1991 to 2000 and linear trends before and during hospital restructuring.

Schull et al. Acad Emerg Med. 2001;8:1037-43.

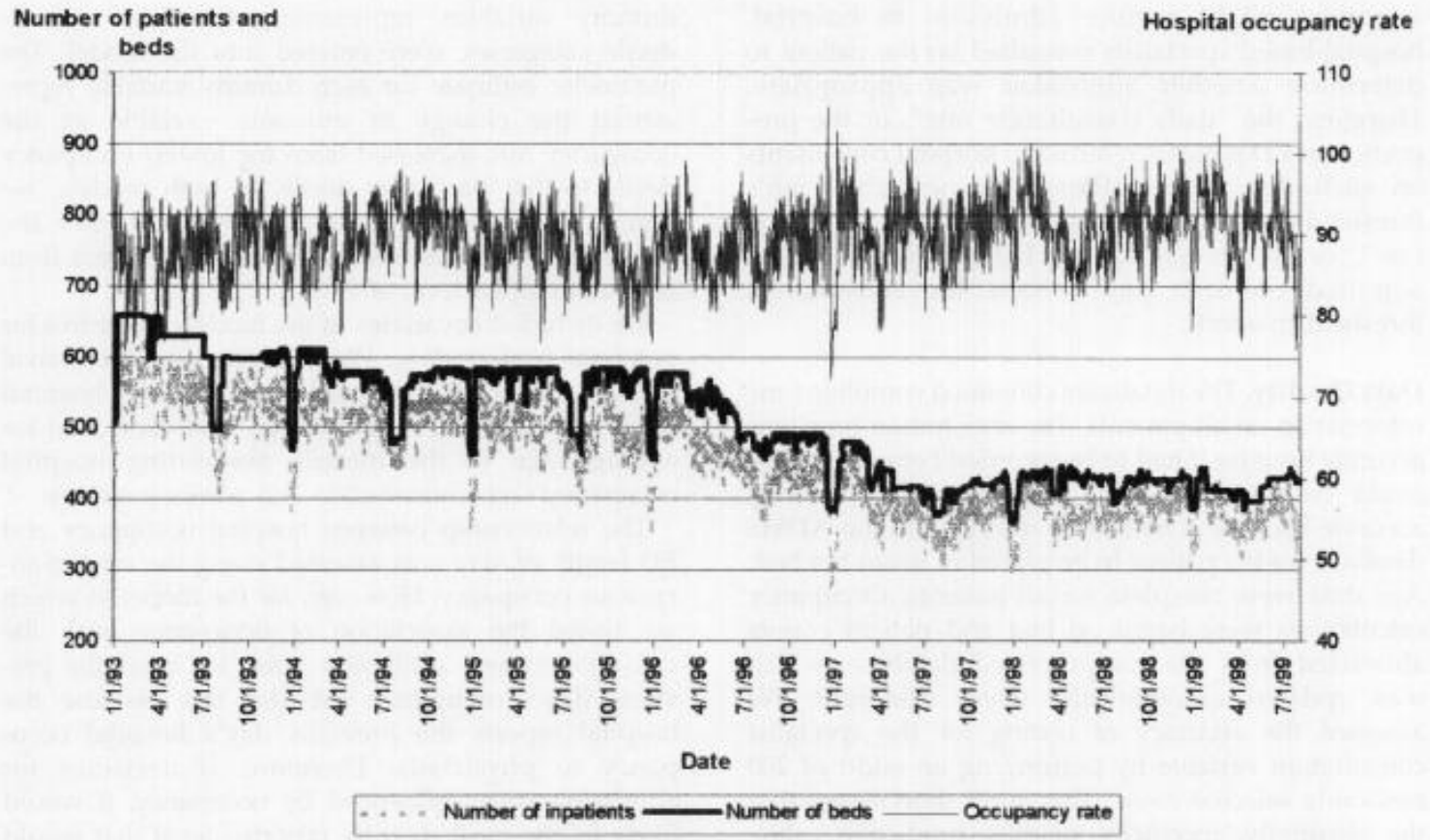


Figure 1. Time series of the daily numbers of patients and beds, and hospital occupancy at the study hospital, 1993–1999. This figure demonstrates the unsmoothed time series of daily occupancy, and the number of inpatients and beds. The study period is presented along the horizontal axis. For each study day, the number of beds and patients are presented using the left vertical axis. The occupancy rate (number of patients divided by the number of available beds) is presented using the right vertical axis.

Froster et al. Acad Emerg Med. 2003;10:127-33.

Why is it so bad?


It surely looks bad enough!

Adverse effects of Overcrowding

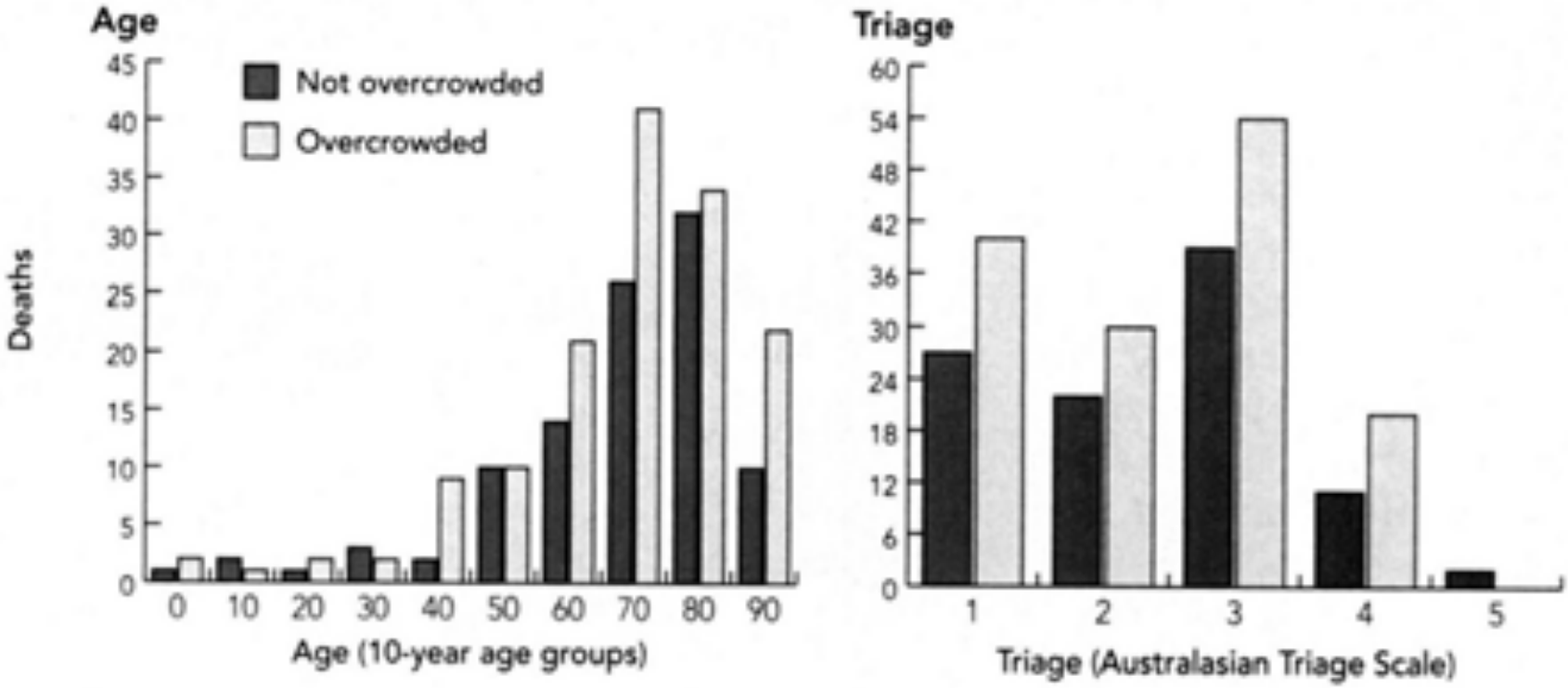
- Increase in mortality
  - "Increase in mortality at 10 days associated with emergency department overcrowding"

Med J Aust. 2006;183:21-6.

  - "Emergency department overcrowding effects on the survival of pediatric patients"
- Decrease in Treatment quality
  - "Emergency department crowding and thrombolysis delays in acute myocardial infarction"

Ann Emerg Med. 2004;44:577-85.

4 Distribution of 10-day mortality by subgroup. The *y* axis represents the actual number of deaths in each subgroup in overcrowded (OC) and not overcrowded (NOC) cohorts



There were 7% more presentations and 43% more deaths in the OC cohort compared with the NOC cohort. ◆

Richardson. Med J Aust. 2006;183:21-6.

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    Med J Aust. 2006;183:21-6.
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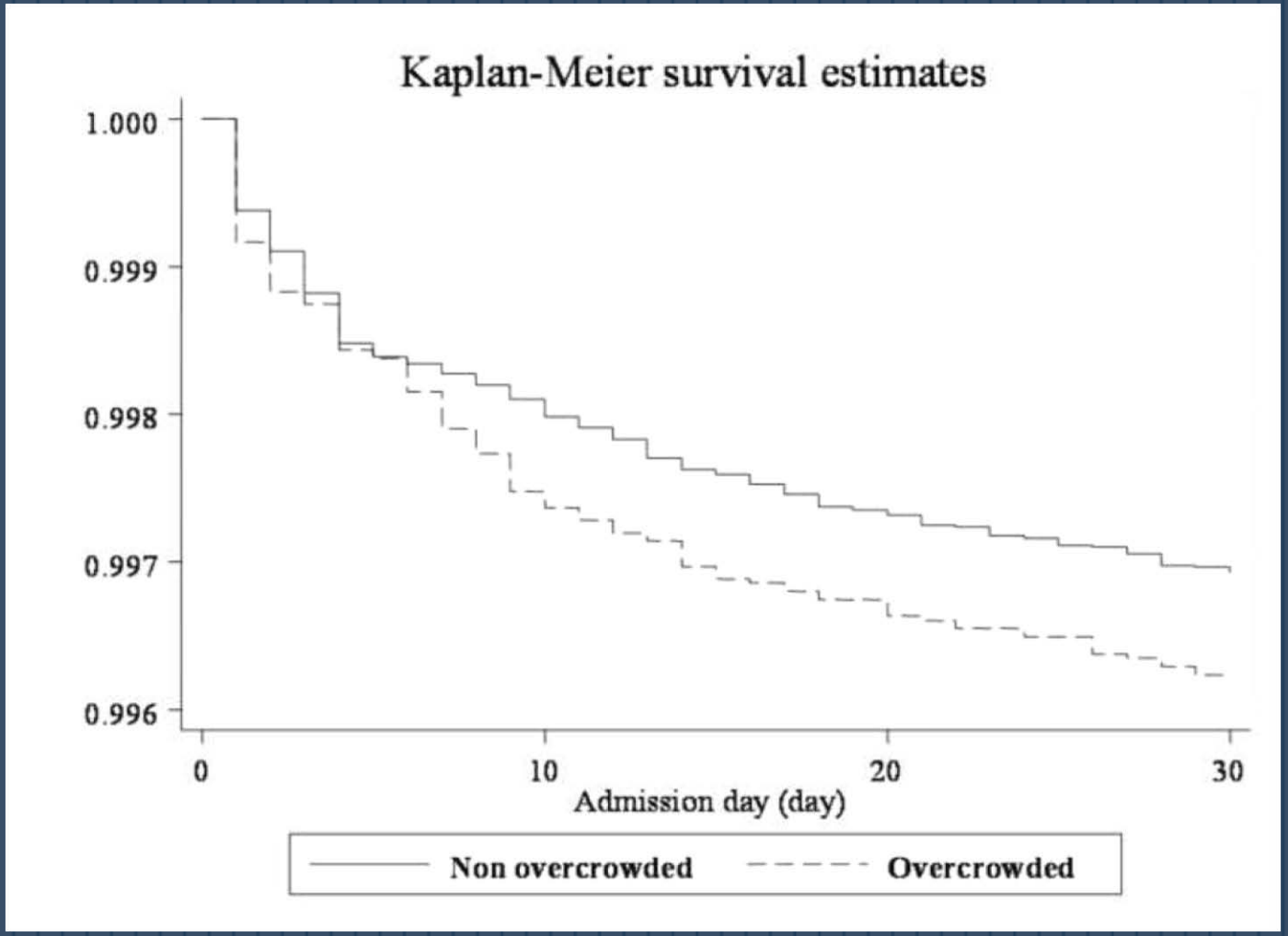
Kaplan-Meier survival estimates
1.000
0.999
0.998
0.997
0.996
0
10
20
30
Admission day (day)
Non overcrowded
Overcrowded

Adverse effects of Overcrowding

- Increase in mortality
  - "Increase in mortality at 10 days associated with emergency department overcrowding"

    Med J Aust. 2006;183:21-6.
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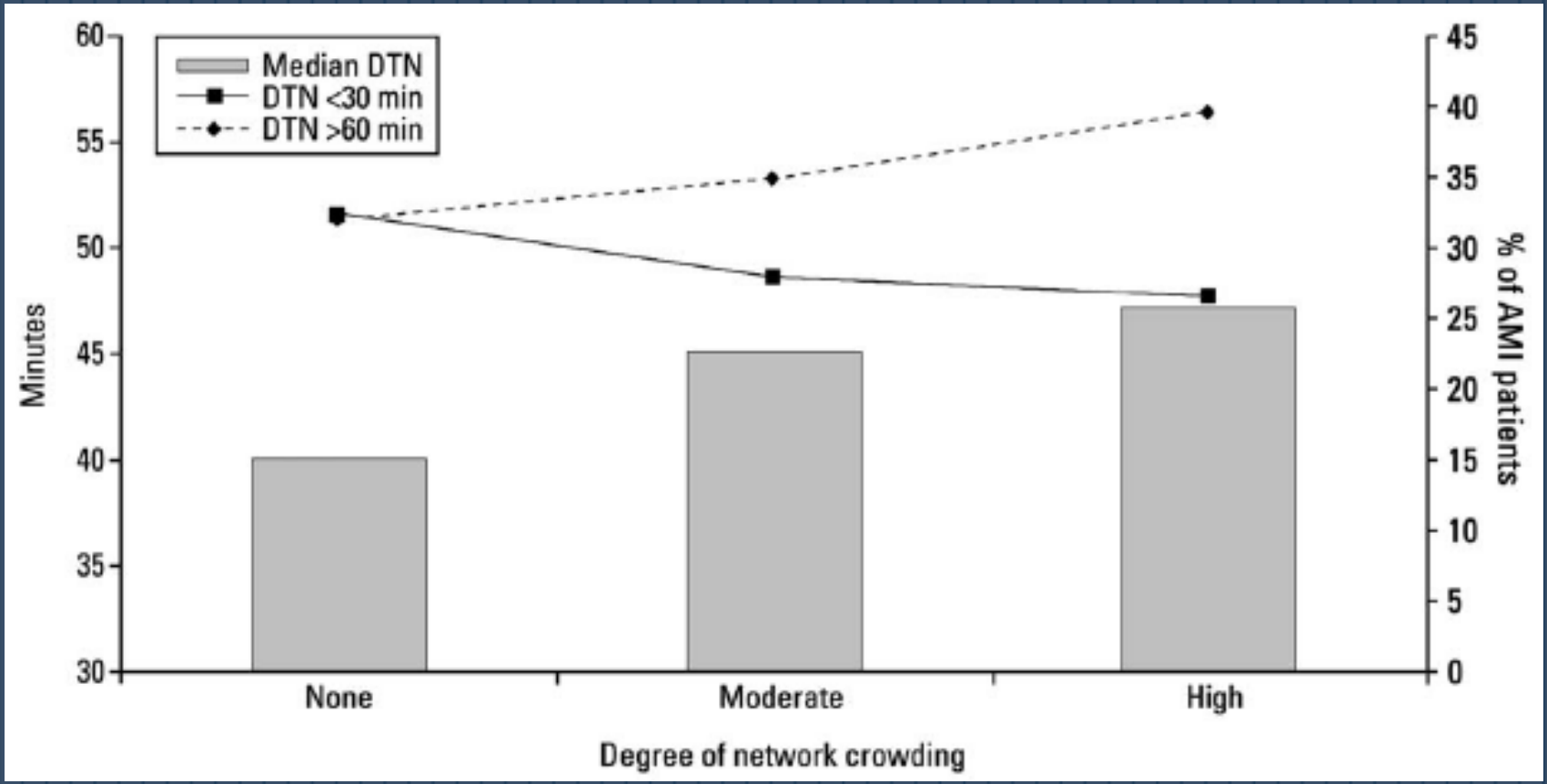

Schull et al. Ann Emerg Med. 2004;44:577-85

Adverse effects on EMS

- Ambulance diversion
  - "Staffing, Capacity, and Ambulance Diversion on Emergency departments: United States, 2003-04"

Advance Data 2006;376

- Increase in turn-around time
  - "Emergency department overcrowding and ambulance transport delays for patients with chest pain"

CMAJ 2003;168:277-83.

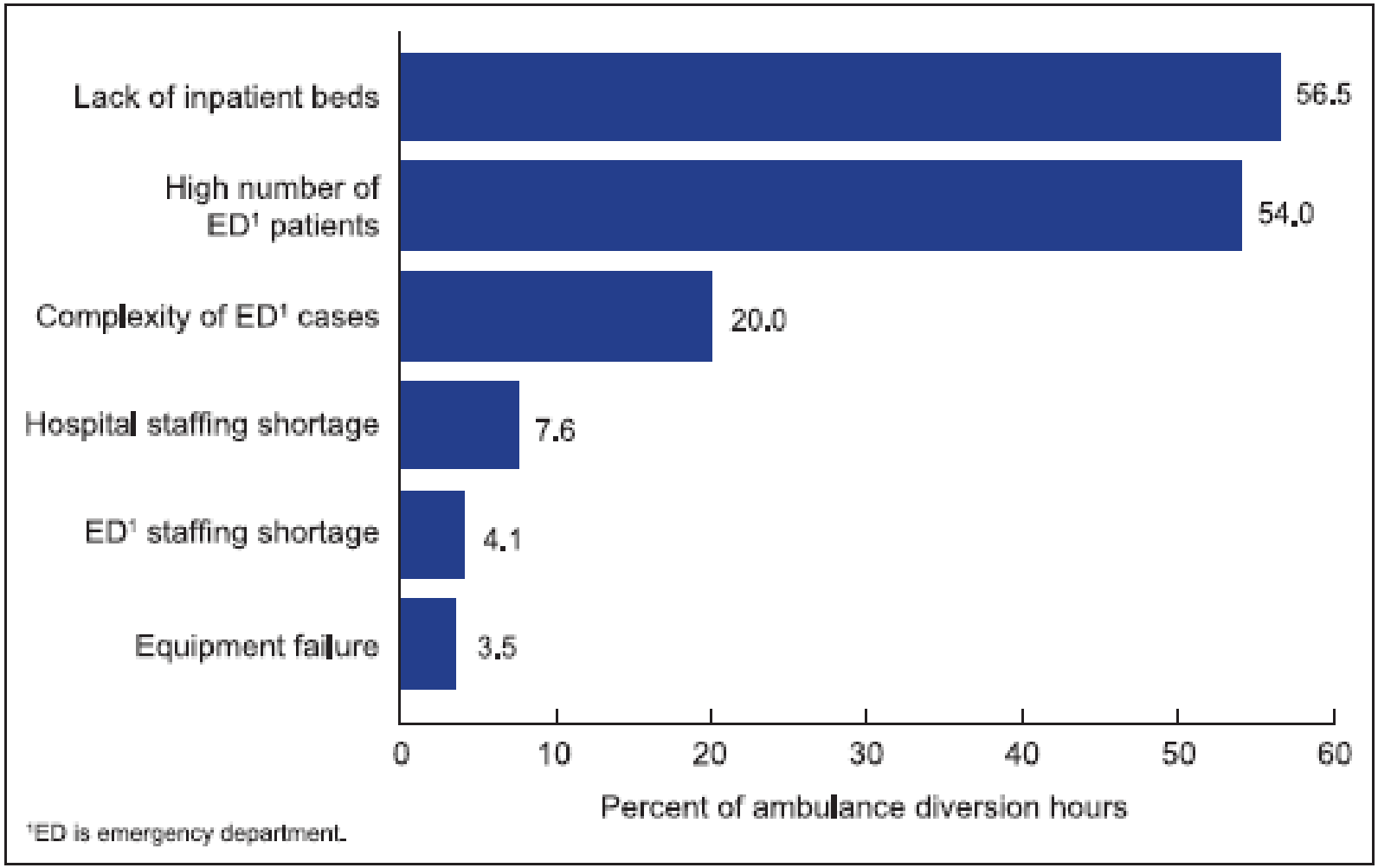

Figure 4. Mean percentage of diversion hours by reasons for diversion: United States, 2003–04

CDC. Advance Data 2006;376

Adverse effects on EMS

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  - "Staffing, Capacity, and Ambulance Diversion on Emergency departments: United States, 2003-04"

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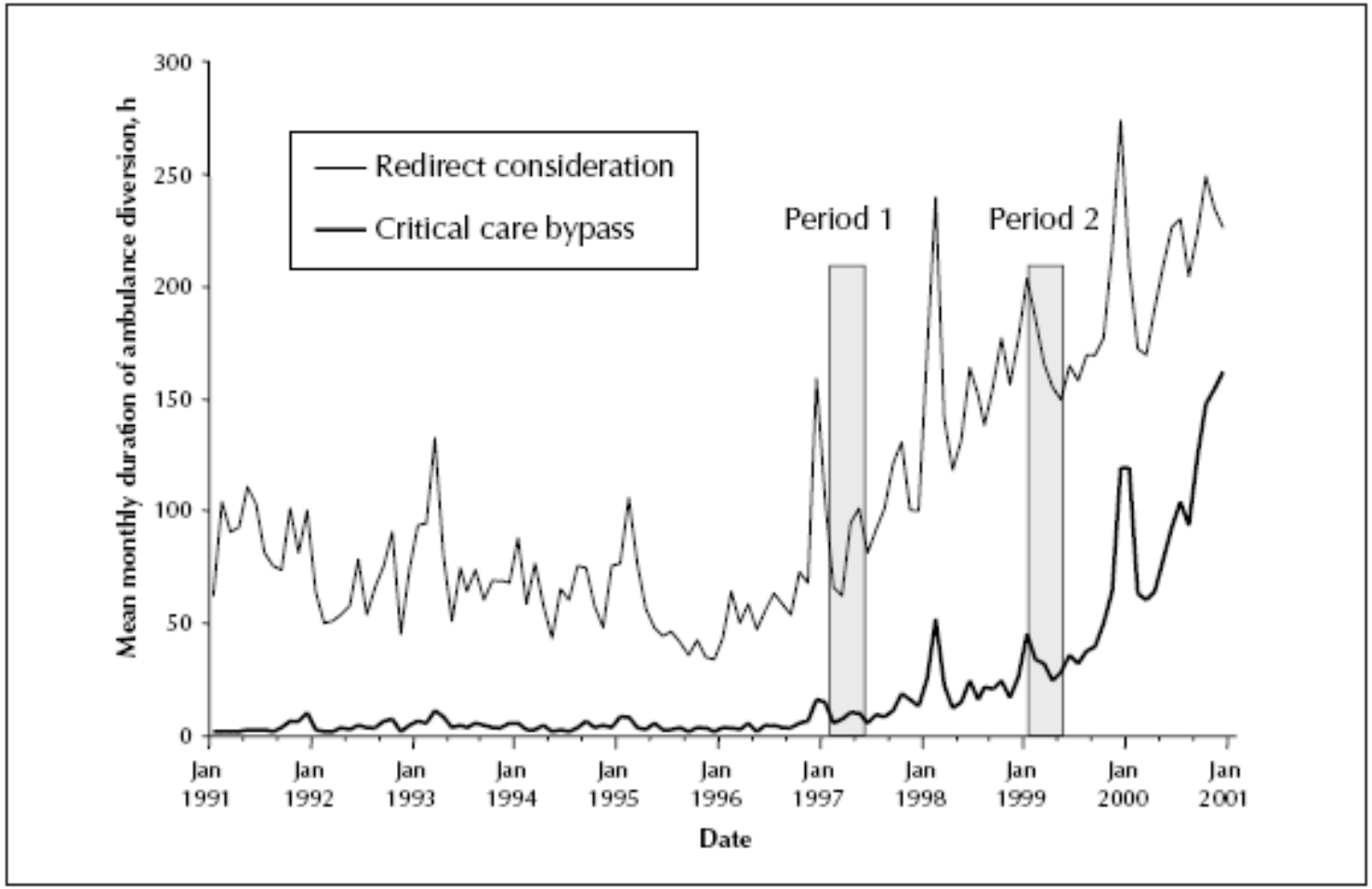


Fig 1: Emergency department (ED) overcrowding in Toronto, 1991–2001, as represented by the mean monthly duration of ambulance diversion at all EDs in the city. Redirect consideration = all ambulances diverted, except those with critically ill patients, critical care bypass = all ambulances diverted, including those with critically ill patients.

Schull et al. CMAJ 2003;168:277-83

What has been studied in Asia?

Korea

- Overcrowding in emergency department (causes).

J Korean Soc Emerg Med 1992;3:71-8.

- Triage of non-emergent patient and guideline for transfer.

J Korean Soc Emerg Med 1995;6:403-10.

- Effect of Emergency Department Overcrowding on the Outcome of patient care – a pilot study -

J Korean Soc Emerg Med 2004;15:1-7.

- Definition and analysis of overcrowding in the emergency department of ten tertiary hospitals.

J Korean Soc Emerg Med 2004;15:261-72.

- Effect of an independent-capacity protocol on overcrowding in an urban emergency department.

Acad Emerg Med 2009;16:1277-83

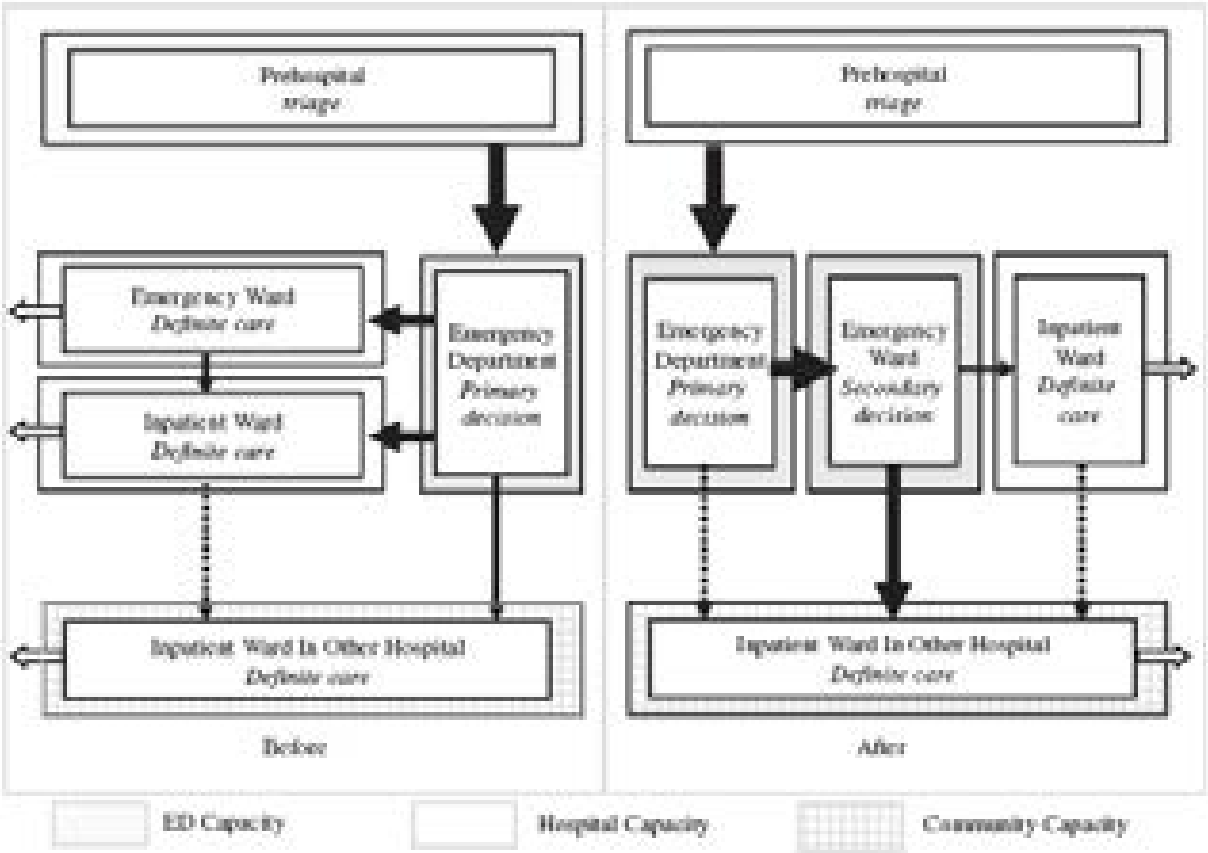


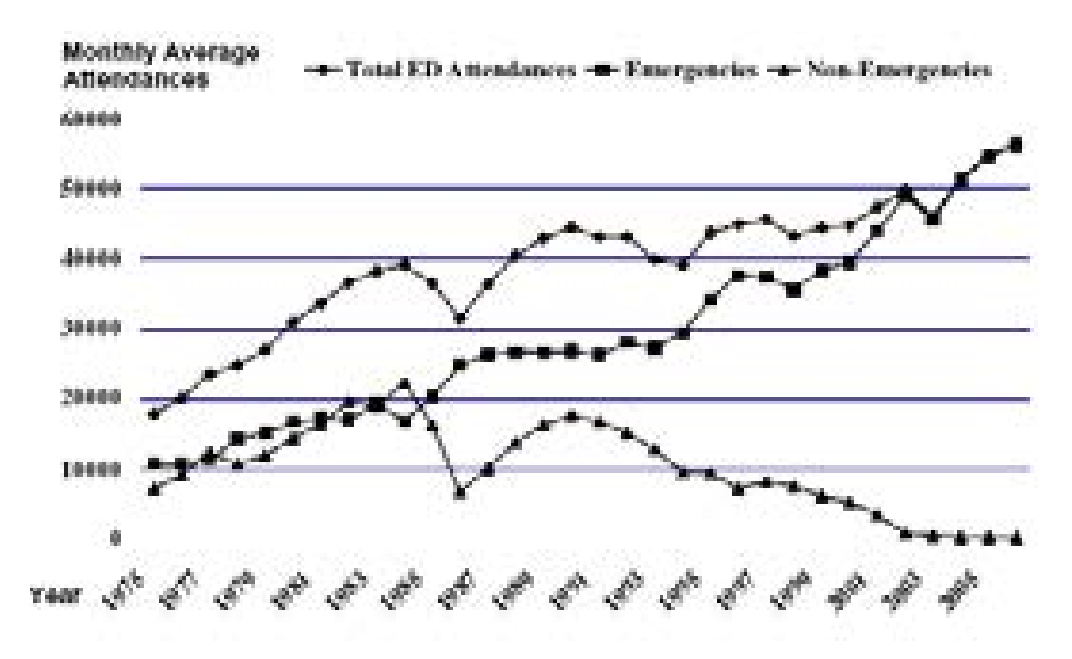
Figure 1. A conceptualized output flow before and after introduction of the independent-capacity protocol (ICP). Before introduction of the ICP, the emergency ward functioned like other inpatient wards. After introduction of the ICP, the emergency ward changed to a place where secondary decision-making for disposition takes place. Dashed lines represent transfers from specific wards to other hospitals that were not analyzed in this study due to small number. Clear arrows represent discharges to home.

Cha et al. Acad Emerg Med 2009;16:1277-83

Singapore

- Impact of health care system interventions on emergency department utilization and overcrowding in Singapore.

Int J Emerg Med 2008;1:11-20



Taiwan

- The effect of prolonged ED stay on outcome in patients with necrotizing fasciitis

Am J Emerg Med. 2009;27:385-90.

Table 2 Stepwise logistic regression for in-hospital mortality

Variable	OR	95% CI	*P* value
Hypotension	32.9	6.9-156.0	<.001
Prolonged ED boarding stay (>8 h)	3.4	1.3-8.6	.012
Early operation	0.16	0.06-0.45	<.001

- ED Overcrowding in Taiwan: Facts and strategies.

Am J Emerg Med. 1999;17:198-202.

Japan

- The increasing use of pediatric emergency facilities in the evening

Pediatr Emerg Care. 2007;23:142-7.

- Circadian pattern of ambulance Use for children in Japanese City

Acad Emerg Med 2004;11:316-8.

What can we do with it?

Proposal

- Survey-based comparison of ED overcrowding in Asia
  - Propose : To describe Overcrowding in Asia, and to propose a proper model to predict and resolve the problem

- Part I

- Part II

A. What do you think is the best definition of ED overcrowding?

1. **Patients have to wait over 30 minutes till seeing a physician**
2. **Beds of ED is full for more than 6 hours a day**
3. **Patients are being treated in the hallway or on the floor for more than 6 hours a day**
4. **The physician is feeling overcrowded for more than 6 hours a day**
5. **Boarding patients are occupying more than 30% of ED beds**
6. **Ambulances are being diverted**
7. **Etc. ( )**

B. Check on the box you agree most

1. Do you think ED overcrowding is problematic?

   ☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

2. Is your ED experiencing overcrowding?

   ☐ Yes ☐ No

3. How often does your ED experience overcrowding?

   ☐ everyday
   ☐ 2 days a week
   ☐ 3 days a week
   ☐ once a week
   ☐ every other week
   ☐ once a month

4. When during a day does overcrowding occur most heavily?

(:) ~ (:) (example 14:00 ~ 18:00)

5. What day is your ED most heavily crowded?

☐Mon ☐Tue ☐Wed ☐Thur ☐Fri ☐Sat ☐Sun

6. In which season does your ED get most heavily crowded?

☐Spring ☐Summer ☐Fall ☐Winter

C. The cause of overcrowding, please check on the box

1. Increased number of patients

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

2. Increased severity of patients

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

3. Non-appropriate use by non-emergent patients

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

4. Shortage of ED space

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

5. Shortage of physician staffing

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

6. Shortage of nurse staffing

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

7. Delays of ED laboratory results

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

8. Increase in specialized tests (ex: gastrofibroscopy, echo)

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

9. Delays of decision and treatment by spcialists.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

10. Shortage of specialists.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

11. Shortage of inpatient beds.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

12. Lack of transferring system.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

D. The influence of overcrowding, please check on the box

1. Delays the diagnosis and treatment

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

2. Increases the adverse outcome (ex: mortality)

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

3. Decreases the satisfaction of patients

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

4. Increases violence inside ED.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

5. Decreases productivity of health care providers.

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

6. Interferes the educational activity for residents and students

☐Strongly agree ☐Agree ☐Even ☐Disagree ☐Strongly disagree

E. The characteristics of interviewees , please check on the box

1. I am a

- ☐ Emergency physician (faculty)
- ☐ Emergency physician (fellowship)
- ☐ Emergency physician (residents)
- ☐ Physicians not trained in Emergency Medicine
- ☐ Nurse
- ☐ Paramedic
- ☐ EMTs

2. My workplace

(Name of institute) _____

(Ex : Seoul National University Hospital)

Proposal

- Survey-based comparison of ED overcrowding in Asia
  - Part I
  - Part II

A. Input factors

1. Age
2. Gender
3. Severity
4. Mode of arrival
5. Insurance coverage
6. Diagnosis

7. Ambulatory clinics

B. Throughput factors

1. ED triage
2. Fast track
3. Tests availability
    1. CT
    2. MRI
    3. Angiography
    4. POCT
4. Staffing
    1. Nurse
    2. Physicians
5. Consultation to specialists

C. Output factors

1. Hospital bed
2. ICU bed
3. Admission policy
4. Community collaborating system

C. Output factors

1. Hospital bed
2. ICU bed
3. Admission policy
4. Community collaborating system

Summary

- ED overcrowding
  - Definition
  - Cause
  - Effects
- Researches in Asia
- Proposal for collaborative approaches


BLS-kids ???