

# Journal Reading

## Measures of Crowding in the Emergency Department: A Systematic Review

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## Introduction

- **Crowding** is a frequent and pervasive phenomenon for the majority of ED in the United States and around the world
  - Longer waiting times to see clinicians
  - Worsening problem of ED boarding
- Crowding adversely affects **mortality, delays in care, patient dissatisfaction** and higher left without being seen (LWBS) rates.

- Most widely accepted conceptual framework of crowding is:
  - input-throughput-output model
  - Common definition or measure of crowding did not exist
- The purpose of this study was to conduct a **systematic review** of all existing crowding measures and compare them in terms of their conceptual foundations and validity.

## Methods

### 《Study Design》

- **Systematic, comprehensive review** of four medical and health care citation databases to identify all studies related to crowding in the ED

### 《Search Strategy》

- PubMed (MEDLINE), CINAHL, Embase, and the **Cochrane Database**
  - From 1966/01/01 to 2009/09/22

### 《Sample derivation》

- **3 sets** of different reviewers examined the articles
  - Titles & abstracts
  - Full-text
  - Examine & summarize
- All measures were categorized into one of **five types**:
  - clinician opinion,
  - input factors,
  - throughput factors ,
  - output factors,
  - multidimensional scales

## Results

- 2,660 papers identified in initial search of the database
  - 747 titles and abstracts reviewed by first set of screeners
  - 92 full text publications reviewed by second set of screeners
  - **Finally total 70 publications meeting inclusion criteria were reviewed**
- 46 of 70 articles were **original studies**, contained 71 measures
  - 3 clinician opinion , 17 input , 21 throughput ,21 output , and 9 multidimensional

### 《Prevalence of Measures》

- **Clinician opinion**, or perception of ED crowding, was **the least commonly** used type of crowding measure
- **Input** measures ranged from waiting times, to **number or percentage of patients**
  - as arrivals,
  - in the waiting room,
  - at triage or registration,
  - by acuity, patient severity and complexity

- **Throughput** measures included from
  - ED capacity measures,
  - **numerical counts**, or percentages of patients in the ED at various stages
  - **patient care times**, and ED length of stay (LOS).
- **Output** measures included
  - hospital measures of numerical counts,
  - mean values or percentages of admissions,
  - **patients boarding in the ED**,
  - hospital beds and census, and
  - times of care to leave the ED

- Multidimensional indices  
→ the most frequently studied measures were:
- **National ED Overcrowding Study (NEDOCS)** scale
- **Emergency Department Work Index (EDWIN)** measure

### 《Validation of Measures》

- The three most commonly proposed **input** measures
  - the total number of patients in the waiting room,
  - waiting room time, and
  - the total number of arrivals.
- The most commonly proposed **throughput** measures
  - ED census (total number of patients in the ED),
  - ED occupancy rate, and
  - ED LOS.

- The most common **output** measures proposed
  - The number or percentage of ED admissions;
  - The number, mean number, or percentage of boarders;
  - boarding time; and
  - inpatient occupancy levels
- Both the total No. of pts in the waiting room & ED arrivals were **positively correlated** with ED process times
  - Such as waiting room time and ED LOS.

- Furthermore, one study found the No. of ED arrivals was an important **leading indicator** of:
  - future ED census and
  - demand for diagnostic resources
- ED admissions, boarders, and inpatient occupancy levels were **significantly correlated** with:
  - ED process times
  - clinician opinion of crowding,
  - ambulance diversion, and
  - LWBS

## Discussion

- There is growing consensus of the need for...
  - Quantitative, objective crowding measures
  - Can be used across multiple sites
  - Feasible and reproducible
- The results of this review suggest that
  - **Time intervals** and **numerical counts** are becoming the most prominent measures of crowding
  - **Flow** and **nonflow**

## Flow & Nonflow

- **Flow** category relies predominantly on **time intervals**
  - e.g., ED total LOS and boarding time.
  - More challenging to observe in real time
- **Nonflow: Numerical counts** of patients
  - e.g., ED census, number of waiting room patients, and number of boarders
  - the traditional concept of ED crowding
  - easier to observe in real time

- **ED-specific variation** across and within multiple EDs
  - Normal or crowded conditions ?
- Does **ED work scales** generalize well enough...
  - EDWIN and NEDOCS ?
- Straightforward, greater reproducibility, **objective** metrics:
  - Number of patients, ED LOS...
- **Subjective** nature and site-specific metrics:
  - Physicians feeling rushed, critical bed status...

- **Numerical counts** (as a percentage of allocated resources) and **process times** are linked with:
  - Predictors of crowding
  - Outcomes of crowding
- **Crowding is not shouldered by the ED alone...**
  - Hospital- or system-wide factors.
  - Time interval performance measures of factors outside the ED such as diagnostic efficiency
  - Laboratory and radiology turnaround times
  - Consult times,
  - Operating room activity, and
  - Inpatient bed availability...

- Consequences of crowding relevant to patients, clinicians, researchers, administrators, and policy makers include :
  - **Clinical outcomes,**
  - **Patient safety,**
  - **Patient and staff satisfaction, and**
  - **Cost of care.**

- Another important finding of this review was the diversity of metrics that were conceptually **measuring the same thing**
  - ED census was also referred to as
    - total number of patients registered or
    - total number of patients in the ED.
    - total number of arrivals
    - number of patients in the waiting
    - number of patients at triage.
    - ED patient process times or LOS
- **On a practical level, each of these metrics measures something different !**

## LIMITATIONS

- The **heterogeneous nature** of the ED crowding literature and studies may have resulted in **misclassification** of papers, study objectives, and measures
- There were often **disparities in the interpretation of results and measures**
- Not evaluate the measures in terms of their **reliability** or **responsiveness**

## CONCLUSIONS

- **Time intervals** and **patient counts** are emerging as the most promising tools for measuring **flow** and **nonflow** (i.e., crowding), respectively.
- Standardized definitions of **time intervals** (flow) and **numerical counts** (nonflow) will assist with validation of these metrics across multiple sites and clarify which options emerge as ***the metrics of choice in this “crowded” field of measures.***



Thanks for your listening