*Hospital Report 2006: Emergency Department Care*

# Clinical Utilization and Outcomes Technical Summary

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# Overview:

*Hospital Report 2006: Emergency Department Care* reports on four performance indicators at the hospital level. All four indicators are included in the E-scorecard at the hospital level (each hospital will be able to view their own indicator values along with the provincial mean). Performance reporting of a 5th indicator that had been included in 2005 report was temporarily discontinued from this years E-scorecard due to a shift in the performance allocation methodology. Redevelopment of the performance rating methodology for this indicator is currently in progress.

This *Technical Summary* provides a detailed description of the methods used to select, calculate, and compare the 2006 indicators across participating Ontario emergency care departments.

This year's results builds on the previous ED reports (2003 and 2004), and includes measures of ED utilization across Ontario, and indicators targeted at 3 clinical groups – **asthma, ankle injuries, and pneumonia.** Recent development work has been undertaken to refine the original methodology including enhancements to the data analysis process.

As in the 2005 report, risk adjustment techniques have been applied to the hospital-level Clinical Utilization & Outcomes (CUO) indicators to control for differences in patient characteristics, which can vary across EDs. These techniques cannot, however, completely eliminate the impact of case-mix differences among institutions.

# Methodology

## *Data Sources*

The National Ambulatory Care Reporting System (NACRS) forms the basis for the information on CUO indicators. NACRS is managed by the Canadian Institute for Health Information (CIHI). Every time a patient is registered at an Ontario ED, a NACRS record is generated for that visit and submitted to CIHI. NACRS data used in this Report are derived from the 2004/2005 fiscal year (April 1st to March 31st ) covering over 4.5 million records. All ED patients who are subsequently admitted to hospital have a second summary abstract created in a separate database – the Discharge Abstract Database (DAD). The DAD is also managed by CIHI and data from the DAD were linked with information from NACRS to provide comprehensive information on the patient's entire stay in hospital including both the ED visit and the inpatient stay. Both the NACRS and DAD data accessed for this year's reporting are protected by privacy and confidentiality policies that ensure that patients and caregivers cannot be individually identified. In order to ensure the confidentiality as well as the validity of results, hospitals fall below a specified case volume screen were excluded in reporting of results.

## *Data Quality*

Some inconsistencies continue to exist in the way the data elements are interpreted and coded by hospitals. Hospitals those were found to have such inconsistencies were not included in the calculation of the relevant indicators. However, Hospital Report investigators continue to work closely with CIHI to assess and improve the quality of the NACRS data. Based on these ongoing data quality initiatives, NACRS continues to be a reliable and important source of information for measuring and reporting ED performance. Continued use of NACRS and ongoing collaborative data quality improvement efforts, will lead to further refinements in the data elements, data coding, and eventually in data quality.

## *Data Inclusion/Exclusion Criteria*

Data from all eligible EDs in Ontario that contribute to the NACRS database were used to calculate provincial, peer group, and LHIN averages.

Records with invalid Ontario health card numbers, or records that were exact duplicates of an existing record were excluded from further analysis, while individuals with missing values for individual data elements were excluded from specific analyses. As well, all records with negative ages or an age greater than 105 years were excluded. The final 2004/2005 dataset included 4,927,499 ED visits. The inclusion and exclusion criteria are summarized in the following table:

**General Inclusions/Exclusions:**

| | Criteria | Codes/Comments |
|---|---|---|
| | Start with full NACRS 2004-2005 dataset | |
| Include: | All cases with valid Ontario health card number (HCN) | |
| Include: | All cases with primary functional centre recorded as emergency department | Visit Functional Centre = ‘71310’ |
| Include: | All cases from valid acute care emergency departments | Do not include cases from mental health facilities, outpatient clinics, or other ambulatory services |
| Exclude: | All exact duplicate records for a single visit | Duplicate records will be excluded if they match a first occurrence exactly for date/time of registration, encounter number, functional centre code |
| Exclude: | All cases greater than 105 years old and those that have negative ages | As a data quality check, all records that have a negative recorded age or an age greater than 105 years old are excluded |

## *A Snapshot of Ontario Emergency Departments*

Emergency departments provide care to a wide range of patients. The indicators included in this report provide a snapshot of care in Ontario EDs, and were selected with input from the ED Advisory Panel. To present patient characteristics in a more meaningful way, some NACRS data elements were recoded to group information together for presentation. For example, age was recoded into defined age groups, and length of stay was changed to length of stay ranges. This year, the age groupings have been broken down further for the under 20 year olds, to better capture utilization and disease patterns for paediatric patients. These recoded data elements were then used in utilization analyses to describe patient characteristics and the services used by ED patients.

### Measures Describing Patient Characteristics and Services Used:

**Patient Characteristics:** The following measures describe the clinical characteristics of ED patients.

- Acuity – urgency rating assigned at the time of patient triage to designate priority for ED care, based on definitions in the Canadian Triage Acuity Scale (CTAS). The same CTAS system is used in all Ontario EDs.
- Diagnostic Data – type of problem or condition that brought the patient to the ED, defined in the codes contained in ICD 10. Codes are based on the final ED diagnosis, and are assigned after care is completed in the ED.

**Services Used:** EDs serve as an interface between communities and hospitals, and important aspects of ED care include how patients arrived in the ED, how long they stayed, and where they went after the completion of their ED care.

- Mode of Arrival –whether the patient arrived at the ED by ambulance or some other means of transportation.
- ED Length of Stay - the time from triage of the patient by ED staff until the time the patient was discharged from the ED. For ED patients who are admitted to hospital, ED length of stay includes the time from patient triage until the time the patient was assigned inpatient status in the hospital computer system; patients transferred from one ED to another are excluded from the length of stay analysis. The delay until the patient physically leaves the ED for a hospital bed is not included.
- Disposition – patients were identified as either dying in the ED, transferred to another ED, admitted to hospital, transferred to another outpatient service within the same hospital, left without visit completion, or discharged from the ED.

These data elements and descriptive measures, with their associated categories, are listed in the table below.

## Data Elements and Derived Variables used to Measure Patient Characteristics and Services Used:

| DESCRIPTION | MEASURE | CATEGORIES | |
|---|---|---|---|
| **Patient Characteristics** | Age Group<br><br>(Derived variable) | 0-90 days<br>3-24 months<br>2-4 years<br>5-9 years<br>10-14 years<br>15-19 years<br>20-44 years<br>45-64 years<br>65-84 years<br>85+ years | |
| | Sex | Male<br>Female | |
| | Triage Level (Based on CTAS scores) | Resuscitation<br>Emergent<br>Urgent<br>Semi-Urgent<br>Non-Urgent | (CTAS score 1)<br>(CTAS score 2)<br>(CTAS score 3)<br>(CTAS score 4)<br>(CTAS score 5) |
| **Services Used** | Arrival by Ambulance | Yes<br>No | |
| | End of Visit Disposition (Derived variable - See below for definitions) | Admitted to Inpatient<br>Transferred to a different ED for care<br>Left before visit completion<br>Dead (death in the ED; or dead on arrival)<br>Intra facility transfer<br>Discharged (Does not fall into any above category) | |

# Clinical Performance Indicators for 2006

## *Clinical Utilization and Outcome Indicators for 2006:*

**Asthma:**

- **The proportion of patients discharged from the ED with a diagnosis of asthma who have an urgent or emergent return visit for asthma or a related condition to any ED within 24 hours of the initial ED discharge.**
- **The proportion of patients discharged from the ED with a diagnosis of asthma who have an urgent or emergent return visit for asthma or a related condition to any ED between 24 and 72 hours after the initial ED discharge.**

**Ankle and Foot Injuries:**

- **The proportion of patients with an ankle or foot injury who receive an x-ray of the ankle or foot at the first ED visit.**
- **The proportion of patients who do not receive an x-ray at the initial visit and who return to any ED within 7 days with the same condition, and subsequently receive an x-ray on the return visit.**

**Pneumonia:**

- **The proportion of pneumonia patients seen in the ED who are admitted with an ED diagnosis of pneumonia and who then have an inpatient stay of <= 2 days.**

***Definitions of the Three Indicator-Level Clinical Conditions*** (asthma, ankle injury, and pneumonia )**:**

**Emergency Department Condition-Specific Patient Groups**

**Asthma:** a disease of the lungs with swelling and narrowing of the airways. It may lead to wheezing, shortness of breath, and other symptoms.

**Ankle Injuries**: blunt trauma sustained to the ankle or foot area .

**Community Acquired Pneumonia (CAP)**: an infection of the lungs resulting in shortness of breath, fever, and an abnormal chest x-ray.

## Categories for Recoding Patient Disposition:

In some cases, the ED disposition coding may be incorrect. Decision rules were developed to re-code patient disposition from the ED. The decision rules were based on a combination of time differences, NACRS disposition codes and DAD records. These rules include:

- Transfer to inpatient from the ED:
  - This category involves NACRS to DAD linkages;
  - Includes all cases for admits to same institution and admits to different institution;
  - Includes all cases with 0 - 2 hour time difference;
  - Includes all cases with negative time differences from – 24 hr to 0 hrs;
  - Includes all cases with time difference >2 hours to 12 hours, where both NACRS (VD= 6,7,8) and DAD (Entry=E) indicated a transfer to inpatient;
  - No cases with a time difference of 12 hours or greater are included.

- Transfer from one ED (NACRS1) directly to a second (different) ED (NACRS2):
  - This category involves NACRS to NACRS linkages;
  - Includes all cases where the visit disposition category recorded in the first NACRS record was 6 or 7, AND where the time difference between NACRS1 and NACRS2 fell between negative 24 hours to plus 2 hours;
  - Includes all cases where the visit disposition category recorded in the first NACRS record was 8, AND where the time difference between NACRS1 and NACRS2 fell between negative 24 hours to plus 12 hours.

- Left before visit completion:
  - This category involves single NACRS records;
  - Includes all cases where the visit disposition category recorded in the NACRS record was one of the following:
    - 2 – Left without being seen or treated by a service provider;
    - 3 – Left after triage but not seen by physician or primary care provider;
    - 4 – Left after triage and assessment but without treatment; and,
    - 5 – Left after initiation of treatment but before completion and against medical advice.

- Death in the ED:
  - This category involves single NACRS records;
  - Includes all cases where the visit disposition category recorded in the NACRS record was 10 (death in the ED) or 11 (dead on arrival) to the ED.

- Intra facility transfer:
  - This category involves single NACRS records;
  - Includes all cases where the visit disposition category recorded in the NACRS record was one of the following:
    - 12 – Intra facility transfer to day surgery;
    - 13 – Intra facility transfer to the Emergency Department;
    - 14 – Intra facility transfer to clinic.

- Repeat visit to the same or different ED:
  - This category involves NACRS to NACRS linkages, excluding ED transfer cases (above);
  - Includes all cases where subsequent ED registration occurs at the same or different institution, and is based on the last NACRS record in the index episode of care;
  - Includes only cases where registration date/time are different for the original ED visit (NACRS 1) and the subsequent ED visit (NACRS 2);
  - Includes all cases with a time difference from negative 24 hours to plus 28 days where a second NACRS record is found after an index visit;

## *Selection of Emergency Department Patient Groups and Clinical Indicators*

In order to make the indicators relevant, information was gathered from the literature and from a series of consultations with ED physicians and nurse managers to identify clinical conditions (diseases and symptoms) frequently assessed and treated in Ontario EDs for which appropriate care could have important implications for treatment and patient outcomes. This information on potentially relevant indicators was combined with an analysis of the data elements available from NACRS to define a set of feasible indicators.

The CUO indicators used in this year's hospital-level report describe either the process or the outcomes of care for three conditions: asthma, ankle injury, and pneumonia. These three clinical conditions cover a range of ages and complexity, and represent approximately 4.3% of annual ED visits.

### <u>Clinical Condition Definitions and Sample Size</u>

| CONDITION | ICD-10 CODES & CONSIDERED AGE GROUPS |
|---|---|
| Asthma<br><br><br>Year 04/05: cases = 66,347 | Main Problem: J45<br>OR<br>Main Problem: R05, R06.0, R06.2, J96 or I46<br>**AND** 2nd or 3rd diagnosis = J45<br><br>Age Restriction: 1 to 64 years |
| Ankle Injury<br><br><br>Year 04/05: cases = 121,712 | Main Problem: S82.3-S82.9, S86, S90.0, S90.3, S90.7, S90.8, S90.9, S93.2, S93.4, S93.6, S96, S99<br><br>Age Restriction: 5 to 84 years |

*Note: Main Problem refers to the first diagnosis entered into NACRS.*

### Changes to Clinical Performance Indicators for 2006:

As part of the continuing evolution of the CUO measures, the Ankle X-ray indicator reported in Hospital Report 2005: Emergency Department Care has not been included in the initial release of this year's scorecard. Evaluation of a more sensitive method of performance allocation for this indicator is in progress. Results will be published with the completion of this work.

## ***Risk Adjustment:***

Clinical utilization and outcome indicator results may differ between hospitals simply due to the variability in patient population characteristics across EDs. In order to provide a fair basis for comparison of performance across hospitals, statistical methods are applied to "risk-adjust" the rates of performance for each hospital to account for these differences in patient characteristics. In this year's reporting, results were risk-adjusted for following characteristics: age, sex, and acuity (triage) levels. There are limits to any risk adjustment strategy. These techniques will reduce the effects of the patient characteristics on the results, but will not eliminate all differences. The factors used for risk adjustment in this report are described in the following table along with the detailed indicator definitions.

### Definitions of Clinical Utilization and Outcome Performance Indicators

| OUTCOME | Definition (NACRS, DAD) | Risk Adjustment |
|---|---|---|
| **ASTHMA** | | |
| Early Recurrent Visit (< 24 hrs) | Second visit meets the following criteria:<br>Main Problem: J45<br>OR<br>Main Problem: R05, R06.0, R06.2, J96 or I46<br>**AND** 2nd or 3rd diagnosis = J45<br><br>Triage: CTAS score 1, 2, or 3<br><br>Time: within 0 to 24 hours of discharge | Sex (male, female)<br><br>Triage: 1&2, 3, 4&5<br><br>Age: 1-5, 6-12, 13-18, 19-44, 45-64 |
| Later Recurrent Visit (24 – 72 Hrs) | Second visit meets the following criteria:<br>Main Problem: J45<br>OR<br>Main Problem: R05, R06.0, R06.2, J96 or I46<br>**AND** 2nd or 3rd diagnosis = J45<br><br>Triage: CTAS score 1, 2, or 3<br><br>Time: within 24 to 72 hours of discharge | Sex (male, female)<br><br>Triage: 1&2, 3, 4&5<br><br>Age: 1-5, 6-12, 13-18, 19-44, 45-64 |
| **ANKLE INJURY** | | |
| X-ray rate (initial visit) | Main Problem: S82.3-S82.9, S86, S90.0, S90.3, S90.7, S90.8, S90.9, S93.2, S93.4, S93.6, S96, S99<br>Intervention: 3VQ10, 3WA10, 3WG10 (CCI) | Sex (male, female)<br><br>Triage: 1&2, 3, 4&5<br><br>Age: 5-12, 13-18, 19-44, 45-64, 65-84 |
| Return X-ray rate (return visit) | Initial Visit:<br>➢ Main Problem: S82.3-S82.9, S86, S90.0, S90.3, S90.7, S90.8, S90.9, S93.2, S93.4, S93.6, S96, S99<br>➢ NO Intervention code: 3VQ10, 3WA10, or 3WG10 (CCI)<br><br>Return Visit:<br>➢ Main Problem: S82, S86, S90.0, S90.9, S93.0, S93.2, S93.4, S96, S99 | Sex (male, female)<br><br>Triage: 1&2, 3, 4&5<br><br>Age: 5-12, 13-18, 19-44, 45-64, 65-84 |

| | | |
|---|---|---|
| | ➢ Intervention code: 3VQ10, 3WA10, or 3WG10 (CCI)<br>➢ Visit start time within 7 days (168 hours) of initial visit end time | |
| **PNEUMONIA** | | |
| Inpatient length of stay ≤ 2 days | Follow-up record:<br>➢ Inpatient record with admit time within 2 hours of initial visit end time or admit time within 12 hours of initial visit end time and index visit disposition of 06, 07, or 08.<br>➢ Total inpatient LOS <= 2 days, calculated as inpatient discharge date/time minus inpatient admission date/time<br>➢ Inpatient disposition is not death, transfer, or left against medical advice | Sex (male, female)<br><br>Triage: 1&2, 3, 4&5<br><br>Age: 20-44, 45-64, 65-74, 75-84 |

## *Reporting Hospital Level Results:*

In the 2006 reporting, performance on the four hospital level indicators is measured at both the corporate level and the individual ED site level. The risk-adjusted results are presented in the web based e-scorecard. In addition to this overall rates, sex specific risk adjusted rates and the results showing the difference between men and women are also provided. Relative risk approach (i.e. (F-M)/F) was used to assess the statistical significance of the differences between men and women

It is important to remember that both the indicators and the data source require ongoing refinement and validation. The calculation and release of these indicator rates is an important step in an ongoing process to develop sound, relevant and feasible, ED clinical outcome indicators. It is anticipated that publication of these indicators will facilitate improved data quality and lead to more in-depth examinations of the delivery of ED clinical care by hospitals.

## *Calculations of the Risk-adjusted rates:*

**Observed Rate:** # observed occurrences / total # cases at hospital level

**Expected Rate:** # expected occurrences / total # cases at hospital level

**Risk –adjusted rate = (Observed rate/Expected rate) * provincial mean**

**95% Confidence Intervals for RA rate (RR) :**

LCL = RR *(1-(1/(9*Observed_rate))- 1.96 /(3* Observed_rate **0.5))**3

UCL = RR * (Observed_rate +1)*(1-1/(9*( Observed_rate +1))+ 1.96 /(3*( Observed_rate +1)**0.5))**3;

## *Calculation of Attributable risk :*

**Attributable risk** = ( Female RA rate –Male RA Rate)/ Female RA rate

**95% confidence intervals** :

LCL = $1 - RR*EXP(1.96*((1-I_{f_adjusted})/(N_f*I_{f_adjusted}) + (1-I_{m_adjusted})/(N_m*I_{m_adjusted}))**0.5)$

UCL = $1 - RR*EXP(-1.96*((1-I_{f_adjusted})/(N_f*I_{f_adjusted}) + (1-I_{m_adjusted})/(N_m*I_{m_adjusted}))**0.5)$

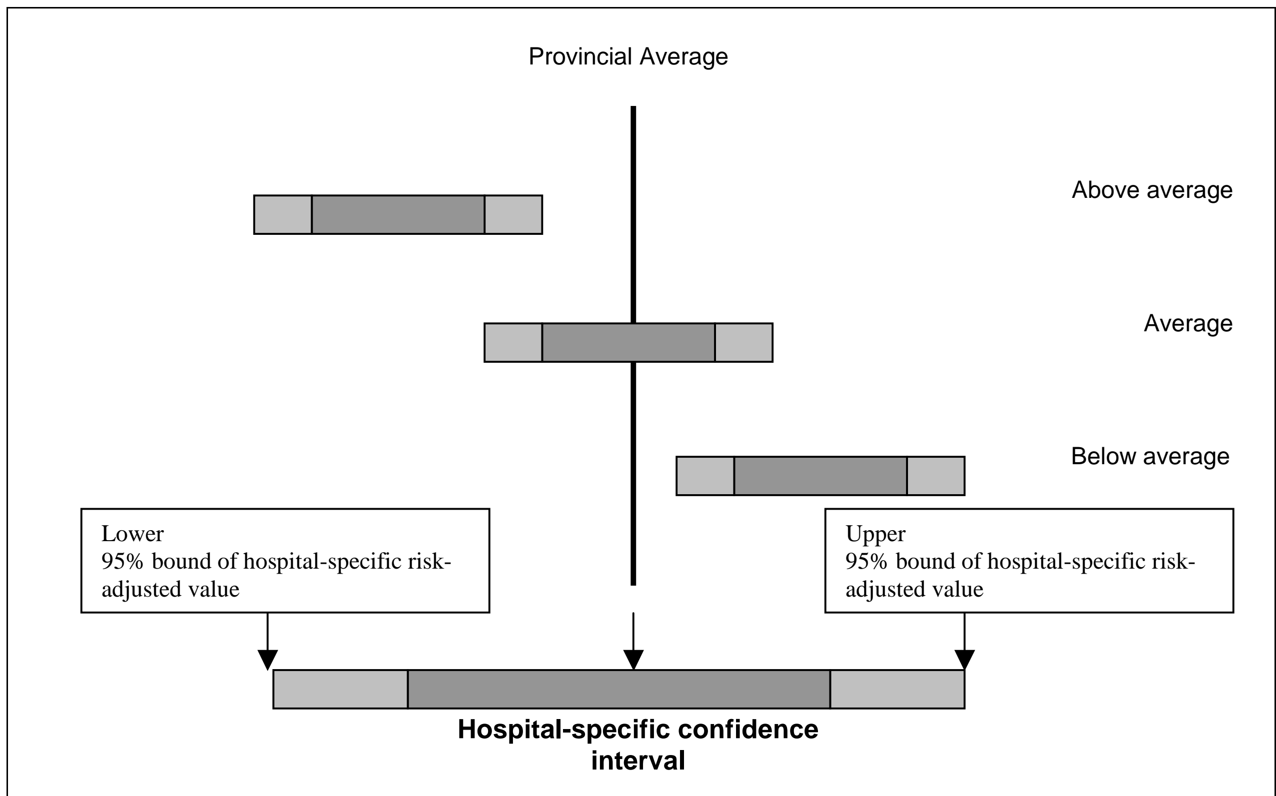
Where RR = relative risk of male to females
$N_x$ = sample size where x = f if female or m if male
$I_{x_adjusted}$ = Adjusted rate where x = f if female or m if male

## *Performance Classification Assignment*

Along with the numeric indicator values on a hospital-by-hospital basis, the 2006 escorecard also includes a Performance classification using colour shades that indicates whether the hospital's score on that indicator reflected above average performance, average performance, or below average performance. The performance levels for the two asthma indicators, pneumonia indicator and the return X-ray rate for ankle injury indicator were assigned by first calculating 95% confidence intervals around the hospital specific risk adjusted rate and comparing them with the provincial average. If the provincial mean is above the upper end of the confidence interval, an above average performance classification was assigned. If the provincial mean is below the lower end of the confidence interval, a below average performance classification was assigned. Finally, if the provincial mean fell within the confidence interval, an average performance classification was assigned.

For the ankle injury X-ray rate indicator, the application of validated decision rules in multiple centres has found that the rate of ankle and foot x-rays should be between 60-62%. Therefore, for this indicator allocation of performance based on comparison of confidence intervals with the provincial mean was not considered appropriate. At present work is being carried out at CIHI to recommend a better approach. Due to this reason results for this indicator are not published in the initial release of the scorecard.

**Performance Rating Methodology for Indicators:** two asthma indicators, pneumonia indicator and the return X-ray rate for ankle injury indicator




**Statistical significance of the differences between women and men** :

There are two categories of shading for these indicators – "statistically significant difference between women and men"; AND "no statistically significant difference between women and men". Again, no single set of measures should be taken as representative of overall hospital performance.

E-Scorecard included the rates for women and men, the values of the differences between women and men on mean rates and the direction and statistical significance of these differences at hospital level. The value quantifying the difference between rates for women and men [i.e. (F-M)/F] is the value of the difference between women and men attributable to sex (after accounting for other considered). Performance ratings for these indicators are based on 95% confidence interval of hospital's risk-adjusted difference values. Again, in terms of interpretation, if this value [i.e. (F-M)/F] is negative, males have higher rates than females; if this value is positive (i.e. it may be positive up to a value of 1), females have higher rates than males. A value of "0" represents true equality between women and men.

For these sex-sensitive indicators, performance allocations are assigned as follows:

- If a hospital's 95% confidence value around their specific value of the difference between women and men for a given indicator surrounds zero, the hospital is classified as having no statistically significant sex difference.
- If a hospital's 95% confidence interval around their specific value of the difference between women and men for a given indicator does not include zero and is negative, then the hospital is said to have unequal (i.e. M>F) performance or a statistically significant sex difference, in which males have a higher rates than females.
- If a hospital's 95% confidence interval around their specific value of the difference between women and men for a given indicator does not include zero and is positive, then the hospital is said to have unequal (F>M) performance or a statistically significant sex difference, in which females have a significantly higher rate than males.

**Performance Rating Methodology for Difference Between the Sexes – ((F-M)/F)**