

***Hospital E-Scorecard Report 2008: Emergency
Department Care***

Clinical Utilization and Outcomes Technical Summary

This technical document has been updated by Jun Gao and Vanita Gorzkiewicz, for Hospital e-Scorecard Report 2008. Acknowledgement is given to Geoffrey M. Anderson, Astrid Guttmann, Patrice Lindsay and Michael J. Schull, the original contributors of the technical document.

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Clinical Utilization and Outcomes

Overview

Hospital E-scorecard Report 2008: Emergency Department Care contains information on ten performance measures used in both hospital-specific comparisons and at the provincial level. This *Technical Summary* provides a detailed explanation of the methods used to select and calculate these indicators.

This year's results build on the previous emergency department (ED) reports, and include indicators targeted at three clinical groups – asthma, ankle injuries, and pneumonia. Another three pediatric indicators are measures of quality of care for three clinical conditions: asthma, bronchiolitis and croup.

As in previous reports, risk adjustment techniques have been applied to the 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.

All of these measures should be used as screening tests. In medicine, screening tests do not provide a final diagnosis, but can help to identify cases that need follow-up. Likewise, the measures of clinical performance in this report should not be taken as a definitive assessment of access, efficiency, or quality. Rather, they are a first step in a quality assessment and improvement process that should involve more detailed analysis.

Although they are screening tests, the Clinical Utilization and Outcomes measures should help health care providers, administrators, and the public to better understand the clinical performance of their institutions and of the hospital system as a whole.

Methods

Data Sources

The National Ambulatory Care Reporting System (NACRS) forms the basis for the information on ED 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 2006-2007 fiscal year (April 1st to March 31st). All ED patients who are subsequently admitted to an acute care 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 report are protected by privacy and confidentiality policies that ensure that patients cannot be individually identified. In order to ensure the confidentiality as well as the validity of results, hospital results that fall below a specified case volume screen (n = 5) 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. 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 EDs¹ in Ontario that contribute to the NACRS database were used to calculate provincial, peer group, and LHIN averages. Data were limited to residents of Ontario.

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 2006-2007 dataset included 5,142,500 ED visits. The inclusion and exclusion criteria are summarized in the following table:

¹ Data from the Centre for Addiction and Mental Health (CAMH) have been excluded as this emergency department serves a different patient population.

Table 1: General Inclusions/Exclusions

	Criteria	Codes / Comments
	Start with full NACRS 2006-2007 dataset	
Include:	All Ontario Cases with valid Ontario Health Card Numbers (HCN)	Province Issuing HCN = ON AND HCN is not equal to '0', '1' or 6 or more 0's (e.g. '000000')
Include:	All cases with primary functional centre recorded as emergency department	Visit MIS Functional Centre = 7*310**
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 on the following data elements: Chart Number; Birth Date; Date of Registration; Registration Time; Health Card Number;
Exclude:	All cases greater than 105 years old and those that have negative ages	Age > 105 years OR Age < 0 years

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.

Three pediatric indicators were developed using a structured panel process, literature review, and administrative data of emergency department visits in Ontario (i.e. NACRS).² These indicators look at x-ray use in the ED for common pediatric

² A. Guttman, A. Razzaq, P. Lindsay, B. Zagorski and G. M. Anderson, “Development of Measures of the Quality of Emergency Department Care for Children Using a Structured Panel Process” *Pediatrics*. 118, 1 (July 2006): pp.114-123 [online], accessed December 1, 2006, from <http://www.pediatrics.org/cgi/content/full/118/1/114>.

conditions. In uncomplicated or typical cases, the routine use of x-rays for the management of these conditions is not indicated.

Indicators and Definitions for 2008

The following ten indicators were calculated for the Clinical Utilization and Outcomes Quadrant of *Hospital E-Scorecard Report 2008: Emergency Department Care*. Definitions and calculation methods for numerator and denominator values are detailed below.

1. Proportion of Pneumonia Patients that have an Inpatient LOS of ≤ 2 days
2. Return Visit Rate for Asthma (≤ 24 hrs) – Adult (20-64 years)
3. Return Visit Rate for Asthma (24 -72 hrs) – Adult (20-64 years)
4. Return Visit Rate for Asthma (0 -72 hrs) – Pediatric (1-19 years)
5. X-ray Rate for Ankle or Foot Injury Patients – Adult (20-84 years)
6. X-ray Rate for Ankle or Foot Injury Patients – Pediatric (5-19 years)
7. Return X-ray Rate for Ankle or Foot Injury Patients (≤ 7 days)
8. Chest X-ray for Rate for Asthma – Pediatric (1-19 years)
9. Chest X-ray Rate for Bronchiolitis – Pediatric (3-24 months)
10. Chest and Neck X-ray Rate for Croup – Pediatric (3 months – 3 years)

1. Proportion of Pneumonia Patients that have an Inpatient LOS of < = 2 days

Definition

This indicator measures the proportion of adult patients (20 to 84 years) seen in the ED with a diagnosis of pneumonia who are admitted as an acute inpatient and who have an inpatient LOS < = 2 days.

Method of Calculation

Note: This indicator involves linking NACRS records in the denominator with subsequent DAD records in the numerator. DAD records may come from other Ontario facilities. Therefore, numerator values for this indicator are not 100% verifiable by individual hospitals.

Numerator (Linked DAD Record)		
	Criteria	Codes
Include:	<p>Inpatient cases linked to the index NACRS record</p> <p>Inpatient LOS < = 2 days</p> <p>Inpatient cases with discharge disposition of home or homecare setting with support services, or home without support services</p>	<p>See Appendix A for linking methodology</p> <p>LOS: (Discharge date – Admit date) < = 2days</p> <p>Discharge disposition: 04, 05</p>

Denominator (Index NACRS Record)		
	Criteria	Codes
Include:	<p>Age 20-84 years</p> <p>Cases with a pneumonia diagnosis</p> <p>Cases that were discharged home or to a place of residence, admitted or transferred to inpatient.</p>	<p>20 < = years of age < = 84</p> <p>Main Problem: J13, J14, J15^, J16^, J18^</p> <p>OR</p> <p>Main Problem: J96^, R05, R06.0, R06.2, G47.3^, R09.2</p> <p><u>And</u> other problem (any position) = J13, J14, J15^, J16^, J18^</p> <p>Visit Disposition: 1, 6, 7, 8, 15</p>

2. Return Visit Rate for Asthma (< = 24 hrs) – Adult (20-64 years)

Definition

This indicator measures the proportion of adult patients (20 to 64 years) who are 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 after the initial discharge.

Method of Calculation

Note: This indicator involves linking NACRS records in the denominator with subsequent NACRS records in the numerator. Records in the numerator may come from other Ontario facilities. Therefore, numerator values for this indicator are not 100% verifiable by individual hospitals.

Numerator (Subsequent NACRS Record)		
	Criteria	Codes
Include:	Return visit cases linked to the index NACRS record	See Appendix A for linking methodology
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
	Cases with an urgent or emergent triage level	Triage Level: 1, 2, 3
Exclude:	Planned revisits and those seen by non ED providers	Visit Type: 3 or 5

Denominator (Index NACRS Record)		
	Criteria	Codes
Include:	Age 20-64 years	20 < = years of age < = 64
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
Exclude:	Cases that left before visit completion, admissions to inpatient, transfers and deaths	Visit Disposition: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

3. Return Visit Rate for Asthma (24 -72 hrs) – Adult (20-64 years)

Definition

This indicator measures the proportion of adult patients (20 to 64 years) who are 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 to 72 hours after the initial discharge.

Method of Calculation

Note: This indicator involves linking NACRS records in the denominator with subsequent NACRS records in the numerator. Records in the numerator may come from other Ontario facilities. Therefore, numerator values for this indicator are not 100% verifiable by individual hospitals.

Numerator (Subsequent NACRS Record)		
	Criteria	Codes
Include:	Return visit cases linked to the index NACRS record	See Appendix A for linking methodology
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
	Cases with an urgent or emergent triage level	Triage Level: 1, 2, 3
Exclude:	Planned revisits and those seen by non ED providers	Visit Type: 3 or 5

Denominator (Index NACRS Record)		
	Criteria	Codes
Include:	Age 20-64 years	20 <= years of age <= 64
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
Exclude:	Cases that left before visit completion, admissions to inpatient, transfers and deaths	Visit Disposition: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

4. Return Visit Rate for Asthma (0 -72 hrs) – Pediatric (1-19 years)

Definition

This indicator measures the proportion of pediatric patients (1 to 19 years) who are 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 72 hours after the initial discharge.

Method of Calculation

Note: This indicator also involves linking NACRS records in the denominator with subsequent NACRS records in the numerator. Records in the numerator may come from other Ontario facilities. Therefore, numerator values for this indicator are not 100% verifiable by individual hospitals.

Numerator (Subsequent NACRS Record)		
	Criteria	Codes
Include:	Return visit cases linked to the index NACRS record	See Appendix A for linking methodology
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
	Cases with an urgent or emergent triage level	Triage Level: 1, 2, 3
Exclude:	Planned revisits and those seen by non ED providers	Visit Type: 3 or 5

Denominator (Index NACRS Record)		
	Criteria	Codes
Include:	Age 1-19 years	1 <= years of age <= 19
	Cases with an asthma diagnosis	Main Problem: J45 [^] OR Main Problem: R05, R06.0, R06.2, J96 [^] <u>And other problem (any position) = J45[^]</u>
Exclude:	Cases that left before visit completion, admissions to inpatient, transfers and deaths	Visit Disposition: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

5. X-ray Rate for Ankle or Foot Injury Patients – Adult (20-84 years)

Definition

This indicator measures the proportion of adult patients (20 to 84 years) with an ankle or foot injury who receive an x-ray of the ankle or foot.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Numerator		
	Criteria	Codes
Include:	Cases within the denominator with an x-ray	Intervention Code: 3VQ10^, 3WA10^, 3WG10^

Denominator		
	Criteria	Codes
Include:	Age 20-84 years	20 <= years of age <= 84
	Cases with an ankle or foot injury	Main Problem: S82.3^ – S82.9^, S86^, S90.0, S90.3, S90.7, S90.8, S90.9, S92.0^, S92.1^, S92.2^, S92.3^, S92.7^, S92.9^, S93.0^, S93.3^, S93.2, S93.4^, S93.6, S96^, S99^
Exclude:	Cases that left before visit completion	Visit Disposition: 2, 3, 4, 5

6. X-ray Rate for Ankle or Foot Injury Patients – Pediatric (5-19 years)

Definition

This indicator measures the proportion of pediatric patients (5 to 19 years) with an ankle or foot injury who receive an x-ray of the ankle or foot.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Numerator		
	Criteria	Codes
Include:	Cases within the denominator with an x-ray	Intervention Code: 3VQ10 [^] , 3WA10 [^] , 3WG10 [^]

Denominator		
	Criteria	Codes
Include:	Age 5-19 years Cases with an ankle or foot injury	5 < = years of age < = 19 Main Problem: S82.3 [^] – S82.9 [^] , S86 [^] , S90.0, S90.3, S90.7, S90.8, S90.9, S92.0 [^] , S92.1 [^] , S92.2 [^] , S92.3 [^] , S92.7 [^] , S92.9 [^] , S93.0 [^] , S93.3 [^] , S93.2, S93.4 [^] , S93.6, S96 [^] , S99 [^]
Exclude:	Cases that left before visit completion	Visit Disposition: 2, 3, 4, 5

7. Return X-ray Rate for Ankle or Foot Injury Patients (< = 7 days)

Definition

This indicator measures the proportion of patients (5 to 84 years) who are discharged from the ED with a diagnosis of ankle or foot injury but without an ankle or foot x-ray, who have a return visit for ankle injury to any ED within 7 days after the initial ED discharge and who receive an ankle or foot x-ray on the return visit.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Note: This indicator involves linking NACRS records in the denominator with subsequent NACRS records in the numerator. Records in the numerator may come from other Ontario facilities. Therefore, numerator values for this indicator are not 100% verifiable by individual hospitals.

Numerator (Subsequent NACRS Record)		
	Criteria	Codes
Include:	Return visit cases linked to the index NACRS record	See Appendix A for linking methodology
	Cases with an ankle or foot injury	Main Problem: S82.3 [^] – S82.9 [^] , S86 [^] , S90.0, S90.3, S90.7, S90.8, S90.9, S92.0 [^] , S92.1 [^] , S92.2 [^] , S92.3 [^] , S92.7 [^] , S92.9 [^] , S93.0 [^] , S93.3 [^] , S93.2, S93.4 [^] , S93.6, S96 [^] , S99 [^]
	Cases that had an x-ray performed	Intervention code: 3VQ10 [^] , 3WA10 [^] , 3WG10 [^]

Denominator (Index NACRS Record)		
	Criteria	Codes
Include:	Age 5-84 years	5 < = years of age < = 84
	Cases with an ankle or foot injury	Main Problem: S82.3 [^] – S82.9 [^] , S86 [^] , S90.0, S90.3, S90.7, S90.8, S90.9, S92.0 [^] , S92.1 [^] , S92.2 [^] , S92.3 [^] , S92.7 [^] , S92.9 [^] , S93.0 [^] , S93.3 [^] , S93.2, S93.4 [^] , S93.6, S96 [^] , S99 [^]
	Cases that were discharged home or to a place of residence	Visit Disposition: 1, 15
Exclude:	Cases that had an x-ray performed	Intervention code: 3VQ10 [^] , 3WA10 [^] , 3WG10 [^]

8. Chest X-ray Rate for Asthma – Pediatric (1-19 years)

Definition

This indicator measures the proportion of pediatric patients (1 to 19 years) with a diagnosis of asthma who receive a chest x-ray.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Numerator		
	Criteria	Codes
Include:	Cases within the denominator with a chest x-ray	Intervention Code: 3GY10^

Denominator		
	Criteria	Codes
Include:	Age 1 – 19 years Cases with an asthma diagnosis	1 <= years of age <= 19 Main Problem: J45^ OR Main Problem: R05, R06.0, R06.2, J96^ <u>And</u> other problem (any position) = J45^
Exclude:	Cases that left before visit completion	Visit Disposition: 2, 3, 4, 5

9. Chest X-ray Rate for Bronchiolitis – Pediatric (3-24 months)

Definition

This indicator measures the proportion of pediatric patients (3 to 24 months) with a main problem of bronchiolitis who receive a chest x-ray.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Numerator		
	Criteria	Codes
Include:	Cases within the denominator with a chest x-ray	Intervention Code: 3GY10^

Denominator		
	Criteria	Codes
Include:	Age 3-24 months	3 < = months of age < = 24
	Cases with a main problem of bronchiolitis	Main Problem: J21^
Exclude:	Cases that left before visit completion	Visit Disposition: 2, 3, 4, 5

10. Chest and Neck X-ray Rate for Croup – Pediatric (3 months – 3 years)

Definition

This indicator measures the proportion of pediatric patients (3 months to 3 years) with a main problem of croup who receive a chest or neck x-ray.

* For further information on the interpretation of this indicator, please see page 21 of this technical report.

Method of Calculation

Numerator		
	Criteria	Codes
Include:	Cases within the denominator with a chest or neck x-ray	Intervention Code: 3GY10^, 3EQ10^

Denominator		
	Criteria	Codes
Include:	Age 3 months – 3 years	3 months < = age < = 3 years
	Cases with a main problem of croup	Main Problem: J05.0
Exclude:	Cases that left before visit completion	Visit Disposition: 2, 3, 4, 5

Risk Adjustment

In comparing hospital rates of utilization and outcomes, it is important to take into account differences in patient characteristics that may vary systematically among hospitals. In clinical research this is called risk-adjustment, where hospital data are adjusted to remove pre-existing influences. This issue is particularly important because patients with certain characteristics are less likely to receive some specific treatments or to have positive clinical outcomes than other groups. If a hospital tends to serve a disproportionate number of such patients, it may be unfairly reported as having higher rates of undesirable events, when in fact, these rates may be comparable to another hospital with lower instances that simply serves a different population. Therefore, to improve hospital comparability, appropriate risk-adjustment techniques were used to adjust the data.

It is important to emphasize that risk-adjustment attempts to control for, but cannot entirely eliminate, the impact of differences in patients' pre-admission health status on performance. There are two key caveats to risk-adjustment. First, the expected performance is a relative measure. It describes the expected level of performance at an institution based on how well all institutions perform. Second, risk-adjustment only *reduces* the effect of differences in the patient population across hospitals; it cannot eliminate the effect of these differences completely. As a result, hospitals with the sickest patients may tend to score more poorly than other institutions, even after risk-adjustment. Likewise, hospitals that treat rare or highly specialized groups of patients may tend to score poorly, even after risk-adjustment. It is important to keep these caveats in mind when comparing hospital performance.

Age, sex and acuity were used to adjust most of the indicators. Table 2 shows the variables that were used for adjustment for each of the ten indicators.

Table 2: Risk-adjustment

Indicator	Categories
1. Proportion of Pneumonia Patients that have an Inpatient LOS of < = 2 days	Age: 20-44, 45-64, 65-74, 75-84 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
2. Return Visit Rate for Asthma (< = 24 hrs) – Adult (20-64 years)	Age: 20-44, 45-64 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
3. Return Visit Rate for Asthma (24 -72 hrs) – Adult (20-64 years)	Age: 20-44, 45-64 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
4. Return Visit Rate for Asthma (0 -72 hrs) – Pediatric (1-19 years)	Age: 0-4, 5-19 Sex: Male, Female Triage (CTAS): I&II, III, IV&V

5. X-ray Rate for Ankle or Foot Injury Patients – Adult (20-84 years)	Age: 20-44, 45-64, 65-84 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
6. X-ray Rate for Ankle or Foot Injury Patients – Pediatric (5-19 years)	Sex: Male, Female Triage (CTAS): 1&2, 3, 4&5
7. Return X-ray Rate for Ankle or Foot Injury Patients (< = 7 days)	Age: 5-12, 13-18, 19-44, 45-64, 65-84 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
8. Chest X-ray for Rate for Asthma – Pediatric (1-19 years)	Age: 0-4, 5-19 Sex: Male, Female Triage (CTAS): I&II, III, IV&V
9. Chest X-ray Rate for Bronchiolitis – Pediatric (3-24 months)	Sex: Male, Female Triage (CTAS): I&II, III, IV&V
10. Chest and Neck X-ray Rate for Croup – Pediatric (3 months – 3 years)	Sex: Male, Female Triage (CTAS): I&II, III, IV&V

Calculating Risk-Adjusted Rates

Indirect standardization was used to calculate risk-adjusted rates. Multiple regression models were used to determine the expected values. Logistic regression was used unless the provincial rate was very low (i.e. less than 5%). When the outcome was very low, poisson regression was used.

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

Calculating Confidence Intervals around Risk-Adjusted Rates

95% confidence intervals around the adjusted values were calculated from the Poisson distribution when the observed numerators were less than 100. Otherwise, the confidence intervals were calculated using Byar’s approximation (shown below).³

$$LCL = (obs/exp) * prate * (1 - 1/(9 * obs) - 1.96/(3 * sqrt(obs))) * * 3$$

$$UCL = ((obs + 1)/exp) * prate * (1 - 1/(9 * (obs + 1))) + 1.96/(3 * sqrt(obs + 1)) * * 3$$

Where: obs = number of observed cases

exp = number of expected cases

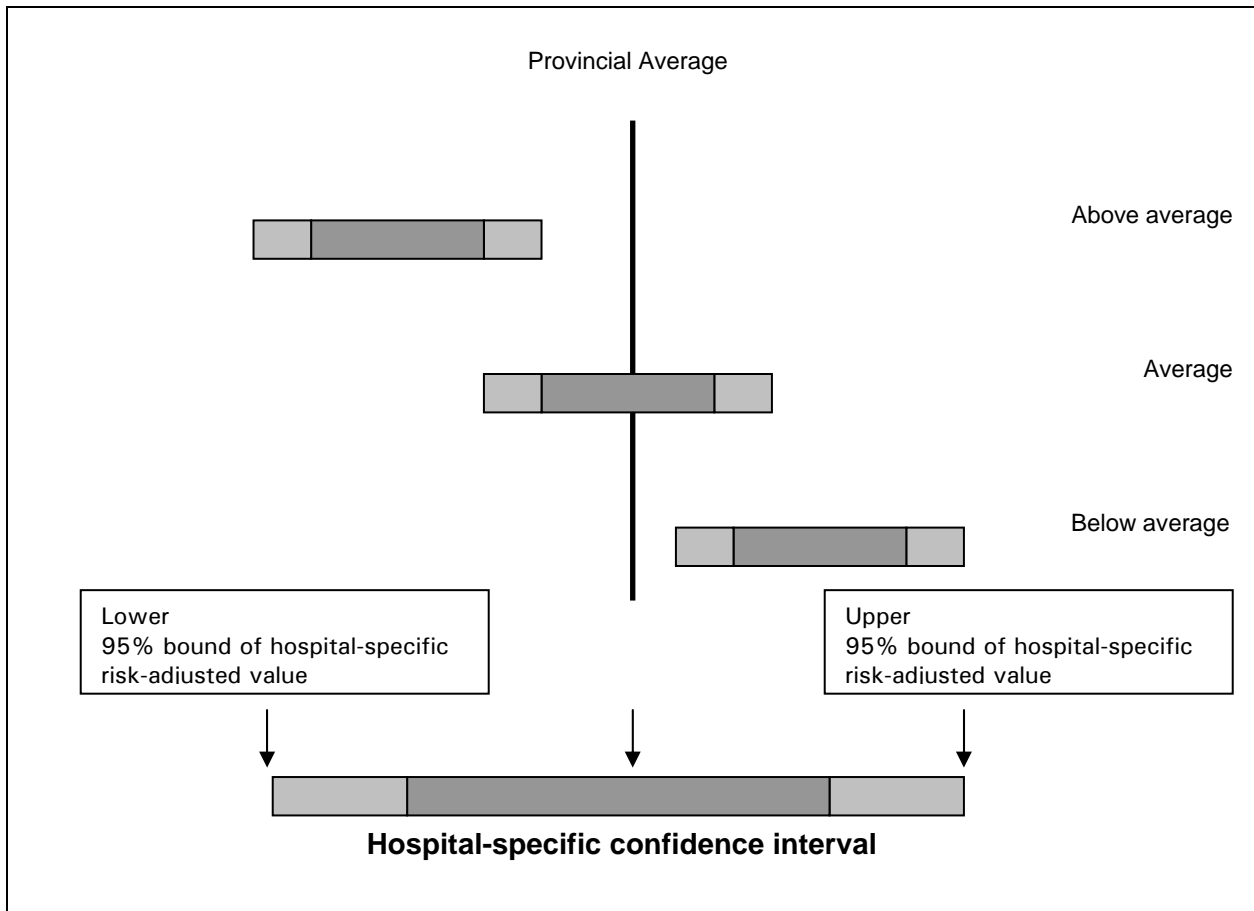
prate = provincial rate

³ Washington State Health Department, *Guidelines for Using Confidence Intervals for Public Health Assessment*, [online] January 8, 2002. cited April 5, 2006, from <http://www.doh.wa.gov/Data/guidelines/WordDocs/CI_guidelines.pdf>

Performance Rating

In *Hospital E-Scorecard Report 2008: Emergency Department Care*, the shading of the cell indicates whether the hospital’s score on that indicator reflected above average performance, average performance, or below average performance. The performance levels 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, then an above average performance classification was assigned. If the provincial mean is below the lower end of the confidence interval, then a below average performance classification was assigned. Finally, if the provincial mean fell within the confidence interval, an average performance classification was assigned. Figure 1 illustrates how performance was determined.

Figure 1: Performance Allocation for Hospital’s Risk-Adjusted Rate



For indicators 5 and 6 - x-ray rate for ankle or foot injury – a multi-centre study found that the application of validated decision rules resulted in significant

reductions in ankle x-rays (resulting in ankle x-ray rates around 60-62%).⁴ Although a certain threshold of x-rays are required, hospitals with lower rates are considered to be doing better for the purpose of this report. However, hospitals with very low x-ray rates for these indicators should examine if they are under-utilizing x-rays by examining their return x-ray rates (indicator 7).

Impact of Radiology Department Service Accessibility on X-ray Indicators

Some small and community hospitals do not have 24-hour access to a radiology department. When appropriate, if the radiology department is closed, physicians ask patients to return for an x-ray when the department is open. Therefore, for these hospitals lower X-ray rates may be a result of not having continuous access to a radiology department. This can also result in higher Return X-ray Rate for Ankle or Foot Injury Patients (< = 7 days) for these hospitals.

⁴ I.G. Stiell, G. Wells, A. Laupacis, R. Brison, R. Verbeek, K. Vandemheen and C.D. Naylor, "Multicentre trial to introduce the Ottawa ankle rules for use of radiography in acute ankle injuries" *BMJ*. 311 (September 2, 1995): pp. 594-597.

Results by Sex

Indicator values for men and women as well as the value for the difference between men and women were calculated and are available on the eScorecard. The sex-specific indicator values were risk-adjusted using the same method as for the regular indicators, however sex was removed from the multiple regression model when determining the expected number. In addition, the ratio of observed to expected cases was multiplied by the sex-specific provincial average.

Calculating the Sex-Difference (Attributable Risk)

The sex-difference indicator value was calculated by quantifying the difference between rates for women and men as follows:

$$\text{Attributable risk} = (\text{Female RA rate} - \text{Male RA Rate}) / \text{Female RA rate}$$

In other words, it is the value of the difference between women and men attributable to sex (after accounting for age and triage). 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. However, it is important to remember that no single set of measures should be taken as representative of overall hospital performance.

Calculating Confidence Intervals around Sex-Difference (Attributable Risk)

95% confidence intervals around the risk-adjusted (RA) sex-difference value were calculated as follows:

$$\begin{aligned} \text{UCL} &= 1 - \text{RR} * \exp(-1.96 * \text{sqrt}((1 - \text{Rf}) / (\text{Nf} * \text{Rf}) + (1 - \text{Rm}) / (\text{Nm} * \text{Rm}))); \\ \text{LCL} &= 1 - \text{RR} * \exp(1.96 * \text{sqrt}((1 - \text{Rf}) / (\text{Nf} * \text{Rf}) + (1 - \text{Rm}) / (\text{Nm} * \text{Rm}))); \end{aligned}$$

Where: RR = relative risk of male to females (i.e. Rm/Rf)

Nx = sample size, where x = f if female or m if male

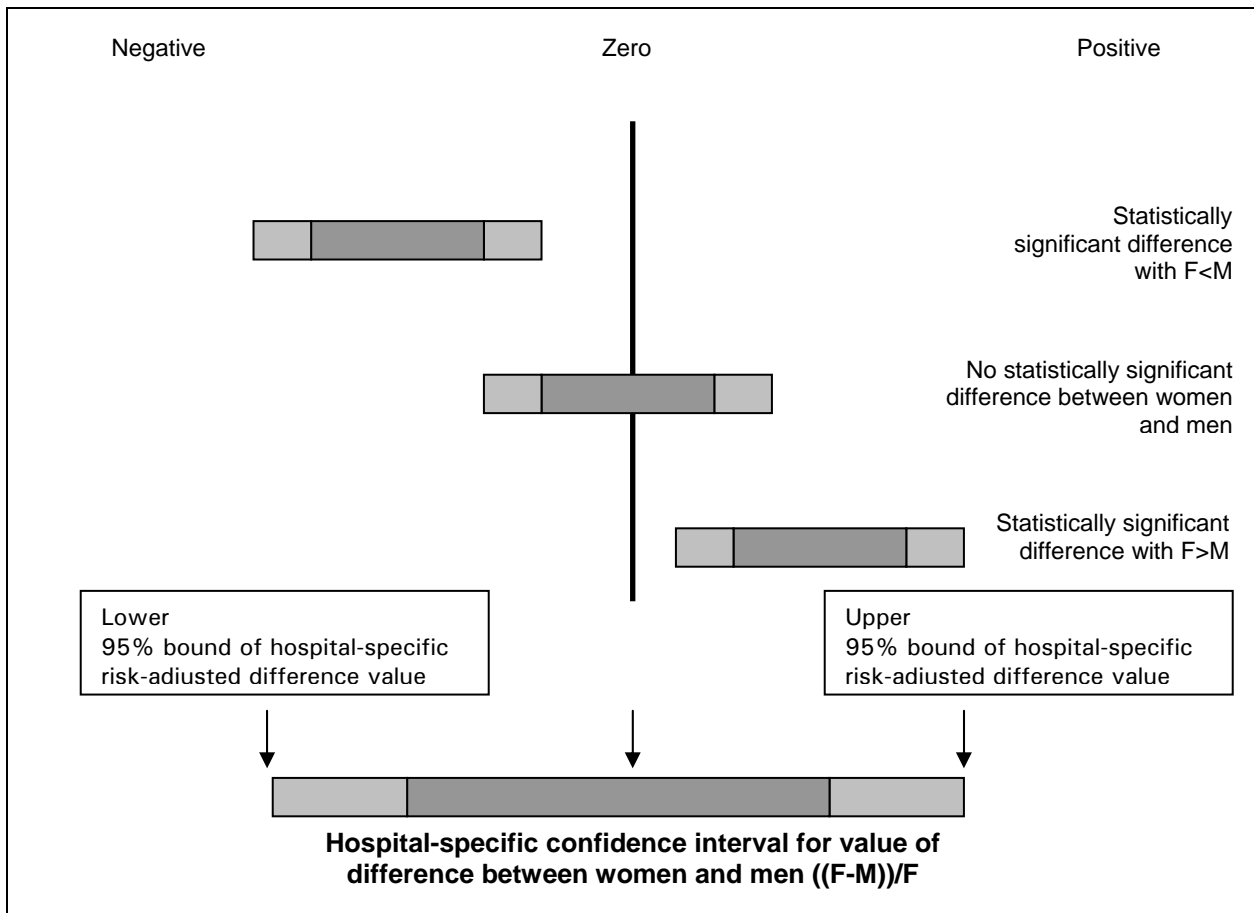
Rx = Adjusted rate, where x = f if female or m if male

Performance Rating for the Sex-Difference (Attributable Risk)

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”. Performance ratings for these indicators are based on 95% confidence interval of hospital’s risk-adjusted difference values, using the following criteria:

- If a hospital's 95% confidence interval around their sex-difference value for a given indicator contains zero, the hospital is classified as having no statistically significant sex difference.
- If a hospital's 95% confidence interval around their sex-difference value 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 sex-difference value 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.

Figure 2: Performance Rating for Difference Between the Sexes ((F-M)/F)



APPENDIX A: Linkage Methodology for Pneumonia Indicator and Return Visit Indicators

An index NACRS record from one facility is linked to a subsequent NACRS/DAD record in any Ontario facility by matching the first 10 digits of the encrypted Health Card Number and the patient birth date. The following criteria and codes detail the linkage methodology for all relevant indicators.

Linkage Methodology	
Criteria	Codes
1. Proportion of pneumonia patients that have an inpatient LOS of <= 2 days	
Include all inpatient (DAD) records with Admit time within -24 to +2 hours of Index NACRS Visit Completion time OR Inpatient (DAD) records with admit time within > +2 to +12 hours, where both Index NACRS Visit Disposition is admitted to inpatient or transfer to inpatient And DAD Entry is indicated as via the ED	-24hrs <= (DAD Admit Time - NACRS Visit Completion Time) <= 2hrs OR 2hrs < (DAD Admit Time - NACRS Visit Completion Time) <= 12hrs And NACRS Visit Disposition: 6, 7, 8 And DAD Entry Code: E
2. Return Visit Rate for Asthma (<= 24 hrs) – Adult (20-64 years)	
Include all subsequent NACRS records where: Subsequent NACRS record "start time"* is within 24 hours of the index NACRS visit "end time"+	0 hrs < (Follow-up record "start time" – Index Visit "end time") <= 24 hrs
3. Return Visit Rate for Asthma (24 -72 hrs) – Adult (20-64 years)	
Include all subsequent NACRS records where: Subsequent NACRS record "start time" * is 24 to 72 hours after index NACRS visit "end time" +	24 hrs < (Follow-up record "start time" – Index Visit "end time") <= 72 hrs
4. Return Visit Rate for Asthma (0 -72 hrs) – Pediatric (1-19 years)	
Include all subsequent NACRS records where: Subsequent NACRS record "start time"* is within 72 hours of the index NACRS visit "end time"+	0 hrs < (Follow-up record "start time" – Index Visit "end time") <= 72 hrs
7. Return X-ray Rate for Ankle Injury Patients (<= 7 days)	
Include all subsequent NACRS records where: Subsequent NACRS record "start time"* is within 7 days of the index NACRS visit "end time"+	0 days < (Follow-up record "start time" – Index Visit "end time") <= 7 days

* start time = earlier of Triage Date & Time or Registration Date & Time

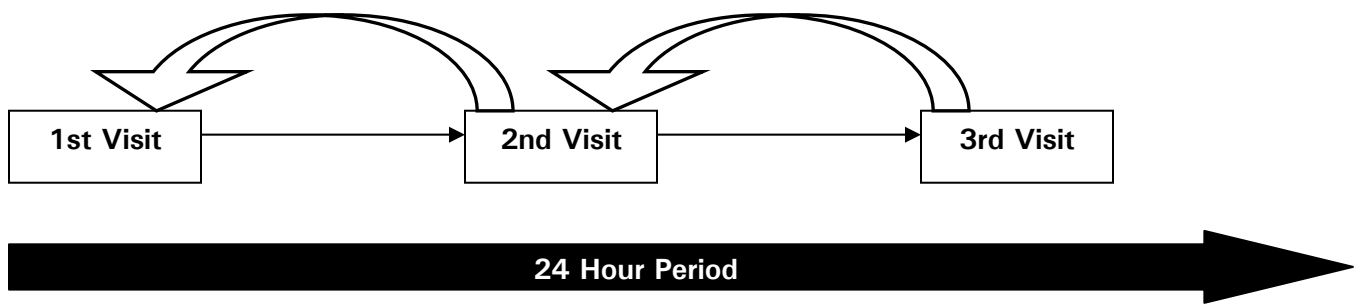
+ end time = Date & Time Visit Completed

Counting Multiple Return Visits

There can be multiple return visits within the same specified time frame. Return visits are only counted for occurrence and not frequency. Therefore, for the return visit numerator, a return visit is only counted if it occurs – the numerator does not count how many revisits occurred. See the example below for further clarification.

Example: An adult patient revisits the ED twice within 24 hours for asthma.

In this example a patient comes to the Emergency Department on 3 separate occasions within a 24 hour period. Each of the 3 visits is counted in the denominator. The first 2 visits are associated with a re-visit. Therefore, this patient has contributed 3 counts to the denominator and 2 counts to the numerator.



Data quality checks for Return Visit Indicators:

- 1) Subsequent NACRS record "start time" cannot equal the index NACRS record "start time".
- 2) Subsequent NACRS record "start time" must be greater than the index NACRS record "end time".

Imputing Time Visit Complete for ED Records

Starting fiscal year 2006/2007, when time visit completed ("end time") was unknown it was recorded on the NACRS record as 9999. 94,742 (1.84%) of NACRS records in this year's ED CUO analysis had a recorded time visit completed of 9999. For these records, the median ED visit length of stay (3 hrs) was used to estimate the date and time visit completed. If the date visit completed was recorded, then the estimated date visit completed was compared to the actual date visit completed, if they did not match, the following rules were applied:

- 1) If the estimated date visit completed was greater than the actual date visit completed, then the estimated discharge time was set to 23:59hrs for the date visit completed recorded on the NACRS record.

- 2) If the estimated date visit completed was less than the actual date visit completed, then the estimated time visit completed was used (the actual date visit completed was also used, unchanged).