What Does "Adjusted" Mean?
A Demonstration of Quality Indicator Calculation in Nursing Homes
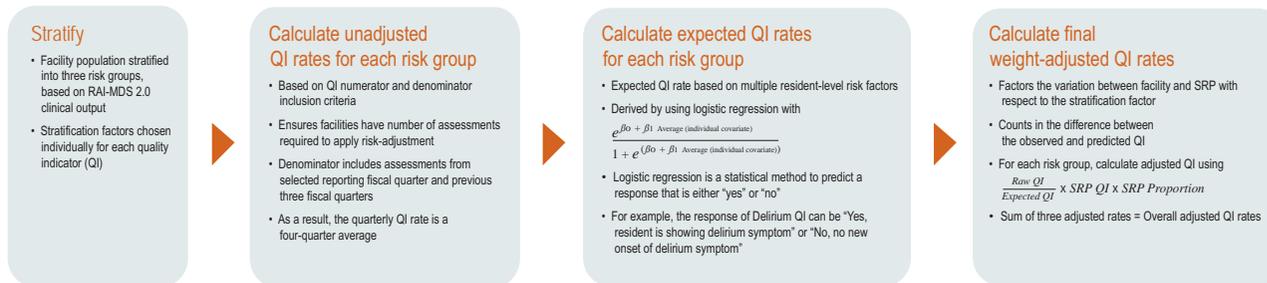
Background

Quality indicators (QIs) enable nursing home leadership and health system managers to measure and monitor their performance, relative to that of their peers, in multiple key domains of quality. The QIs reported by the Canadian Institute for Health Information (CIHI) are risk-adjusted; this allows for comparisons among nursing homes, by adjusting for differences in the populations served and the associated differences in risk that come with various conditions.

Objectives

- Define unadjusted and adjusted QIs
- Demonstrate the QI risk-adjustment process for the Continuing Care Reporting System (CCRS), using an example
- Highlight how nursing homes can interpret their CIHI QI results
- Provide guidance on how to understand and address variation in unadjusted and adjusted QI results

What is the difference between an unadjusted and adjusted QI?

Definition	Use
Unadjusted QIs Numerator: Total number of residents triggering a QI Denominator: Total number of residents at risk for triggering a QI Unadjusted QI = (numerator / denominator) × 100%	Provide accurate information about the frequency of a quality-of-care outcome. Best used to gauge performance over time **within** a facility.
Adjusted QIs Rate calculated using logistic regression and weighted average to 1. Compare the risk profile of an individual facility with the profile of a standard reference population (SRP);* and 2. Modify the unadjusted QI results as if each facility served an SRP.	Best used when comparing performance **across** facilities or jurisdictions.

Note
* The SRP and associated statistical parameters used for risk-adjustment were created through interRAI research and are based on assessment data collected from more than 3,000 facilities in six U.S. states and 92 residential care facilities and continuing care hospitals in Ontario and Nova Scotia.

How is risk-adjustment calculated?

Risk-adjustment process

Stratify
- Facility population stratified into three risk groups, based on RAI-MDS 2.0 clinical output
- Stratification factors chosen individually for each quality indicator (QI)

Calculate unadjusted QI rates for each risk group
- Based on QI numerator and denominator inclusion criteria
- Ensures facilities have number of assessments required to apply risk-adjustment
- Denominator includes assessments from selected reporting fiscal quarter and previous three fiscal quarters
- As a result, the quarterly QI rate is a four-quarter average

Calculate expected QI rates for each risk group
- Expected QI rate based on multiple resident-level risk factors
- Derived by using logistic regression with

$$\frac{e^{\beta_0 + \beta_1 \ \text{Average (individual covariate)}}}{1 + e^{(\beta_0 + \beta_1 \ \text{Average (individual covariate)})}}$$

- Logistic regression is a statistical method to predict a response that is either "yes" or "no"
- For example, the response of Delirium QI can be "Yes, resident is showing delirium symptom" or "No, no new onset of delirium symptom"

Calculate final weight-adjusted QI rates
- Factors the variation between facility and SRP with respect to the stratification factor
- Counts in the difference between the observed and predicted QI
- For each risk group, calculate adjusted QI using

$$\frac{Raw\ QI}{Expected\ QI} \times SRP\ QI \times SRP\ Proportion$$

- Sum of three adjusted rates = Overall adjusted QI rates

What does an adjusted QI look like?

Example: Calculating Percentage of Residents With Symptoms of Delirium for Facility A and Facility B

Table 1: Quality Indicator Definition

Denominator	Residents with valid RAI-MDS 2.0 assessments,* excluding comatose and end-of-life residents
Numerator	Residents satisfying any of the following conditions • Any new onset of delirium symptom on target assessment • Previous recorded symptoms still present on current assessment • No previous recorded symptoms but symptoms present on current assessment
Stratification Factor	Depression Rating Scale (DRS) • Low Risk: DRS = 0 • Medium Risk: DRS = 1 or 2 • High Risk: DRS = 3 to 14
Resident-Level Risk Factor	If a resident is younger than 65, then C_AGE = 1; otherwise, C_AGE = 0

Notes
* The Resident Assessment Instrument Minimum Data Set, version 2.0 (RAI-MDS 2.0)© documents the clinical and functional characteristics of residents and is the foundation data standard for CCRS. RAI-MDS 2.0 © interRAI Corporation, Washington, D.C., 1995, 1997, 1999. Modified with permission for Canadian use under licence to the Canadian Institute for Health Information. Canadianized items and their descriptions © Canadian Institute for Health Information, 2013.

Table 2: Standard Reference Population's Delirium QI Rate and Percentage of Each Risk Group

Stratification	Denominator	Unadjusted QI Rate	Percentage of Each Risk Group
Low Risk	96,071	7%	$\frac{96,071}{187,218}$ = 51%
Medium Risk	55,741	10%	$\frac{55,741}{187,218}$ = 30%
High Risk	34,848	14%	$\frac{34,848}{187,218}$ = 19%
Overall*	**187,218**		

Note
* The overall denominator is not always the sum of all denominators in the risk groups; it is the total number of residents with assessments that meet the denominator inclusion criteria.

Figure 3: Proportion of Each Risk Group and Unadjusted QIs in the High-Risk Group

Standard Reference Population

Facility A
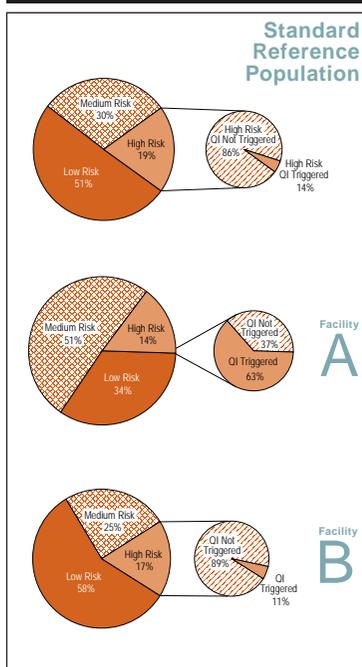
Facility B

How do we interpret this adjusted QI example?

Facility A has fewer residents in the low- and high-risk groups but more residents in the medium-risk group than SRP.

The high-risk group has an unadjusted QI rate of 62.86% (Figure 1), which is distinctly different from the 14% of the SRP in Table 2.

Facility B has similar proportion of residents and unadjusted rates in each risk group compared to SRP.

The final adjusted QI rate changed minimally when each group was re-weighted.

The final adjusted QI rate increased, because the already-high QI rate in the high-risk group became even bigger once it was given more weight to match the reference population.

- Initially, the **unadjusted QI** rate was **14.15%**.
- When the risk groups were re-weighted, the **adjusted QI** rate became **17.41%**.

Figure 1: Facility A

Figure 2: Facility B
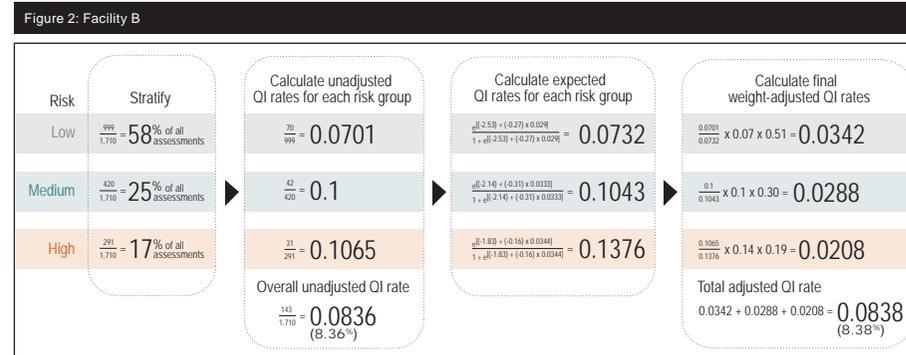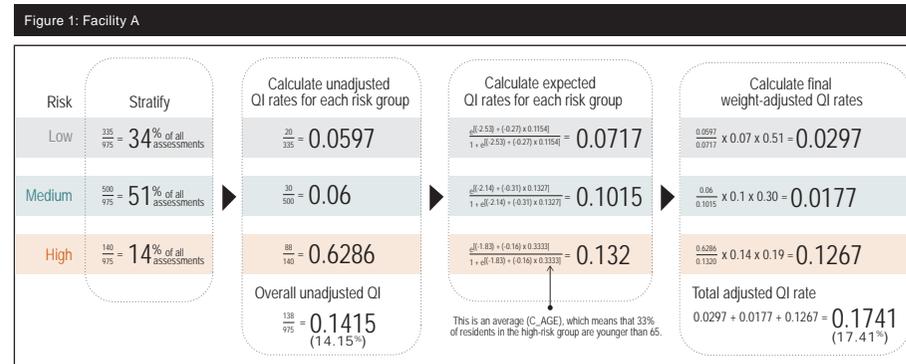
How can a facility address variance between unadjusted and adjusted QI rates?

- **Within a facility**, it is important to know the residents' risk profiles and look at the unadjusted QI rates of each risk group.
  - For instance, in Facility A, there are more residents with symptoms of delirium in the high-risk group. Therefore, it's a good idea to target this group with interventions to address symptoms of delirium.
- The **unadjusted QI rate** represents an actual count of residents with symptoms: use it to support clinical decisions for residents.
- The **adjusted QI rate** represents a number based on an SRP to enable fairer comparisons.
  - It takes into account the differences among residents cared for within a facility.

About
Home and Continuing Care

CIHI's Home and Continuing Care (HCC) program provides clinicians, managers, policy-makers and the public with information for planning, quality improvement and accountability. Continuing care organizations across Canada—including complex or chronic care hospitals, residential care facilities such as long-term, nursing or personal care homes, and home care programs—submit data to HCC databases. Collaborating with interRAI, an international research network, supports evidence-based reports, including standard clinical measures and quality indicators.

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December 2013