HOW TO CALCULATE A HOSPTAL'S OBSERVED/EXPECTED MORTALITY RATIO

The method for calculating a hospital's observed/expected (O/E) mortality ratio is described below.

Introduction

NELA will be using the bespoke NELA Risk Adjustment tool from the start of year 5 data collection (from 1 December 2017). We therefore encourage teams to use and evaluate the new NELA Risk Adjustment tool. We also welcome feedback on its performance as it is utilised in practice.

The NELA Risk Adjustment model predicts **30-day mortality** and demonstrates better calibration, particularly at higher predicted mortalities (>15%), than does the original P-POSSUM model[1].

This document describes the method for calculating the observed versus expected mortality ratio for an institution based on the NELA Risk Adjustment model and, for reference, the original P-POSSUM model.

For a more detailed explanation of calculating the observed versus expected mortality ratios refer to Spiegelhalter, Stat Med 2005, 24:1185-1202[2].

Method

A data export is downloaded from the NELA webtool as "NELA proforma (shortened field names)".

The variables used are:

Observed deaths: the number of emergency laparotomy patients who died in the hospital

Expected deaths: the sum of predicted risk of death (expressed as a decimal rather than percentage) of all patients in the hospital, not just those who died

O/E ratio: Observed deaths / Expected deaths

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[1] NELA Technical Document – Development of the Risk Adjustment Model July 2016

[2]

http://www.medicine.cf.ac.uk/media/filer_public/2010/10/11/journal_club__spiegelhalter_stats_in_med_funnel_plots.pdf

Worked Example

30-day mortality figures are the outcome measure used for the calculation. This could be modified to risk adjust at other time periods (eg 90-days, 1-year) but the risk prediction models may be less accurate beyond the 30-day period.

A data export is performed for hospital "Y" (please refer to the accompanying 'worked example' Excel file).

- 10 patients underwent surgery
- *Observed **inpatient** deaths* = 2
- *Observed deaths within **30-days** of surgery* = 1
    - o 1 patient died within 30-days of surgery (patient 7)
    - o Patient 10 died 43 days after surgery
- *Expected deaths within **30-days** of surgery* = 1.586 (NELA Model) or 1.799 (P-POSSUM Model)
    - o This is based on all 10 patients who had surgery
- *O/E ratio* = 0.63 (NELA Model) or 0.56 (P-POSSUM Model)

How to Perform These Calculations

Step 1:	Download your hospital's data from the NELA webtool using the first export option, "NELA proforma".
Step 2:	A zero in column IO (S07Status_Disch) identifies patients who died in hospital (inpatient deaths).
Step 3:	Calculate the length of stay (LOS) and exclude any cases with an LOS >30 days. LOS (days) can be calculated using the formula [column IP (S07Date_DischDate) – column CX (S04ArrivalInTheatreDatetime)]. (This formula is provided in column IS (Post-Op LoS) in the attached spreadsheet (O-E-ratio-calculation Worked Example) and can be copied and pasted directly into the spreadsheet of your own data).
Step 4:	Identify those emergency laparotomy patients who died within 30-days. This is the <u>observed number</u> of deaths. Column IT (Observed 30-Day Mortality Count) performs this calculation. A "1" in this column represents a patient who died within 30-days, and a "0" represents a patient still alive at this point. The total number of deaths within 30-days is given in cell IX7. The formula here will need to be amended for the number of patients in the download.

Step 5:	Column CW (S03PreOpNelaMortalityRisk) contains the pre-operative NELA Risk Model predicted 30-day mortality, column CT (S03PreOpPPOSSUMMortality) contains the same for P-POSSUM. The sum of the values in columns CT and CW, when expressed as decimals, represent the <u>expected number</u> of deaths within 30-days of surgery for the P-POSSUM and NELA models, respectively. These calculations are shown in cells IX5 and IX6. They can be copied and pasted into your spreadsheet for these calculations. **But note**, you will need to change the range in the formulae (i.e. CT11 and CW11) to include the number of patients in your spreadsheet.
Step 6:	Calculation of the observed deaths within 30 days / Expected deaths within 30 days (O/E ratio). For NELA: 1 / 1.586 = 0.63 (i.e. result of Step 4 / result of Step 5). For P-POSSUM: 1 / 1.799 = 0.56

In other words, the number of observed deaths within 30 days at hospital "Y" was approximately two-thirds of the deaths expected for patients with these characteristics.

Please note: From year-to-year, the column locations in the NELA data downloads may change. Also, it is important to ensure the ratio is the correct way round!

How to Handle Missing NELA Predicted Mortality Values
The method described above uses the *pre-operative* NELA predicted mortality risk. Should these be missing, substitute the *post-operative* NELA predicted mortality (column HX S06PostOpNelaMortalityRisk). If both values are missing, exclude this patient from the calculation.

There should always be a P-POSSUM score – however, if values are missing from this model, the risk will default to the lowest category for that missing variable. This will potentially lead to an *underestimation of risk* for this patient and will give a *worse O/E ratio* than otherwise.