A comparison of internal versus external risk-adjustment for monitoring clinical outcomes

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Oral presentation at MIE 2011
30th August, Oslo
• Intensive Care
  – Insight own performance - mortality

• Use of quality registry
  – NICE registry
  – 2010: 81 Dutch Intensive Care Units (ICUs)

• Case-mix
  – Internal
  – External
Introduction (2)

Control charts
- Industry / health care
- Generate warning signals
- Detect unexpected increase or decrease in mortality
- Risk-adjusted Exponentially Weighted Moving Average

From: Cook et. al 2010 Quality and Safety in health care
• Research questions
  – Internal vs. external risk adjustment

  – Warning signals when mortality remained constant

• Research questions
  – Warning signals when mortality is increasing
Methods (1)

• 60 months data of fictitious ICUs
  – Well/average/poor
    • 12 months with constant performance
    • 48 months with either
      • Constant performance
      • 60 months data of fictitious ICUs
        – Well/average/poor

10,000 runs
Methods (2)

• Outcome measure
  – Percentage of runs where warning signals given for decrease/increase in mortality over a period of 60 months
Results – constant mortality rate

- Constant mortality rate:
  - Internal risk-adjustment:
    - 33-34% warnings signals during 60 months for the three types of ICUs
  - External risk-adjustment:
    - Well ICU: 100% signal decreasing mortality during
      - Constant mortality rate:
        - Internal risk-adjustment:
          - 33-34% warnings signals during 60 months for the three types of ICUs
Results – increasing mortality rate – internal risk adjustment

Percentage of warning signals (cumulative) given: mortality increased and using internal model

- Well performer: increase in mortality
- Average performer: increase in mortality
- Poor performer: increase in mortality
- Well performer: decrease in mortality
- Average performer: decrease in mortality
- Poor performer: decrease in mortality
Results – increasing mortality rate – external risk adjustment

Percentage of warning signals (cumulative) given: mortality increased and using external model

Number of months

Well performer: increase in mortality
Well performer: decrease in mortality
Average performer: increase in mortality
Average performer: decrease in mortality
Poor performer: increase in mortality
Poor performer: decrease in mortality
Conclusion/Discussion

• Internal risk-adjustment preferred
  – Fewer warning signals when performance remained constant
  – Increases in mortality detected
  – Development requires sufficient data

• Caution with external risk-adjustment
  – Well performing ICUs
Questions?