BIG DATA IN HEALTHCARE: HOSPITAL PATIENT OUTCOMES IMPROVEMENT – INTERNATIONAL EXPERIENCE
Overview

• We will look at the benefits of sharing of data by hospitals in the context of big data analytics.

• Dr Foster Global Comparators: What it is and its aims.

• Hospital patient outcomes improvement: an example of the benefit of international collaboration
Bristol was awash with data. There was enough information from the late 1980s onwards to cause questions about mortality rates to be raised both in Bristol and elsewhere had the mindset to do so existed”
Comparison of UK paediatric cardiac surgical performance by analysis of routinely collected data 1984–96: was Bristol an outlier?

Paul Aylin, Bernardino Afshin, Nicky Bear, Adrian Cook, Paul Elliott, Stephen J W Evans, Audrey C Lawrence.

**Summary**

Background. Reports of high mortality after paediatric cardiac surgery at the Bristol Royal Infirmary, UK, led to the establishment of an independent public inquiry. One of the key questions was whether or not the mortality in Bristol was unusual compared with other specialist centres. This paper presents the analysis of data from 11 other major centres in England.

**Methods**

Data obtained for all 12 centres in January 1997. Data were collected for all children born in England, who underwent cardiac surgery within 60 days of birth. Mortality was recorded to 3 months after discharge. Cases were defined from the remaining 12 centres.

**Results**

Interpretation. Our results suggest that Bristol was an outlier, and we do not believe that statistical variation, systematic bias in data collection, case-mix, or data quality can explain a divergence in performance of this size.
Paediatric cardiac surgical mortality in England after Bristol:
Aylin P, Bottle R, Jarman B, Elliott P.
BMJ 2004; 329 (7 October 2004)
Dr Foster Global Comparators

- Started in 2010 as a collaboration between a group of international hospitals
- Use of routine administrative data as the foundation to identifying areas of statistically significant variance from the benchmark for key outcomes
- Common aim of improving quality of patient care
Dr Foster Global Comparators

• Use of the statistical approaches to risk adjustment based on case-mix developed by Imperial College London

• Now with approaching 40 members in 11 countries:
  • US, UK, Australia, Italy, Belgium, Holland, Norway, Denmark, Finland, China, Saudi Arabia

• An efficient way for hospitals to understand where they need to focus to improve patient care
Global collaboration: lessons

• Meaningful international comparison can be made using administrative data

• As a result meaningful change to outcomes can be achieved by working internationally with hospitals facing similar challenges in different countries
METHODOLOGY & RISK ADJUSTMENT
Dr Foster Unit at Imperial College

- Part of Imperial College London, School of Public Health.
- Led by Prof. Paul Aylin
- Develop the methodology used in Dr Foster tools
- Peer-reviewed journal papers on methods and variations in quality of care
Risk Adjustment

Example: Trusts C (London) and D (North of England)

- For each hospital and patient group, take the actual (‘observed’) number of deaths and divide it by the predicted (or ‘expected’) number of deaths: this is the SMR.

- Derive expected number from risk model where each patient’s probability of death is estimated depending on their set of casemix factors: sum these probabilities of death for each hospital to give the expected number of deaths.
Methodology – risk adjustment

Define comorbidity
- 32 conditions (Elixhauser + dementia)
- General weights for each outcome
- GOAL-specific weights
- Score = weights added together

Define other case-mix adjustment variables
- Diagnosis or procedure subgroup
- Age (5-year bands)
- Sex

Define other case-mix adjustment variables (continued)
- Planned (yes/no)
- Emergency admission in previous 30 days (yes/no)
- Year of discharge
- Transfer in (acute, non-acute, non-transfer)
- Interaction between age & comorbidity
- Interaction between planned & transfer
Principal Findings. There were 6,737,211 inpatient records, including 214,622 in-hospital deaths. Although diagnostic coding depth varied appreciably by country, comorbidity weights were broadly comparable. U.S. hospitals generally had the lowest mortality rates, shortest stays, and highest readmission rates.

Conclusions. Intercountry differences in outcomes may result from differences in the quality of care or in practice patterns driven by socio-economic factors. Carefully managed administrative data can be an effective resource for initiating dialog between hospitals within and across countries. Inclusion of important outcomes beyond hospital discharge would increase the value of these analyses.
The data that is utilised

• Routine administrative data
• Admitted patients
• 16 formats
• Multiple versions of ICD-9 and ICD-10 diagnosis coding
• Multiple procedure coding systems
• 5+ years (2005-2015)
• >20m records loaded
Indicators

Across all ICD diagnoses and a group of procedures:

• Mortality
• Length of Stay
• Readmissions

Also:
• Sepsis
• Complications of care

Aim is to add Laboratory, Radiology, Pathology and other datasets
Conclusions: A comparison of 7-day mortality among academic medical centers in industrialized countries reveals stark variability. Although 2006 stroke mortality in UK hospitals was almost double that of US hospitals, dramatic reductions were subsequently seen. Further analysis of national policy or practice changes that have driven these improvements promise to be revealing.
Reconciliation of international administrative coding systems for comparison of colorectal surgery outcome

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CONCLUSION: The linkage of international hospital administrative data that we developed enabled comparison of documented surgical outcomes between countries. This methodology may facilitate international benchmarking.

- 52,444 case records from 31 institutions in five countries.
- Mapping between coding and procedure coding systems was achieved.
- Risk Adjusted model was created
The Global Comparators project: international comparison of 30-day in-hospital mortality by day of the week

Milagros Ruiz, Alex Brettie, Paul P Aylin


Conclusions We show that mortality outcomes for our sample vary within each country and per day of the week in agreement with previous studies of the ‘weekend effect’. Due to limitations of administrative datasets, we cannot determine the reasons for these findings; however, the international nature of our database suggests that this is a systematic phenomenon affecting healthcare providers across borders. Further investigation is needed to understand the factors that give rise to the weekend effect. The participating hospitals represent varied models of service delivery, and there is a potential to learn from best practice in different healthcare systems.
Example: AMI Coventry & Warwickshire

• Institution was a high performer in the UK, treating 82 per cent of AMI patients within 90 minutes of arrival at the hospital.

• They could not see how to improve anymore.

• As a GC Member they realised, based on the available data analysis, that hospitals in other countries had significantly better performance.
They adopted Yale AMI improvement programme.

The latest audited results are as follows:

• Median door to balloon times reduced from 52 to 30 mins
• Regularly hitting 100% of patients treated within 90 mins
AMI Coventry & Warwickshire

Best of all:

*Mortality from AMI dropped by 25% in the year following implementation*
GLOBAL COMPARATORS: TOOLKIT
Global Comparators toolkit

Fictitious Data
Global Comparators toolkit

Fictitious Data
Global Comparators toolkit

Fictitious Data
Global Comparators toolkit
Global Comparators toolkit


Diagnosis group*: Acute cerebrovascular disease

Fictitious Data
Global Comparators toolkit
Global Comparators toolkit

Fictitious Data
Global Comparators toolkit

Fictitious Data
Pyramid Model Of Investigation To Find Credible Cause

**1st Step:** Does the coding reflect what happened to the patient

**2nd Step:** Has something occurred locally to affect your casemix

**3rd Step:** The Local Health Economy may treat patients differently than the rest of the country/region e.g. provision of hospices, etc

**4th Step:** Examine when other issues have occurred

**Finally:** An individual is rarely the cause of an alert. A Consultant name may be coded against the primary diagnosis but many individuals and teams are involved in the patient’s care

*Lilford et al. Lancet 2004; 363: 1147-54*
THANK YOU
Contact

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