Implications for public health

The Faculty of Public Health (FPH) is committed to ensuring that hospital care is safe, effective and provides the highest possible standard of clinical care. The first attempt to categorise hospitals by their mortality rates and make imputations about the quality of care delivered in them based on how many patients die, dates back to the seminal work of Florence Nightingale (best known for dramatically decreasing hospital deaths in the Crimea by improving sanitation) and the statistician William Farr. Together, they compiled the first ever 'league table' of hospital mortality rates in 1863. Their efforts were widely criticised at the time, and many of the problems with their methodology have never been satisfactorily resolved. It is essential to understand the controversies around hospital mortality data in order to prevent the significant harm that can come from their misuse.

Counting deaths and creating mortality ratios

The question of which deaths to count is more complex than it appears at first glance. There is no agreement about the time frame that should be used (e.g. only deaths while in hospital or also for some period after discharge), which departments within the hospital to include, whether deaths from all conditions or from selected conditions should be counted, and which hospital the death should be attributed to when a patient dies after transferring between hospitals.

Furthermore, because hospitals are of such widely varying size and complexity, comparing absolute numbers of deaths is meaningless. As hospitals which tend to admit sicker patients will have higher crude mortality rates (†), most published statistics today present a standardised mortality ratio, which is calculated as the number of 'observed deaths' divided by the number of 'expected deaths' after taking into account differences in age, sex and disease across hospitals (a statistical process called 'risk adjustment'). However, just as there is no agreement over which deaths to count, neither is there any 'gold standard' formula to calculate the number of expected deaths. Various organisations choose different ways to count observed deaths and use different methods of risk adjustment, for example Dr Foster Intelligence produces the hospital standardised mortality ratio (HSMR), Health and Social Care Information Centre (HSCIC) the summary hospital mortality indicator (SHMI) and Caspe Healthcare Knowledge Systems (CHKS) the Risk Adjusted Mortality Index (RAMI); not surprisingly they can produce wildly different estimates of mortality rates. One study, which compared four different methods across 83 hospitals in America, found that of 28 identified as the 'worst' mortality hospitals by one company, 12 appeared in the 'best' category when other methods were used.

Patients die in hospital for many reasons, of which quality of hospital care is only one. Others include lack of availability of hospice beds, inadequate primary care, inadequate care-home provision and even patient choice. The hospital has no control over any of these external factors yet they can all result in increased numbers of deaths, which increases the ratio of observed to expected deaths, and hence the HSMR or SHMI. Changes in community health services can have a big effect on 'hospital' mortality rates – for instance when Walsall opened a

† Words in bold are defined on page 4

KEY CONTROVERSIES

1. Counting deaths and creating mortality ratios
2. Shortcomings in risk adjustment
3. Can hospital mortality statistics be used to identify hospitals with poor quality care?
4. Can use of mortality statistics cause harm?
5. How should we use hospital mortality data?
hospice, the nearby hospital’s HSMR and SHMI fell sharply7.

**Shortcomings in risk adjustment**

Whenever a patient is discharged from or dies in hospital, data about their diseases and any operations performed are summarised using classification codes and submitted as hospital episodes statistics (HES data) to a national database. Major problems are lack of consistency in coding and lack of reliability, because all we have in order to make predictions about a patient’s likelihood of dying, based on similar patients in the past, are a handful of codes summarising the reason for their admission, eg. “J18.0 Broncho-pneumonia, unspecified”. Studies of clinical coders have found considerable variation in choice of codes and coding depth. This means expected deaths, and hence mortality ratios, can vary substantially depending on how patients have been coded1. Dr Foster has acknowledged that a hospital recording an average of 2.5 codes per patient would have an HSMR around 15-20 points higher than one recording 5.5-6 codes per patient4. There are perverse financial incentives to increase coding depth too, since if more codes are recorded hospitals can charge their commissioners more as their patients will appear to be sicker. A similar phenomenon of over-coding has been observed in the United States5.

Patients whose admission includes a palliative care code are effectively considered ‘very likely to die’ by Dr Foster’s calculations, and therefore these patients have a profound effect on HSMR. Some patients receive palliative care even when they are not at imminent risk of death, yet the palliative care code, and hence HSMR, cannot distinguish these two categories of patients. (SHMI calculations of ‘expected deaths’ are not nearly so influenced by palliative care coding but have other limitations). National guidance on when palliative care codes should be applied is notoriously ambiguous6, and, because of this, hospitals vary enormously in their coding practice, which ranges from 0 to 44% of deaths7.

Even if a universally consistent standard of coding could be achieved, this does not eliminate the problems of adjusting for risk as the probability of a patient dying from a given condition is not the same throughout the country (the so-called ‘constant risk fallacy’8). In addition, patient lifestyle factors such as smoking and alcohol are not recorded in HES data. This means that calculating risk of dying based on patients’ lifestyles has to use proxy measures instead, and this is chiefly done using postcode as a (very problematical) proxy for deprivation, and hence lifestyle, risk factors.

One response to the inherent shortcomings of using administrative coding data to predict the risk of dying is to use clinical parameters as well as or instead of classification codes. For instance using blood test results, blood pressure, weight etc. might create a fuller picture of the patient’s severity of disease on admission to hospital, and potentially their likelihood of dying.

However, this introduces other problems: firstly we don’t fully know which data are best at predicting severity of disease; secondly different hospitals can collect different and non-comparable data, making comparisons between hospitals impossible; thirdly information systems are often not set up to draw data from many different sources together. The more data that is required to predict patients’ severity of disease, the greater the likelihood that certain bits of information are not collated.

In the case of children’s heart surgery in Leeds, the simple failure to consistently supply children’s weight to the calculations affected these to such an extent that the unit’s mortality rate appeared to be double the national average. This incorrect calculation was then used as part of the justification of a proposal to close the unit4.

**Can hospital mortality statistics be used to identify hospitals with poor quality care?**

It is sometimes claimed that, provided case mix has been properly adjusted for, any remaining variations in mortality ratios between hospitals must be a result of variations in quality of care. However, studies have consistently demonstrated that even after risk adjustment, there is no clear relationship between a hospital’s standardised mortality ratio and its quality of care10. This is because:

- Risk adjustment is never perfect, especially given the limitations of HES (which was originally intended for use in finance and planning and not for predicting mortality) and known variations in coding practice
- Hospitals are large and complex organisations that will inevitably have a mixture of outstanding care and areas of weakness which counterbalance one another
- Quality is a complex concept and includes many more factors than merely the risk of death. The NHS definition of quality in healthcare encompasses four domains: preventing illness, safe, effective and personal11. Some of the problems exposed in the Keogh Review and the Francis Inquiry were serious violations of patient dignity but by themselves were unlikely to kill any patients.

Careful auditing of case records has found that only around one in every 20 deaths in hospital has any factors that might have impacted on the inevitability of the patient dying, in other words whether it was a preventable death12. Deaths due to failings in care reflect an incredibly small proportion (around 0.15%, or one in six hundred) of all admissions, and it is perfectly possible for a hospital to
have a low HSMR whilst nevertheless offering poor quality care.

Some people advocate the use of hospital mortality data as a ‘smoke alarm’ that can potentially identify hospitals with problems. However, using this data as a screening test to identify poor quality hospitals results in frequent ‘high mortality alerts’ that require significant resources to investigate but which most of the time do not result in findings of poor quality care. One study estimated that in 91% of hospitals investigated as a result of their high mortality rates, the alert would be a false alarm13. Meanwhile, hospitals with normal or low mortality data provide no reassurance that the quality of care is acceptable. If hospital mortality rates are to be likened to a smoke alarm, they are the faulty sort that have a tendency to go off whenever the hot tap is run, but fail to sound when the frying pan has caught fire.

Can use of hospital mortality statistics cause harm?

- **Institutional damage.** Significant stigma can follow the publication of an adverse mortality statistic14. This can cause a loss of confidence in patients, demoralise staff and inhibit recruitment. Perversely this could potentially happen to a good quality hospital with a high HSMR, resulting in a fall in quality of care. False alarms can be expensive to investigate.

- **Distress and confusion to the general public.** The media frequently use mortality data completely inappropriately, for example to confuse the number of ‘excess deaths’ with the number of ‘preventable deaths’ or to imply that the mortality rate is a useful proxy measure for quality of care. By definition, approximately half of all hospitals will have more than average deaths and half will have fewer. To claim that the highest mortality hospitals have thousands of ‘excess deaths’ makes no more sense than to suggest that hospitals with the lowest mortality rates have sent thousands of people home alive who really should have died. It also conceals the reality that ‘preventable deaths’ happen in all hospitals.

- **Conflicts of interest.** A number of companies sell analysis tools to hospitals on the premise that these enable the hospitals to analyse which patients are contributing to the mortality figures. The vested interest in defending the putative link between mortality and quality of care was acknowledged in the Francis Inquiry15.

- **Distracting from genuine problems.** Hospitals with high HSMRs are expected to examine their coding and clinical systems to try to find an explanation for the high figures, which may miss important quality problems that harm patients but do not cause death. On the other hand, hospitals whose figures are low or within normal limits have little incentive to ask themselves whether there is more they could be doing to improve patient safety and quality of care. For example faced with a high HSMR, Stafford Hospital first examined their coding and realised patients were seriously under-coded. When they increased their coding depth, their HSMR fell to below average, prompting Dr Foster to praise them for being one of the ‘five most improved’ hospitals in the country14. Yet at the very same time, the Healthcare Commission was uncovering widespread problems in care. Similarly, Sir Bruce Keogh acknowledged that many of the problems uncovered in the hospitals he reviewed during 2013 could well be happening in other hospitals too. More recent inspections of hospitals with apparently normal or low HSMRs appear to be confirming this15, 16.

  - **Credibility.** The expression “hospital mortality rates” sounds so integral to hospitals that explanations of high rates that appeal to external factors such as availability of hospice beds or quality of primary care and nursing home care may sound unconvincing to anyone who has not understood how these statistics are actually calculated.

How should we use hospital mortality data?

Ways in which hospital mortality statistics must not be used:

- To compare the quality of one hospital to another, eg. league tables.
- To attribute ‘preventable deaths’ to individual hospitals,
- To falsely assume that a low or ‘within expected limits’ mortality ratio implies good quality of care and overlook clinical or organisational failings that are causing harm to patients.
- To only focus attention on hospitals when attempting to interpret hospital mortality statistics, instead of also considering the impact of external factors such as community pressures or hospice facilities.
- To obsessively search for lessons learnt from ‘preventable deaths’ at the expense of not learning from the many more cases where patients survived.
- To assume that there are such things as ‘good’ hospitals and ‘bad’ hospitals. In reality, most hospitals are large complex organisations with both good and bad elements across different departments and sites.

Better ways to investigate hospital quality of care:

- An evidence-based, structured approach to review all hospital deaths. One example of this is being developed during 2014 by the London School of Hygiene and Tropical Medicine.
• A much more consistent, rigorous and questioning approach to inspecting hospitals. Every NHS hospital should experience as thorough a review as the process undertaken by Sir Bruce Keogh’s team. The process conducted in the 14 Keogh-review hospitals could easily be adopted as a template for periodic inspection of every hospital, with economies of scale if this were undertaken.

• Pay more attention to staffing levels, one of the factors identified by the Berwick report. A consistent criticism of Stafford was that it was under-staffed by doctors, nurses and other healthcare professionals.

• Pay far more attention to community health and social care factors to ensure there are adequate means of caring for terminally ill patients, and more generally to relieve pressure on the ‘pinch points’ of A&E and elderly care wards, and to prevent unnecessary admission in the first place.

**Appropriate use of hospital mortality data:**

• FPH does not support the use of risk-adjusted mortality statistics to compare or rank hospitals, nor does it believe they should be used to estimate ‘preventable deaths’.

• If hospital mortality data is to continue to be published, we need a far more explanatory communication strategy to accompany the data and outline its serious weaknesses and limitations.

• There is an important place for the analysis of certain categories of deaths such as maternal deaths or peri-operative deaths. However, the most effective way to analyse this data is the existing Confidential Inquiry which seeks to learn and disseminate lessons without ‘naming and shaming’ individual hospitals or their staff.

• There may be a role for mortality data in research, for instance to explore how well it conveys information about factors external to the hospital which might help target resources more appropriately.

---

**DEFINITIONS**

**Berwick Review** A review of safety in the NHS by the American Prof Don Berwick following the Francis Inquiry.

**CHKS** A private company that provides a hospital benchmarking service and calculates the RAMI.

**Classification codes** Two systems are in use which classify patients according to why they came into hospital: the World Health Organization’s 10th International Classification of Disease (ICD-10), which lists medical conditions, and the Office of Population Censuses and Surveys Classification of Interventions and Procedures (OPCS-4) which describes operations.

**Clinical coders** Hospital administrators who summarise a patient’s medical history and reasons for admission into codes which are entered into a national database for purposes of health service finance and planning.

**Coding depth** The number of clinical codes entered per patient. Can be up to about a dozen but in practice 3-6. Hospitals that enter more codes per patient may be more diligent but this can result in patients appearing sicker and thus more expensive to treat and considered more likely at die in risk adjustment formulae, which can then underestimate the hospital’s standardised mortality ratio.

**Crude mortality rate** The number of deaths over a period of time divided by the number of patients admitted over the same period. It fails to account for differences in patient characteristics between hospitals.

**Dr Foster Intelligence** The company that calculates HSMR.

**Excess death** A statistical calculation of the number of additional deaths relative to the national average that occur in hospitals whose standardised mortality ratio is higher than average. One could imagine a hypothetical opposite, negative deaths, or excess deaths which did not happen in hospitals with lower than average mortality rates.

**Francis Inquiry** A series of two major inquiries, the first independent, the second public, into failings in care at Stafford Hospital.

**HSCIC** Health and Social Care Information Centre. Source of HES data and calculate SHMI.

**HES data** Hospital episodes statistics – the principal national database which is used to calculate mortality statistics.

**HSMR** Hospital standardised mortality ratio. Dr Foster’s calculation takes deaths in hospital other than in Accident and Emergency departments, for the 56 most common medical conditions, and divides by the number of deaths it expects for the hospital, based on factors including age, sex, other medical conditions and local deprivation. Patients who die after being transferred between two hospitals are counted twice over.

**Keogh Review** Commissioned after the second Francis Inquiry was published, this was a detailed inspection of the quality of care in 14 hospitals identified as having either a high HSMR or a high SHMI.

**Perioperative death** A death that occurs during or shortly after surgery.

**Preventable death** In contrast to ‘excess death’, a preventable death is one that is considered, after careful review, to be a result of failings in medical care. Preventable deaths can occur in any healthcare setting and there is little evidence to suggest they are more common in hospitals with a high standardised mortality ratio.

**RAMI** Risk Adjusted Mortality Index – another method of expressing standardised hospital mortality ratios, calculated by CHKS.

**SHMI** Summary hospital mortality indicator. Calculated by HSCIC, this includes all deaths in patients admitted to non-specialist hospitals and deaths within 30 days of discharge, divided by the number of expected deaths adjusting eg. for age, sex and diagnosis, but does not make adjustments for deprivation or palliative care.

**Standardised mortality ratio** The number of ‘observed deaths’ over a period of time divided by the number of ‘expected deaths’ that might potentially have occurred had the hospital had the same pattern of deaths as the national average for the type of patients admitted.
Finally, hospital mortality data can be used for internal quality control and audit, since this is not coloured by internal system variations such as coding. Unfortunately this sounds less compelling than "your hospital has a higher than expected mortality rate, so there must be a problem and you need to go and fix it"\(^{20}\), but this was how Florence Nightingale succeeded in improving outcomes for soldiers in the Crimea, whereas her later attempt at putting hospitals into a 'league table' was fundamentally flawed.

**REFERENCES**

6 Health and Social Care Information Centre. 2013. *The Use of Palliative Care Coding in the Summary Hospital-level Mortality Indicator*.
9 Does Leeds General Infirmary have a death rate "twice the national average"? Available at [http://tinyurl.com/nzcdstn](http://tinyurl.com/nzcdstn).
15 Francis R. *Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry Volume 1: Analysis of evidence and lessons learned (part 1)*.

**Acknowledgements:**

Author: Dr David Pitches
With thanks to FPH’s Health Services Committee
May 2014

**PRODUCED BY THE FACULTY OF PUBLIC HEALTH**

The Faculty of Public Health (FPH) is the standard-setting body for specialists in public health in the UK. FPH is the professional home for more than 3,200 professionals working in public health. Our members come from a range of professional backgrounds (including clinical, academic and policy) and are employed in a variety of settings, usually working at a strategic or specialist level.

FPH is a joint faculty of the three Royal Colleges of Public Health Physicians of the United Kingdom (London, Edinburgh and Glasgow). In addition, FPH advocates on key public health issues and provides practical information and guidance for public health professionals, aiming to advance the health of the population through three key areas of work: health promotion, health protection and healthcare improvement.