ASSOCIATION OF PUBLIC HEALTH OBSERVATORIES

APH

10 YEARS

Dying to know

How to interpret and investigate hospital mortality measures

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1. Introduction

‘These measures are not without controversy. Some believe they have very limited value and should not be used at all. Others accept their limitations but think they are a crucial part of quality improvement’

Over the last few years, monitoring deaths in hospital has become a standard part of assessing the performance of our hospitals and the quality of their care. There are a number of different ways in which this can be done, the most common of which involves calculating standardised mortality ratios (SMRs).

However, these measures are not without controversy. Some believe that they have limited value and should not be used at all, and certainly not to trigger public enquiries into hospital failings.[1-2] Others accept limitations of the SMRs but think they are a crucial part of wider quality improvement.[3-4]

Following the Francis Inquiry into the events at Mid Staffordshire NHS Foundation Trust, it is clear that measuring hospital mortality will continue to be part of assessing and improving the quality of care of our hospitals. One of the recommendations of the inquiry, however, was a thorough review of how hospital mortality measures are developed and used. This work is being undertaken on behalf of the National Quality Board and, while it is likely to address some of the shortcomings and variation between existing mortality measurement methods, many of the underlying principles will continue to apply.

Evidence so far suggests that the hospital mortality ratio, as a single indicator of hospital quality is, at best, akin to a smoke alarm; it may signal something serious, but more often than not it will go off for reasons unrelated to quality of care. But, like smoke alarms, hospital mortality ratios should never be ignored.

Regular examination and better understanding of hospital mortality can potentially improve the way care is delivered, recorded and coded, and in turn, help improve the quality of the data used.

In the new era where outcomes amenable to NHS action are seen to be vital indicators of NHS quality, hospital mortality is likely to continue to play a part.

This briefing has been produced by the Association of Public Health Observatories (APHO) to complement the detailed technical work of the national review, and to help trust Boards, commissioners and ultimately patients, understand the fundamental principles and pitfalls in interpreting hospital mortality measurement.

Specifically, this guide aims to help you understand more clearly:

- how hospital mortality is measured
- what the figures do and don’t tell you about your hospital compared with others
- what actions and further investigations to take as a result.

1 Black N. Assessing the quality of hospitals. BMJ 2010; 340:c2066.
2 Lilford R, Pronovost P. Using hospital mortality rates to judge hospital performance: a bad idea that just won’t go away. BMJ 2010; 340:c2016.
3 Jarman B, Aylin P, Bottle A. A plea for reason. BMJ 2010; 340:c2744
4 Jarman B. In defence of the hospital standardized mortality ratio. Healthc Pap 2008; 8(4):37-42.

2. Why measure hospital death rates?

Every year around half a million people die in England; the overall number of deaths having fallen from 490,000 in 2001 to 475,000 in 2008.[5]

Over the same time period, the total number of people who died in hospital fell from 300,000 to 274,000, and has fallen as a proportion of all deaths (from 61% to 58%).

But looking at trends in absolute numbers doesn't tell us very much.

In order to understand whether people are getting healthier, or our hospitals are getting safer, it is necessary to calculate death rate. The death rate is the number of people who die in relation to the size of the population in which these people live. This measure is usually known as a crude rate.

It is important to do this because simply tracking the actual (observed) number of deaths is not sufficiently helpful. For example, if the rate at which people in the population die stayed the same, but the population grew, then there would be more deaths overall.

In general terms, the rationale for calculating death rates in hospital is that they can be used to measure hospital quality in some way, and therefore help trusts:

- reduce mortality rates
- improve patient safety
- reduce avoidable variation in care and outcomes.

'In order to understand whether people are getting healthier or our hospitals are getting safer, it is necessary to calculate death rates'

Death rate = the number of people who die in relation to the size of the population* in which these people live.

*There is more about what 'population' means in Section 3.

5 http://www.nchod.nhs.uk

3. Measuring hospital mortality

If we use the simple death rate definition described earlier, a hospital death rate is the number of people who die in hospital relative to its 'population' - usually based on the number of people who are admitted to, or discharged from, the hospital during a given period of time.

Often, however, we want to know if the mortality rate is higher or lower than average or how hospitals compare. A more convenient measure in common use is a standardised mortality ratio (SMR). Part of the national review of hospital mortality monitoring will specify a new ratio to be known as the Summary Hospital Mortality Indicator (SHMI). There are several variants of this - but two in common usage, calculated by commercial organisations, are the Hospital Standardised Mortality Ratio, or HSMR, produced by Dr Foster Intelligence[6] and the Risk Adjusted Mortality Index (RAMI) produced by the health intelligence provider, CHKS Ltd.

3.1 What does 'standardised' mean and why do we do it?

An important factor to consider in calculating any mortality rate is that the chance of dying is very strongly related to age. The older somebody is, the more likely they are to die within a fixed time period, whether or not they are in hospital.

Standardised Mortality Ratio (SMR) = the ratio of the number of deaths in hospital within a given time period, to the number that might be expected if the hospital had the same death rates as some reference population (e.g. the hospitalised population of England)

Therefore, in calculating summary death statistics, allowances are made for differences between age structures of populations. The process by which this allowance is made is called standardisation.

As well as standardising for age, most hospital mortality measures also attempt to make adjustments for differences in patients' gender, diagnoses, deprivation, co-morbidity (additional diseases), whether they are recorded as receiving palliative care and sometimes the procedures they have had. All these factors can influence deaths in a hospital, but are ultimately outside of its control.

3.2 How does standardisation work?

Most hospital mortality measures are calculated by indirect standardisation. In simple terms, this is a three stage process:

Step 1: The **risk** of dying with each given combination of age, sex, diagnosis and other risk factors is worked out for a 'standard' population - usually the hospitalised population in England. This process calculates the risk for particular patient subgroups within the standard population. In the HSMR for example, there are more than 2,000 different combinations of age, sex, deprivation, admission type, diagnosis and co-morbidity.

Step 2: This risk is then applied to the corresponding subgroups in the local hospital in order to calculate how many deaths would be **expected** to occur in that trust if the standard level of risk applied locally. The expected number of deaths is therefore a locally-weighted count of deaths. For some local hospitals, there may be none or very few patients and deaths in some of the subgroups.

Step 3: This 'expected' figure is then compared with the **observed (actual)** number of deaths that occurred in the hospital to give a ratio. The ratio between the number of expected deaths and the number of actual deaths is known as a standardised mortality ratio (SMR). It represents the number of actual deaths divided by the number of expected deaths x 100.

Standardised mortality ratio (SMR) = the number of actual deaths divided by the number of expected deaths x 100.

* ***Example:*** *If national data produced an expected local trust figure of 3500 hospital deaths, and the actual number of deaths was 2975, then this would give an SMR of 2975/3500 x 100 (or i.e. actual/expected x 100), which equals 85*

6 HSMRs are calculated by the Dr Foster Unit at Imperial College, sited within the Department of Primary Care and Public Health in the School of Public Health. HMSRs are available for trusts to use through various Dr Foster tools, including The Good Hospital Guide, and through NHS Choices.
Technical details on the HSMR can be obtained from: http://www.nhs.uk/NHSEngland/Hospitalmortalityrates/Documents/090424%20MS(H)%20-%20NHS%20Choices%20HSMR%20Publication%20-%20Presentation%20-%20Annex%20C.pdf
Technical details on the RAMI can be obtained from: http://www.chks.co.uk/index.php?id=853

3.3 Setting the baseline at 100

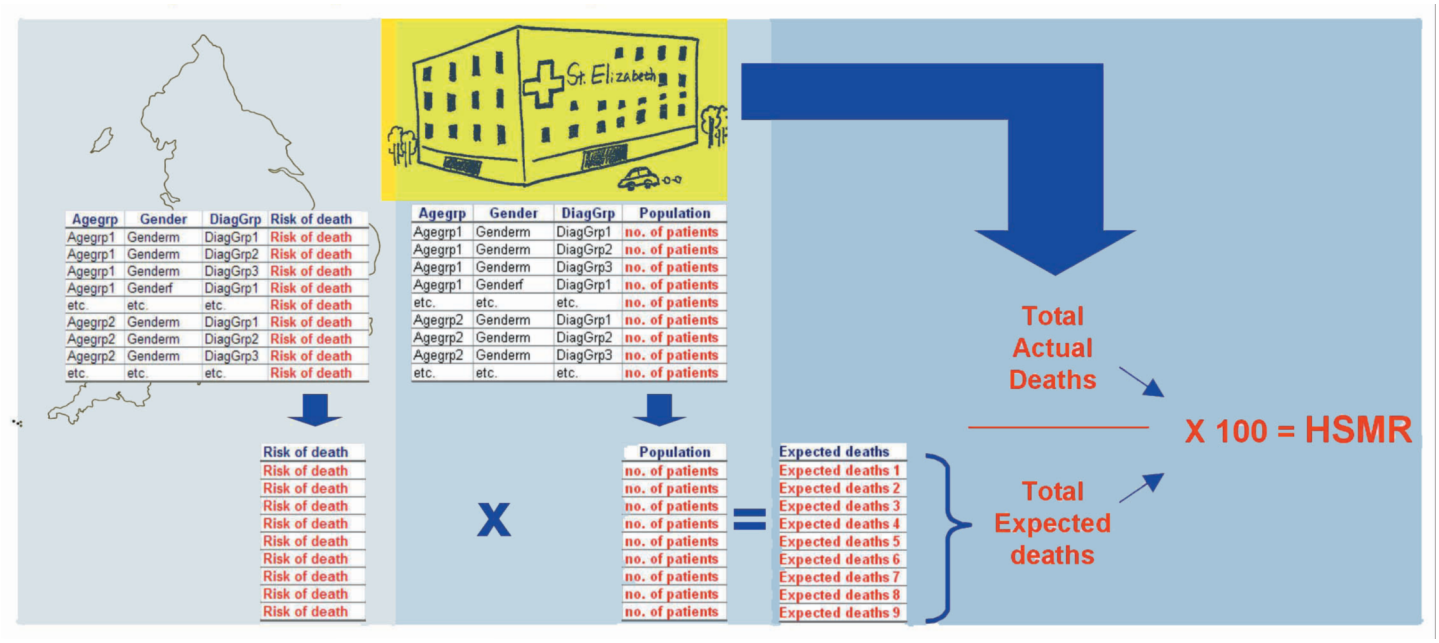
When using mortality ratios, it is usual practice to set the SMR in the standard population at the value of 100. This simply means that there is an exact match between the observed deaths and the expected deaths - hence it is the 'standard'. Using 100 also makes it easier to express local trust SMRs in terms of a percentage difference to this standard.

* ***Example:*** *If a trust's SMR is 85, it has 15% fewer deaths than expected. Similarly an SMR of 120 would indicate 20% more deaths than expected.*

3.4 Putting it all together

The diagram below is a simple summary of how a hospital mortality ratio is calculated.

Figure i. Simple hospital mortality ratio calculation



4. Interpreting hospital mortality ratios

'Given the complex nature of the calculations involved, and the various methods used, there are some important issues for trusts to consider when interpreting this type of mortality measure'

By adjusting for age, gender, diagnoses and other factors (see Section 3.1) any remaining difference between a trust's expected number of deaths and actual number of deaths may be attributed to things within the hospital's control, such as quality of care.

However, given the complex nature of the calculations involved, and the various methods used, there are some important issues for trusts to consider when interpreting this type of mortality measure and deciding what actions to take.

4.1 Understanding local service configuration

Where people die

All hospitals serve a population. Within that population there will be alternative locations where someone may die; for example, at home, or in a hospital, hospice or care home. The higher the proportion of deaths which occur in hospital compared with the national average, the higher the hospital mortality ratio will be.

Recent analysis carried out by the South West Public Health Observatory on behalf of the National End of Life Care Intelligence Network shows that the proportion of deaths in different settings varies widely from place to place, as well as between causes of death.[7] Empirical research suggests that this variation can explain some of the difference between different trusts' mortality ratios.

* ***Example:*** *Impact of place of death*

  In the table below, trust A has a low HSMR, but a significantly higher proportion of deaths than expected for its population occur in care homes or nursing homes (ie not in hospital). Trust B, however, has the opposite finding. These additional figures help place hospital mortality in a wider context.

* ***Example:*** *Disaggregating causes of death*

  A trust had noticed that its HSMR value had increased and had become statistically significantly greater than 100. Further investigation revealed that the majority of the increase was concentrated in two diagnoses - lung cancer and secondary cancer. Both these conditions have a poor prognosis and deaths in these cases are to be expected and unrelated to quality of care issues. The increasing 'in-hospital' mortality ratios were not due to increasing levels of cancer, but attributable to changes in the pattern of care and increases in admissions from hospices to the acute hospital in the local area.

Table i

	HSMR	% catchment population deaths in hospital	% catchment population deaths in hospice	% catchment population deaths in care & residential homes
Trust A	70	46.7	5.6	21.7
Trust B	120	65.9	3.9	9.5
England	100	58.4	5.0	15.6

(Sources) *Good Hospital Guide* *National End of Care Intelligence Network*

7 http://www.endoflifecare-intelligence.org.uk/view.aspx?rid=71

4.2 Counting deaths

How place of death is recorded

Counting the number of deaths in hospital is not as straightforward as it may seem and what is included in the mortality statistics can vary from trust to trust.

In some mortality indicators a death may be counted more than once - this may be the case where a patient is transferred from one hospital to another and the death may be attributed to both hospitals. In some available tools the death is counted once and may be attributable to initial hospital of admission or the hospital of death. The indicator should make it clear how deaths in this situation are treated.

* ***Example:*** *No agreed method of recording place of death*

Most hospital mortality measures, including the HSMR, are based on the Hospital Episode Statistics (HES) dataset. HES contains records for inpatients and therefore counts people who are admitted to hospital who then die. However, hospitals themselves often use bereavement office records when counting their actual deaths and these include all the people who have been certificated in hospital when they have died. This may well include people who have died in the accident and emergency department, or are brought into hospital dead. The figures for in-hospital deaths may, therefore, vary from place to place depending on whether or not these are also included in the HES record. Clearly deaths from road traffic accidents, or a cardiac arrest in the street, are not usually influenced by the quality of hospital care.

Palliative care coding

At present, the various mortality ratios have different approaches to including palliative care patients. The way such patients are recorded in the base data (used to calculate these ratios) varies between trusts. There is no standard method. There is an ICD code (Z515) which is used to denote palliative care, but its use varies widely; at a trust level, between 1% and 60% of deaths may be coded which reflects the use of the code, rather than the proportion of patients who are terminally ill and likely to die in hospital. Knowing this proportion locally will give you important contextual information.

If a ratio is used which takes account of the coding of palliative care, and both mortality and coding levels are high, then this suggests that the explanation for a high mortality rate does not relate to poor quality hospital care.

Depth of coding

Some mortality ratios include co-morbidity or case-mix measures which give an idea of the complexity and severity of cases. These measures are used to capture differences which influence a patient's survival, such as the co-existence of other diseases. The calculation of these depends on the recording of secondary or additional diagnoses.

We know from data quality audits that trusts vary in the degree to which secondary diagnoses are captured. The average number of diagnoses per patient is known as the depth of coding; the greater the depth, the greater the potential reduction in mortality rate if case-mix adjustment is used.[8] However, if mortality and depth of coding are both high, then this will not be the explanation. Similarly, trusts with average or low mortality ratios, but good depths of coding, may be better at recording relevant codes - although this may disguise a genuinely high mortality rate.

Accuracy and variation in clinical coding

Some mortality ratios, such as the HSMR, don't include all deaths (only around 80% of all in-hospital deaths), including instead only deaths of people who have been admitted for certain reasons. In practice, however, hospitals may well code the reasons for an admission differently. And, with people being admitted to hospital for shorter lengths of time, a diagnosis may not be reached so readily. Along with variations in coding practice, this may bias the results of hospital mortality calculations. There are many other issues, for example the use of particular case mix scores which rely on the completeness and accuracy of secondary diagnosis codes in the Hospital Episode Statistics.

4.3 Understanding the metric

Excess or avoidable deaths?

A hospital mortality ratio is calculated by counting the number of actual (observed) deaths in a trust and comparing it with the number of expected deaths. The difference between the expected number of deaths and the observed number is often called the 'excess deaths'. In this case the word excess is a technical term, but is sometimes interpreted by the media as deaths which were avoidable (i.e. that they should not have happened at all), unexpected, or attributable to failings in the quality of care. None of these can be directly inferred from an SMR - it can only signal that further investigation may be required.

8 http://www.audit-commission.gov.uk/SiteCollectionDocuments/Downloads/26082010pbrnhsdataqualityreport.pdf

Quirks of standardised mortality ratios - dangers of comparing and ranking hospitals

It is likely that the frequency of risk groups (populations grouped by age/gender/diagnoses/admission type/deprivation) vary widely between trusts and local weightings may therefore be very different. While HSMRs, for example, are valid for comparing trusts to the national average (the standard population) they are less useful for comparisons between trusts.[9]

Furthermore, the process of indirect standardisation can create paradoxical results where, although the mortality rates by age in one trust are higher than another, the SMR is lower. A simple example is given in the table. It is not known how often this occurs with respect to hospital mortality ratios, but work looking at population SMRs for local authority districts suggests it is a reasonably common problem.[10] This means that ranking hospitals on the basis of their SMR is likely to be misleading and some commentators suggest that a different method of standardisation which avoids this quirk is a better approach. Additionally it is important to be able to disaggregate the data if an SMR is high in order to understand why this may be the case.

* ***Example:*** *Low mortality can mean a high SMR*

In Table ii, despite area A having lower mortality rates in all age bands than area B, its SMR is higher.

The importance of relativity

Hospital mortality is falling both nationally and locally, even in those trusts which have high standardised mortality ratios (SMRs) or have had a high profile in the media. SMRs show relative performance - it is entirely possible for an SMR to fall but death rates increase. For this reason SMRs should be looked at alongside crude death rates. This subtlety of interpretation is often missed in media reporting and causes confusion.

Ensuring that the baseline is 100

When using mortality ratios it is normal practice to set the expected mortality in the standard population at 100 (see Section 3.3). This is the baseline and it should be consistent.

However, Figure ii shows quarterly HSMR data for England taken from one of the Dr Foster tools (Performance Monitor). It can be seen that the England standard fluctuates around 100 until the quarters of 2009/10 when it falls to 85. The reason for this is that the statistical model used to calculate expected deaths is based on 2008/9 data and overestimates the number of deaths in the national population compared to that which is observed, because in-hospital mortality rates have fallen. Therefore in the national population the SMR (the ratio of observed to expected deaths) will have fallen. Since trust SMRs are relative to the national figure, they will fall too, reflecting the fall in mortality rates.

'The use of standardised mortality ratios to understand hospital mortality is about showing relative performance. This subtlety of interpretation is often missed in media reporting and causes confusion'

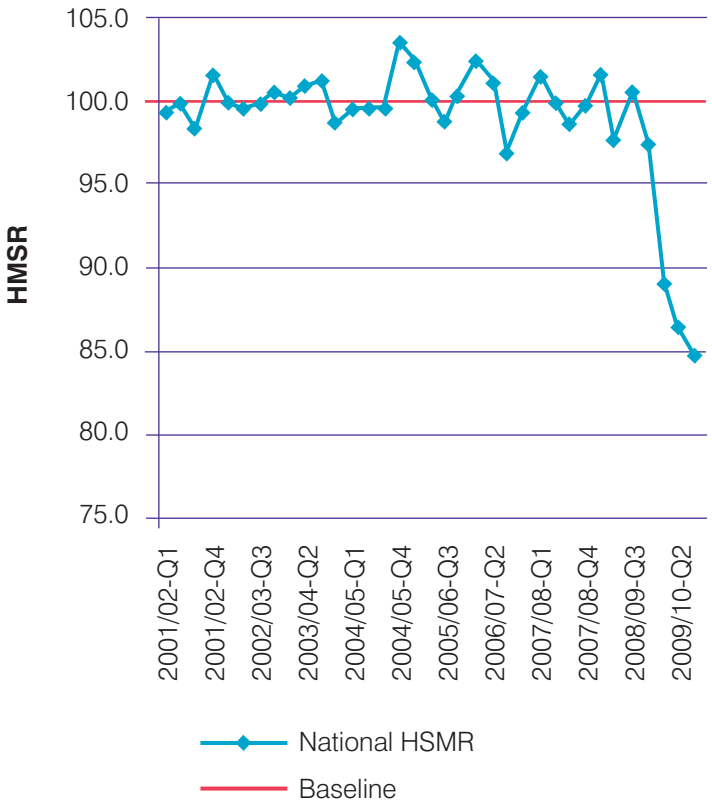
Table ii

Age	Area A				Area B				Standard		
	Deaths	Popn.	Death Rate	Expected deaths	Deaths	Popn.	Death Rate	Expected deaths	Deaths	Popn.	Death Rate
0-64	342	128,114	**2.67**	258	208	77,549	**2.68**	155	89,658	44,091,013	2.0
65-74	373	13,776	**27.1**	300	249	9,134	**27.7**	199	95,923	4,391,281	21.8
75+	825	8,971	**91.9**	782	651	7,058	**92.2**	615	348,525	3,998,180	87.2
Total	1540			1338	1108			969	534,106		
SMR				**115**				**114**			

(Adapted from 5).

9 Julious SA, George S and Nichol J. Why do people still use standardised mortality ratios? Pub Health Med 2001; 23(1): 40-46
10 Julious SA, George S. Are hospital league tables correctly calculated? Pub Health 2007; 121(12): 902-904.

Figure ii. Shifting HSMR goalposts can cause confusion



Failure to take this into account can mislead people into thinking that HSMRs have improved when they have not.

As trust boards and others are increasingly interested in more frequent monitoring of mortality rates, it is important to be confident that the baseline is constant. One option is to 're-base' more frequently. To do this within the existing data, you need to divide the local HSMR figure by the corresponding national figure.

* ***Example:*** *The HSMR figure for a quarter at one trust was obtained from the trust information system and was reported as 93 - an apparent fall from the previous year when it was 105. However, the national figure (i.e. the standard) was reported as 86. The re-based figure was therefore 93/86 * 100 = 108 - a rise rather than a fall.*

5. Knowing when to act

‘We need a way of deciding when to be concerned; is the rate significantly higher than expected? Is there a trend?’

SMRs and mortality rates vary between trusts and fluctuate over time within trusts. This is especially true if SMRs or mortality rates are monitored frequently over short periods of time. The degree of fluctuation will be higher simply because the effect of chance is greater when the number of deaths is smaller.

We need a way of deciding when to be concerned; is the rate significantly higher than expected? Is there a real trend?

5.1 Is the SMR high or is it just ‘noise’?

For SMRs, the baseline is usually set at 100 and that means trusts can calculate limits within which it would expect local mortality rates to sit.

These limits are called control limits and can be set to different levels (although for regular monitoring the limits should be nationally agreed and constant). They are generally set so that the chance of exceeding these limits is about 1 in 1000. If the local SMR is higher than the upper limit, it may be a cause for concern (see the example below). However, if it is below the lower limit, it might also warrant attention - perhaps to identify and understand good practice, or data issues, e.g. coding inconsistency.

5.2 Trends and triggers

It is important to recognise that a single figure in time cannot be looked at in isolation - it must be examined in the context of a trend. For instance, if a trust’s SMR for a single period does not exceed the control limits, but is persistently above 100, there may be still be cause for concern.

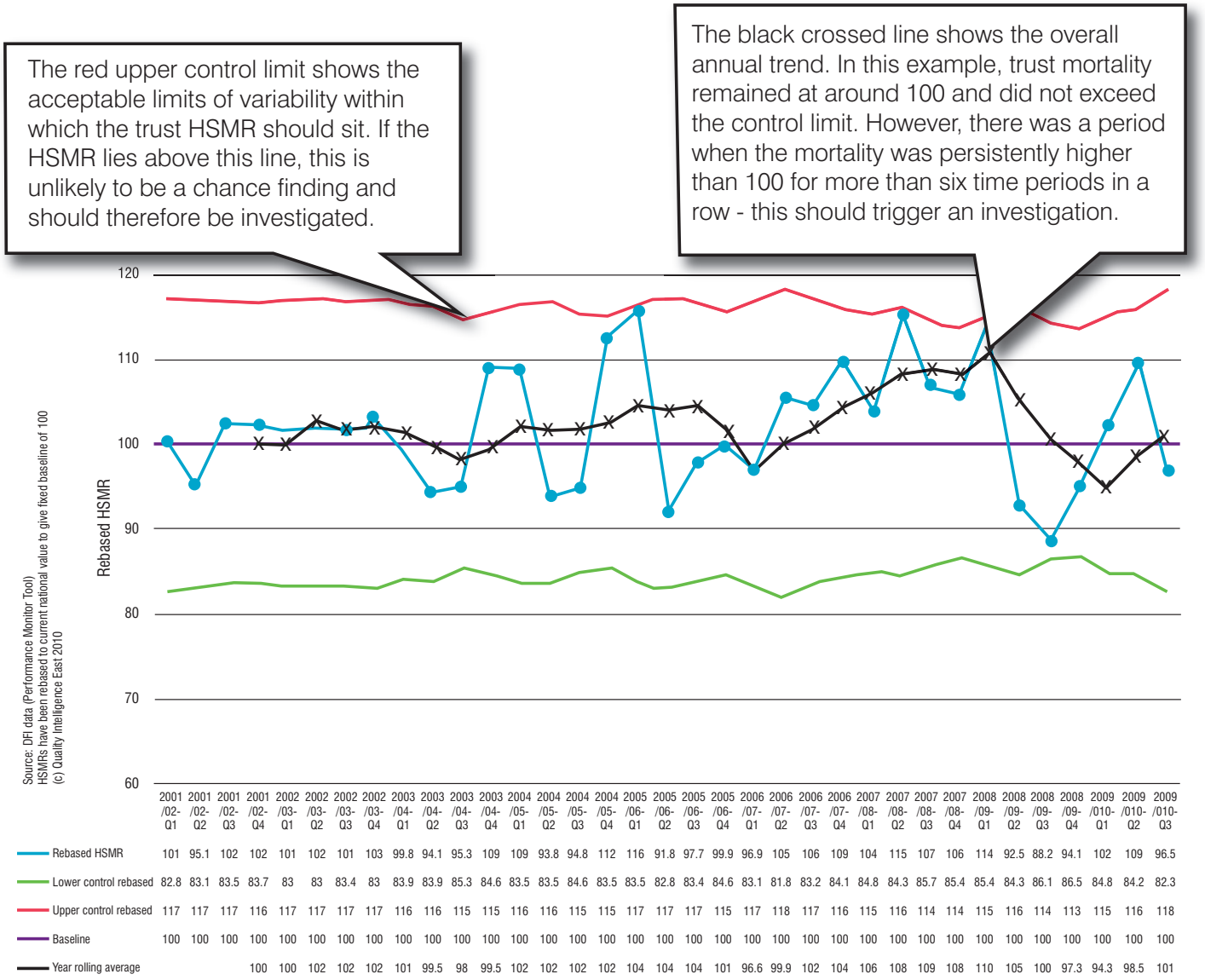
Any of the following three scenarios, where there is a high possibility that the pattern of the data has not risen by chance alone, could be used as triggers for investigating a high mortality rate:

1. higher than the upper control limit on a single occasion
2. higher than 100 on six or more successive occasions
3. six or more consecutive increases, regardless of the start level (a rising trend).

* ***Example:*** *Using a control chart*

The control chart overleaf (Figure iii) shows the quarterly trend in an individual trust’s HSMR, compared with the expected baseline of 100 (shown in purple).

Figure iii



	2001/02-Q1	2001/02-Q2	2001/02-Q3	2001/02-Q4	2002/03-Q1	2002/03-Q2	2002/03-Q3	2002/03-Q4	2003/04-Q1	2003/04-Q2	2003/04-Q3	2003/04-Q4	2004/05-Q1	2004/05-Q2	2004/05-Q3	2004/05-Q4	2005/06-Q1	2005/06-Q2	2005/06-Q3	2005/06-Q4	2006/07-Q1	2006/07-Q2	2006/07-Q3	2006/07-Q4	2007/08-Q1	2007/08-Q2	2007/08-Q3	2007/08-Q4	2008/09-Q1	2008/09-Q2	2008/09-Q3	2008/09-Q4	2009/010-Q1	2009/010-Q2	2009/010-Q3
Rebased HSMR	101	95.1	102	102	101	102	101	103	99.8	94.1	95.3	109	109	93.8	94.8	112	116	91.8	97.7	99.9	96.9	105	106	109	104	115	107	106	114	92.5	88.2	94.1	102	109	96.5
Lower control rebased	82.8	83.1	83.5	83.7	83	83	83.4	83	83.9	83.9	85.3	84.6	83.5	83.5	84.6	83.5	83.5	82.8	83.4	84.6	83.1	81.8	83.2	84.1	84.8	84.3	85.7	85.4	85.4	84.3	86.1	86.5	84.8	84.2	82.3
Upper control rebased	117	117	117	116	117	117	117	117	116	116	115	115	116	116	115	115	117	117	117	115	117	118	117	116	115	116	114	114	115	116	114	113	115	116	118
Baseline	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Year rolling average				100	100	102	102	102	101	99.5	98	99.5	102	102	102	102	104	104	104	101	96.6	99.9	102	104	106	108	109	108	110	105	100	97.3	94.3	98.5	101

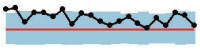
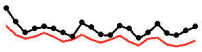
Source: Quality Intelligence East.

5.3 What else do you need to know?

A high SMR or persistent trend is a signal for further investigation. A range of other information can help determine if there is a genuine quality problem or where to look further. The trust mortality 'dashboard' is another method of presenting trust mortality data. It provides important contextual information that can help pinpoint a problem.

Figure iv. Trust mortality dashboards - an example (April 2010)

These reports are intended to provide commissioners and NHS trusts with a profile of current hospital mortality and potential contributory factors. They will be produced quarterly and show current HSMRs and trends with specialty and diagnosis break downs, where people die, and palliative care coding.
Data to Q3 2009/10. HSMR = Hospital standardised mortality rate.

Indicator			Data Period	Value/ chart	Key
1	Fully risk-adjusted HSMR	All admissions	Q4 2009/10	104.1	HSMR rebased to national value 100
2	Fully risk-adjusted HSMR	Emergency admissions	Q4 2009/10	103.4	
3	Fully risk-adjusted HSMR	All admissions	Q1 2009/10 to Q4 2009/10		Trust value (black square) plotted relative to HSMR = 100 (centre line), with control limits (amber), significantly high (red) and significantly low (green)
4	Fully risk-adjusted HSMR	Emergency admissions	Q1 2009/10 to Q4 2009/10		
5	Trend in HSMR	All admissions	Q4 2004/05 to Q4 2009/10		HSMR = 100 (red line) with control limits (blue); dotted line shows trust values by
6	Crude mortality (deaths per 100 superspells)	All admissions	Q4 2004/05 to Q4 2009/10		Dotted line shows trust values; red line is national mean
7	Age-sex HSMR	General medicine	2008/09		
8	Age-sex HSMR	General surgery	2008/09		
9	Age-sex HSMR	Geriatrics	2008/09		
10	HSMR	Stroke	2009/10		Trust value (black square) plotted relative to HSMR = 100 (centre line), with control limits (amber), significantly high (red) and significantly low (green)
11	HSMR	Acute MI	2009/10		
12	HSMR	COPD	2009/10		
13	HSMR	Heart failure	2009/10		
14	HSMR	Fractured neck of femur	2009/10		
15	HSMR	Pneumonia	2009/10		
16	End of life care	% deaths with palliative care code Z515	2009/10	11.0%	Regional mean = 10%
17	End of life care	Trend in palliative care coding of inpatient deaths	2004/05 to 2009/10		Annual proportion of deaths coded, with regional rate (red)
18	Where people die	% deaths in care homes	2009/10	10.5%	Regional mean = 17%
19	Where people die	% deaths in hospital	2009/10	61.2%	Regional mean = 54%

- Latest quarter HSMR is average.
- HSMR trend is stable.
- Speciality SMRs are at national average.
- The proportion of deaths in hospital is above average and the proportion of deaths in care homes below average.

Source: Quality Intelligence East.

Figure iv is an example dashboard and shows:

- the current HSMR for the quarter and the year to the quarter
- a control chart of the trend (in miniature)
- the trend in crude death rates compared to the national average
- 'drill-downs' by specialty (these three account for 75% of all in-hospital deaths)
- diagnosis (the six most common reasons for admission where people die)
- relative coding of palliative care - a high proportion of people who die in hospital are receiving palliative care but the recording of this varies widely by hospital.
- some information on where people die.

5.4 Action checklist for investigating a high SMR

Many trusts are already taking appropriate actions in relation to their local mortality rates. But in the current climate, and given the media and public concern over hospital mortality in general, it might be useful to follow these six basic principles:

Key Principles	Sources of further support
1. Understand how mortality rates are measured and mortality ratios constructed	• APHO Technical Briefing 3: Commonly Used Public Health Statistics and their Confidence Intervals http://www.apho.org.uk/resource/item.aspx?RID=48457 • InPHORM 6. Standardisation http://www.erpho.org.uk/viewResource.aspx?id=12267
2. Understand how to distinguish a warning "signal" from "noise"	• Ask your local Public Health Observatory or Quality Observatory for help • Understanding Uncertainty website http://understandinguncertainty.org/ • NHS Institute resources http://www.institute.nhs.uk/quality_and_service_improvement_tools/quality_and_service_improvement_tools/quality_and_service_improvement_tools_for_the_nhs.html • APHO Technical Briefing 2 http://www.apho.org.uk/resource/item.aspx?RID=39445
3. Adopt best coding practices and check your data	• Audit Commission benchmarking tools http://www.auditcommission.gov.uk/health/audit/paymentbyresults/benchmarkerandportal/Pages/default.aspx • Connecting for Health coding standards http://www.connectingforhealth.nhs.uk/systemsandservices/data/clinicalcoding/codingstandards • Professional Association of Clinical Coders http://codeinfo.org/newpaccuk/index.html
4. Understand key aspects of local palliative and terminal care services provision including how hospital /community/other services are configured, care pathways in use and local coding practice.	• End Of Life Programme http://www.endoflifecareforadults.nhs.uk/ • National End of Life Care Intelligence Network http://www.endoflifecare-intelligence.org.uk/home.aspx
5. Make use of regular quality improvement tools such as mortality reviews, case note reviews, trigger tools	• NHS Institute safer care http://www.institute.nhs.uk/safer_care/safer_care/safer_care_-_home_page_2.html • Institute of Healthcare Improvement http://www.ihi.org/IHI/Topics/ReducingMortality/
6. Regularly review hospital performance - both your HSMR, crude mortality rates and diagnosis-specific rates - as part of a package of general quality improvement measures.	• Public Health or Quality Observatories http://www.apho.org.uk http://www.qualityobservatory.nhs.uk • Commercial organisations