The Good Indicators Guide:

Understanding how to use and choose indicators

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Contents

Foreword

As leaders, we have a responsibility to know the essential data and information better than anyone else. We need our teams and organisations to be able to capture, interpret and communicate the essence of any situation in order to make the right decisions at the right time. The indicators we use and choose therefore need to be carefully designed to be practical, complete, valid and robust so we can concentrate on those areas that need further investigation. In short, we need to sort the wheat from the chaff in the information overload world we now live in. This short guide focuses on the key principles behind developing, understanding and using indicators. It is designed to be an essential and readable guide to those in senior positions who may not always feel entirely comfortable with this important area in healthcare leadership.

Bernard Crump

Chief Executive
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1. Introduction

Indicators are a fact of life for every NHS local authority, and social care organisation. For the most part, you will have little or no choice over the indicators that are used to measure performance in your organisation. If you don't fully understand the indicators you have to work with; if you think they paint an inaccurate picture of how things really are on the ground; or suspect they are fundamentally flawed in some way – you can find yourself locked into an unhappy relationship with a performance measurement tool that you can neither challenge nor improve.

1.1. What is this guide designed to do?

This guide is intended to be a short, practical resource for anyone in any health system who is responsible for using indicators to monitor and improve performance, systems or outcomes. A guide this size can't give all the answers to indicators. However, it can help you ask the important questions.

For instance…

- if you are working with imposed mandatory indicators, you need to be sure that your "measured" performance isn't falling short of what is really true, either because you don't understand them or how to make the best of them

- if you have a choice over which indicator to use, or an opportunity to introduce a new indicator to your organisation – you need to be competent in choosing the ones that will genuinely help you measure local systems, services and outcomes.

After reading this guide, you should be able to assess the validity of the indicators you are working with, **allowing you to exert more control over the way your organisation is properly judged, regulated, and run.**

Underlining all this is the reality that anyone working in a health system is working in a complex and political environment. This guide aims to balance what is desirable in terms of using indicators in the most correct and most rigorous way, with what is practical and achievable in such settings.

1.2. Why focus on indicators?

Why devote a whole guide to just indicators? They are, after all, just one very specific tool for measurement and improvement (see definitions in the Glossary on page 30).
The answer is that we all love indicators when they seem to summarise and bring summary/simplicity, but not when they judge us, or something dear to us.
It is then that we realise that people and organisations can be unfairly

judged and rewarded on the basis of indicators that may tell a wrong or incomplete story.

Or think of it like this: of all the comments from new non-executive directors that join the boards of health organisations, one of the most common seems to be:

"How can we ensure that the organisation is actually doing what it says it is doing?"

The answer should be;

"Because we use good indicators to measure the right things and feed these with the best data we can get."

1.3. How to use the guide

This brief guide is NOT the last word on indicators; nor is it designed to provide off-the-shelf indicators for any particular service or system.

The **Good Indicators Guide** should be used alongside other related resources offered by the National Health Service Institute for Innovation and Improvement (www.institute.nhs.uk), and the Association of Public Health Observatories (APHO) (www.apho.org.uk), as well as real

examples from the Department of Health (www.dh.gov.uk), the Information Centre (www.ic.nhs.uk), the National Centre for Health Outcomes Development (www.nchod.nhs.uk), the Healthcare Commission (www.healthcarecommission.org.uk) and others.

In particular, you should read:

• the NHS Institute's Improvement Leaders' Guides on **Measurement for Improvement** and **Improving Flow** www.institute.nhs.uk/ improvementleadersguides

• APHO's Annual **Health Profiles** http://www.communityhealthprofiles.i nfo/

1.4. And if you read nothing else…

Our hope is that the guide is short enough and important enough to be read right through. However, there are some key sections that will be useful by themselves – especially as quick-reference resources you can revisit.

These are:

• section 2. Indicators – the important principles (page 5) and

• section 7. Criteria for good indicators and good indicator sets. (page 23).

If you only read two sections from this guide, read these!

2. Indicators: some useful background

Objectives of this section:
- to help you understand why indicators have assumed such importance
- to explore why indicators cause so much anxiety and resentment
- to discuss the different ways indicators can be used.

2.1. What are indicators, and why are they so important?

- indicators are **succinct** measures that aim to **describe** as much about a system as possible in as few points as possible.

- indicators help us **understand** a system, **compare** it and **improve** it.

Indicators are extremely important forms of measurement, but they can also be controversial (see 2.3 below). Like all powerful tools, they can easily do as much harm as good.
The world is becoming a more transparent and competitive place, where people want instant summary information. Indicators appear to fit this need and are therefore becoming an increasingly important part of how everybody works.

2.2 The three key roles of measurement

Indicators, like many other forms of measurement, can be used in three broad ways:

1. for **understanding**: to know how a system works and how it might be improved (research role)

2. for **performance**: monitoring if and how a system is performing to an agreed standard (performance/managerial/improvement role)

3. for **accountability**: allowing us to hold ourselves up to patients, the government and taxpayers and be openly scrutinised as individuals, teams and organisations (accountability/democratic role).

2.3. Why are people suspicious and mistrustful towards indicators?

Mistrust and ambivalence towards indicators is hardly surprising when considering what they are designed to do. While they play an increasingly fundamental role in monitoring our performance, they can only ever *indicate* and *summarise* the complex systems in which we work.

For instance… A particular hospital has a high death rate amongst its patients. This is important and needs investigating. It may be because it is a specialist hospital and admits many very ill patients from other hospitals, or it may be because there is room for improvement in the way the hospital treats and cares for patients. *Lesson: indicators rarely give definitive answers but they nearly always suggest the next best question to ask that ultimately WILL give the answer required.*

Consequently, indicators very often make people and organisations feel vulnerable, exposed and defensive. This feeling is not likely to change unless more is done to help people understand and accept the strengths, as well as the limitations, of these important measurement tools.

2.4. Four things to know and accept about indicators

- **Indicators only indicate:** an indicator will never completely capture the richness and complexity of a system. This makes people nervous that they will be judged unfairly on the basis of only one (or a few) facts. A set of indicators will usually not improve things much. Indicators are designed to give 'slices' of reality. They might provide the truth, but they rarely give the whole truth. This leads to people's understandable fear that they are being unfairly measured and judged. Like any reductionist approach, an indicator must be understood in **context**

- **Indicators encourage explicitness:** indicators force us to be clear and explicit about what we are trying to do. Not everyone feels comfortable with this as there is

A useful analogy

Imagine a car dashboard: an **indicator** is a warning light flashing on the dashboard. It is fed by one of many streams of **data** – maybe oil level, temperature, etc... It flashes when all is not well, suggesting we **stop** the car. The indicator "alerts us to something worthy of further investigation."

often a desire to retreat to non specific agreements rather than face important differences in understanding. It can be difficult attaining a true agreement and understanding of the work, though indicators can be very helpful in achieving this by asking such questions as "What would success look like if we could only measure three things?"

- **Indicators usually rely on numbers and numerical techniques:** A lot of people – even competent professionals - fear numbers. Yet, in order to be able to use indicators properly or challenge them, we need a basic understanding of elementary statistics (rates, ratios, comparisons, standardisation etc). Although many statistical methodologies can be difficult and counter-intuitive to learn (especially if they are only used occasionally), indicators don't always use complex methods.

- **Indicators should not just be associated with fault-finding:** people often assume that indicators are designed to find fault. In fact, they can help us understand our performance be it good or bad. Well-designed measurement systems identify high performers (from whom we can learn), as well as systems (or parts of systems), that may warrant further investigation and intervention.

2.5. Measuring to improve

While indicators do come (deservingly or not), with a lot of 'baggage', using them properly can yield enormous benefits – particularly in terms of improving systems and outcomes for patients, staff and taxpayers.

Improving any system (e.g. a care pathway), depends on good measurement and good understanding:

- we measure to understand how things work (e.g. a care pathway) so:

- we can understand how we might do things better.

There is deliberate emphasis on the word *understand* in this guide – many approaches to improvement assume that simply by measuring something, it can be properly improved. Using indicators well is an important part of understanding and therefore improving. But measurement **on its own** very rarely leads to improvement - you can't make pigs fatter just by measuring them!

Measurement is necessary for improvement but is not sufficient on it's own.

Successful improvement depends on more than good measurement – not least understanding how to turn measures into the sorts of messages that will change hearts and minds. (See section 5, p18).

Of all the comments from new Non-Executive Directors (NEDs) that join the boards of health organisations, one of the most common seems to be: *"How can we ensure that the organisation is actually doing what it says it is doing?"*

2.6. Improvement starts with clarity

Before beginning the process of improving any system, there needs to be clarity over what that system is aiming to do.

In fact, agreeing and articulating the objectives of a system can often be the most valuable part of the whole measurement and improvement process. Lack of shared understanding is very often at the root of inefficiencies in a system.
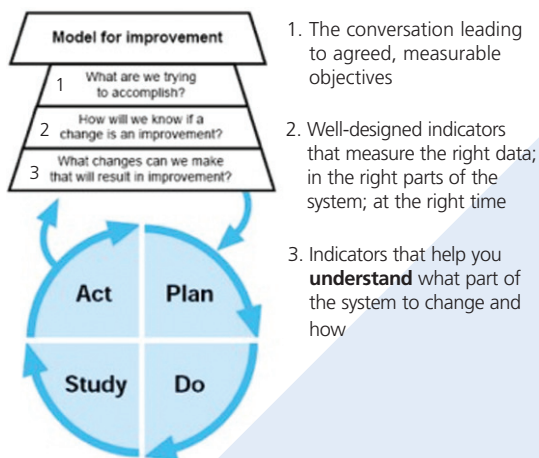
Reaching a consensus about objectives has to start with constructive **conversation** between all the key partners within the team, system or organisation.

However this conversation is approached, two fundamental question need to be addressed:

- "do we have a consensus about what this organisation is trying to do?"

- "can we agree on how to translate these broad aims into measurable objectives?"

The Model for improvement[1] is a valued tool right across the NHS. It too starts with the key question about what a service or system is aiming to achieve.

Figure 1: The Model for improvement

1. The conversation leading to agreed, measurable objectives

2. Well-designed indicators that measure the right data; in the right parts of the system; at the right time

3. Indicators that help you **understand** what part of the system to change and how

1 Langley G, Nolan K, Nolan T, Norman C, Provost L, (1996), *The Improvement Guide: a practical approach to enhancing organisational performance*, Jossey Bass Publishers, San Francisco.

2.7. The conversation: how it might start and what it can do

As a typical board meeting comes to a close, the conversation between a Chief Executive Officer (CEO) and one of the Non Executive Directors (NEDs) might go like this…

CEO: Anything else to discuss?

NED: I'm still a bit worried about the quality of our chronic pain service.

CEO: OK. What's concerning you?

NED: I've heard that our next inspection is going to be difficult. Plus, a colleague of mine has had a particularly unsatisfactory experience recently as a patient of the service.

CEO: That's interesting. We haven't got time to debate it in length now, but I'll make sure we find out:

- how we can measure the quality of this service at the moment

- how the national inspection agency will measure it

- and how we currently incorporate the views of people who use the service.

- We'll try and get this ready for the next meeting when we are due to discuss our next version of the performance dashboard.

Even from this brief exchange, we can see:

- the importance of understanding the key objectives of a service

- the importance of reconciling different ways of measuring it

- the importance of linking measurement to quality and improvement, and

- the challenge of combining the very powerful and real experiences of one person (even if not necessarily representative or typical), with an assessment using reliable data that summarises the experience of all users.

Using indicators can help to meet all these challenges more confidently, explicitly and with better end results.

3 points to take away

- indicators are only one form of measurement and people mistrust them
- if used properly, they will help to better understand what systems claim to do and how they can be improved
- indicators must be chosen and used in a way that relates very specifically to the objectives of the system in question.

3. The anatomy of an indicator

Objectives of this section:
- to show the basic construction of an indicator
- to help you deconstruct an indicator and assess the appropriateness

3.1. Understand what you're looking for

Whether you are using indicators that have been imposed on you, or whether you need to choose the best indicators for your local needs, the only way to feel comfortable, confident and competent with these measurement tools is to understand their structure or 'anatomy'.

When you understand what constitutes a good indicator – it becomes much easier to:

- select the most appropriate indicators when there is a choice.

- distinguish between perceived 'poor or excellent performance' due to a poor or inappropriate indicator, and genuine 'poor or excellent performance' due to a well designed indicator.
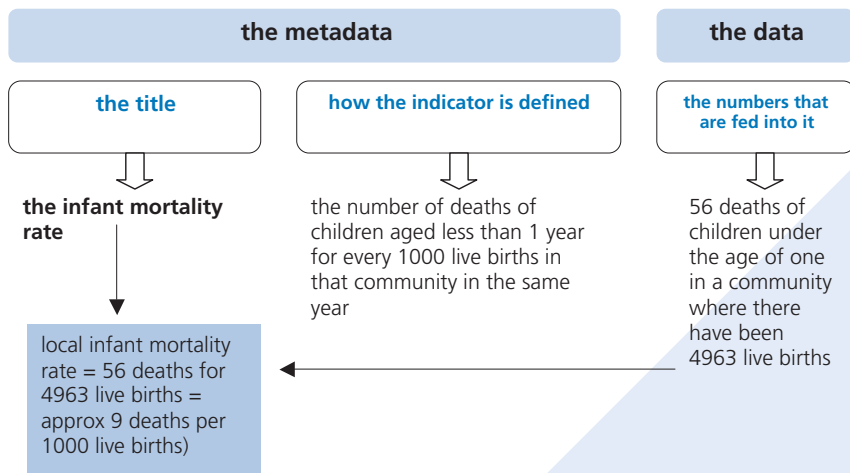
- address any weaknesses in the measurement systems if the indicator is well constructed, but the local data being used in the indicator is inaccurate.

3.2. The basic anatomy of an indicator

In operational terms the indicator is known as a metadata, referring to the title, the rationale, and the information about how it is actually constructed.

This is different from the information that is fed into the indicator. Which is called the **data**.

For example, "Infant Mortality Rate" is often used as a basic indicator of the health of a community, especially in economically poorer countries.

the metadata		the data
the title	**how the indicator is defined**	**the numbers that are fed into it**
the infant mortality rate	the number of deaths of children aged less than 1 year for every 1000 live births in that community in the same year	56 deaths of children under the age of one in a community where there have been 4963 live births
local infant mortality rate = 56 deaths for 4963 live births = approx 9 deaths per 1000 live births)		

3.3. Good metadata

Good decisions depend on the most appropriate indicator populated with the best available data. A poorly designed, or poorly chosen indicator with reliable data, or a well designed/chosen indicator with unreliable and /or untimely data, has very little value (and is sometimes positively dangerous).

It is the *metadata* that will help you assess if a particular indicator is:

• important and relevant for you

• able to be populated with reliable data

• likely to have a desired effect when communicated well.

A detailed example of metadata is offered in Appendix A at the end of this guide. It uses the 'People with diabetes' indicator from the Association of Public Health Observatories' (APHO), Health Profiles for England 2007.

It's worth spending some time looking at this and getting to grips with the level of detail you should aspire to when assessing and choosing indicators. If this seems onerous at first, most of the essential metadata elements of an indicator can be clarified by asking these 10 basic questions:

10 key questions	Answers and examples
1. What is being measured?	**Levels of diabetes**
2. Why is it being measured?	**It is a serious disease with serious consequences. Although it can be prevented and treated, it is still the leading cause of chronic disease globally and accounts for about 10 per cent of NHS costs**
3. How is this indicator actually defined?	**From recorded levels in general practice**
4. Who does it measure?	**All persons, all ages**
5. When does it measure it?	**Which day/month/year?**
6. Will it measure absolute numbers or proportions?	**Proportions: numbers of case per thousand resident population**
7. Where does the data actually come from?	**Collection and collation from Quality Outcome Framework (QOF) data in General Practice via the NHS Information Centre**
8. How accurate and complete will the data be?	**The data cover more than 99 per cent of GP registered patients in England, although not everyone is registered with a GP (especially some groups with particular needs - *see next box*)**
9. Are there any caveats/ warnings/problems?	**Potential for errors in collection, collation and interpretation (such as an under-sampling of ethnic populations, young people, homeless people, migrants, and travellers)**
10. Are particular tests needed such as standardisation, significance tests, or statistical process control to test the meaning of the data and the variation they show?	**E.g. when comparing small numbers, in small populations, or to distinguish inherent (common cause) variation, from special cause variation (See section 4 for more on variation).**

3.4. Is the appropriate indicator populated with the best available data

While the indicator needs to be as appropriate as possible, the data need to be as valid as possible. Neither will ever be perfect (See section 8 p28 'Myths about indicators').

You will always need to use your judgement to assess whether both the indicator and the data it uses are good enough, when combined for your purposes. Remember, a trustworthy indicator won't give you definitive answers itself, it will only alert you to an issue you may need to explore further.

How you select your indicators and the data that feed into them will often involve making a trade-off between what is convenient (and possible), to collect, and what you ideally want for your measurements.

Making this judgement call won't always be easy, mainly because you will need to factor in how other people will react to being asked to collect the data if they see it as more work, or don't understand the rationale behind the measure (another good reason to pin down clear and detailed metadata for your indicators).

For instance… It may be quite easy to use data from routine collections for surveillance or administrative purposes (e.g. people who come into contact with some part of the health service). However, this data will inevitably be biased. Some of the most important information (e.g. population based data that relates to behaviour and lifestyle), will be impossible to judge from routine systems based on health service contacts.

3.5. Good indicators mean groundwork

Understand the pressures on others. Health organisations already collect vast amounts of data and often this is duplicated - and staff on the ground are often not entirely clear what happens to the data or why they are needed. Feedback to those who collect data is important in order to engage the whole system.

You should aim to nurture some active ownership of the data and indicators with frontline staff. At the very least, be aware of the burden on frontline teams and don't add to it without spending time talking to them.

For example ask staff:

- how the service works
- what, if anything, they want to change about it
- what barriers they face
- what information they already collect
- what they consider the fairest measure of their work process and its outcome.

This is all about building up trust, credibility and ownership with the people and teams who are not only responsible for collecting the data, but who will be pivotal to making and sustaining any subsequent improvements in the system.

3 points to take away

- every indicator is made up of metadata and data
- the metadata helps you understand the background of an indicator and judge whether the indicator is likely to be an appropriate and possible measure
- an indicator without trustworthy data to feed it, is often worthless and sometimes dangerous.

4. Understanding variation

Objectives of this section:
- to help appreciate how fundamental an understanding of variation is to managing a system
- to help answer the question: "Is this variation we have spotted important enough to warrant further investigation?"
- to give an example of a statistically robust and visually intuitive way of understanding variation

4.1. Why is variation important?

It has already been started in Section 2 that indicators only indicate. They are deigned as a high level summary of a system and they help to identify and prioritise the issues that are worth investigating further.

But measurement of *any* system or process will reveal some variation. It's this inevitability that makes understanding different sorts of variation so important. Perhaps the most important skill when you are presented with data is to assess whether the inevitable variation is significant enough to warrant further action or not.

'Ultimately, the ability to lead depends on one's ability to understand variation'.

W Edwards Deming

For instance… A frequently used way of assessing and comparing performance is to construct a league table by simply ordering the values and highlighting those at the bottom of the pile. The most important flaw with this process is that, even if everyone is doing well, there will inevitably be someone at the end of the spectrum. However, this does not necessarily automatically mean underperformance.

(ref: Adab et al, Marshall et al)

4.2. Statistical process control

A particularly valid and useful way of analysing variation is using "Statistical Process Control" (SPC). Developed by Walter Shewhart in the 1920s, it involves distinguishing between:

- the normal, everyday, *inevitable* (and usually unimportant), variation which is intrinsic and natural to any system – **'common cause variation'**

- and the more important variation which is indicative of something special happening and which calls for a fuller understanding and often action – **'special cause variation'.**

Statistical Process Control, like any tool to analyse variation, can be used within a single system (institution) over time, or can be used to analyse variation between different institutions.

One of the most common mistakes in analysing variation (e.g. by using indicators), is the failure to appreciate that common cause and special cause variation are fundamentally different. This results in one of two problems:

- wasting time, money and effort investigating what appears to be an 'outlier' when, in fact, that result is actually within a range that is deemed acceptable by the system

(i.e. treating common cause variation as if it were special cause variation)

- wasting time, money and effort investigating and dealing with special cause variation as if it were common cause variation. So, because of just one particular outlier, an organisation makes changes right across a system that is already working well, when the focus of attention should be on that one particular outlier.

Statistical process control techniques can help you distinguish between these two types of variation and judge whether you have:

A: a working system where the average level of performance is acceptable and there are no outliers	**ideal**

B: a working system whose average level of performance is acceptable, but with outliers e.g. lung cancer mortality	**action: address the outliers**

C: a system whose average level of performance is not acceptable regardless of the variation e.g. boys' educational attainment in England	**action: concentrate on the whole system rather than particular individuals within the system**

There is an important caveat about a system that appears to be "in control" that is often overlooked or misunderstood.

A set of data that does not exhibit special cause variation does not *necessarily* represent a system that is performing well. The whole system may be uniformly under performing. (as in boy's educational outcome, above box C). (see below: figures 2 and 3).

For instance, a clinical department in a trust could be performing within their own control limits, but failing to meet externally required target expectations, because their horizontal line may be set much higher or lower (i.e. the target expectations are determined by data or people other than those within the own organisation).

> The real strength of Statistical Process Control, when the results are displayed as control charts, is that it combines statistical rigour with an attractive and persuasive method of displaying data.

Figure 2: A statistically uniform system (compared with itself over time)

Showing the proportion of A&E attendances seen within four hours. The average proportion is 98.4 per cent - there is one special cause variation denoted by the square marker at week 10.
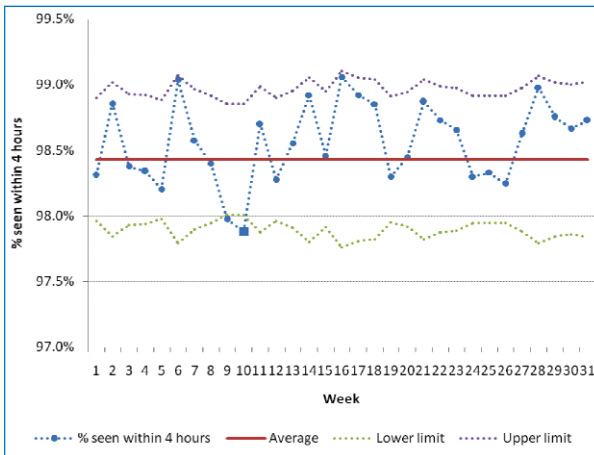
Figure 3: A statistically uniform system not meeting expectations [compared with itself over time]

Showing the proportion of A&E attendances seen with four hours. However, compared with target expectation (red line), the whole system is performing at the wrong level.
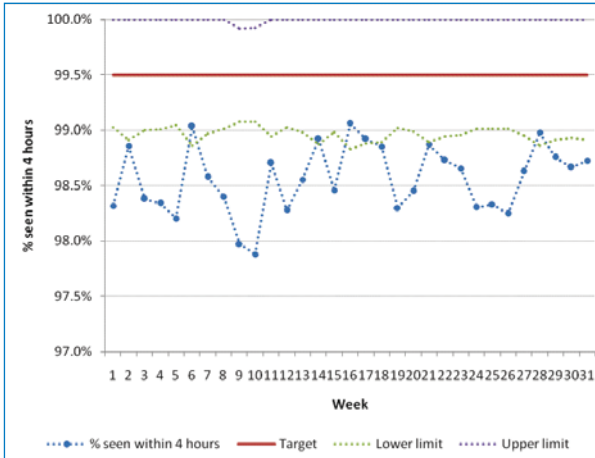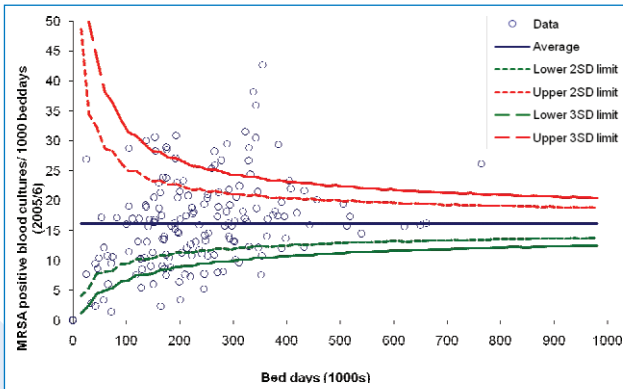

Figure 4: An non-uniform system comparing NHS Trusts with each other

This display of Statistical Process Control, (figure 4.), shows widespread variation in MRSA rates between NHS Trusts in 2005/6. The type of display shown in figure 4 is often called a funnel plot. Those Trusts that are closest to the blue line (the average), need not be investigated further – in fact, it might be wasteful to do so. The area between the upper dotted line and upper continuous line is often termed the "alert" area. The area above the continuous red line is often called the "alarm" area. Such a graph also indicates where Trusts appear to

be performing very well. Lessons need to be learnt from such Trusts (assuming the data are correct).

There are other ways of comparing data using indicators in pictorial form (bar charts, simple ranking, dashboards, etc…), however, when data are analysed using Statistical Process Control, and well displayed and compared using control charts and/or funnel plots, they combine:

- statistical robustness with

- visual intuitiveness.

3 points to take away

- the most common mistake in using indicators for improvement is not understanding that common cause and special cause variation are fundamentally different
- Statistical Process Control (SPC) helps you distinguish between the two
- SPC gives you a valid statistical approach along with an attractive and persuasive way of displaying your data to others.

5. Changing hearts and minds

Objectives of this section:
- to help you understand that improvement happens by appealing to people's rational **and** emotional sides
- to help you communicate what the indicators actually tell you

5.1. What really makes people and organisations change?

Indicators are summary measures and no matter how important or valid they are, they will rarely, by themselves, motivate people to change.

There are institutes and university departments entirely devoted to the science of change. People rarely change until they judge that the risk of not changing outweighs the risk of changing. Bringing them to this point requires much more than having valid measures. It requires appealing to people's emotional side, as well as to their technical and rational selves.

Most people involved in measurement realise it is necessary for change to happen; however, too few realise when measurement is not sufficient.

5.2. Why is communication important?

It can be simplistic and unwise to separate the world of measurement from the world of improvement. Similarly, never separate the design of indicators from the design of the larger change process. All these areas are connected through good communication.

*'I am not interested in measurement per se. I am obsessed by improvement and the role measurement has in **that** process.'*

Don Berwick, Institute for Healthcare Improvement

While good communication skills are clearly vital, they are not in the scope of this short guide. The focus here is on the fundamental principles that will help you use measurement in a way that genuinely has the power to change hearts and minds when well communicated as part of a larger change process.

5.3. Four principles for changing the way people think

- **think about your audience:** Ask yourself who you want to influence. Information in general (and indicators in particular), can be most influential when they are well-received by the people who have the greatest control. So there is considerable potential for using information that your audience both understands, and wants to feel they can do something about.

- **make presentation matter:**
Many people from a numerical background find it difficult to understand why people don't find the research they have done or the data they have assembled more compelling. But not everyone responds well to graphs and charts. There is a balance to be struck: if you've spent time and effort on selecting the most valid indicators and gathering good data:

- you don't want to 'dumb down' the information they give you just to get people to take notice

- but neither do you want people to ignore it because it's too complex or completely impenetrable.

There are classic texts and examples to show how useful and unuseful quantitative information can be to help people change their view and understanding of the world. (See Tufte's classic works in Further reading).

Do the simple things well:

- labels: ensure you label your tables and graphs clearly

- text: ensure the text on them is large enough to read

- colour: remember that red and green colour coding can be a problem for some people (8% of men are red-green colour blind).

- **test your approach:** Whatever method you choose for presenting your information, it is often helpful to test out the approach you want to use, before you present it formally. If the presentation or techniques you are using (e.g. Statistical Process Control), are likely to be unfamiliar to those you want to influence, spend some time beforehand developing their understanding, or consider changing your approach.

- **appeal to people's emotions:**
Failing to appeal to the emotional side of people (what they think and what they feel), will probably doom any change process.

Try not just to present your data – look for the 'story' it is telling in terms your audience will appreciate. If you have done your groundwork at the earlier stages and started a constructive conversation with frontline staff and service users, you're likely to find this much easier.

'People change what they do less because they are given analysis that shifts their thinking, than because they are shown a truth that influences their feelings'.

Prof John Kotter,
Harvard Business School

For instance… It is usually more powerful to say that "half of all smokers will die early because they smoke" than "over 100,000 smokers die prematurely each year".

5.4. The importance of timing, context and original purpose

The right indicator, at the right time and in the right context can stimulate huge change, where it might have no effect in other contexts and at other times. So if an indicator has been developed for one purpose (e.g. for research and surveillance), and you use it for another (e.g. performance management), make sure you've thoroughly thought through the implications. Indicators that are thoughtlessly used will be carelessly treated and even manipulated by those whose behaviour it is trying to influence for the patient's and public's good. People will even start to manipulate the system to meet the target set by the indicator, forgetting or avoiding the original intention of the target ("Gaming").

The lesson is always to remember the circumstances in which an indicator has been developed before using it elsewhere. It may still be useful, but the context always needs to be considered and made explicit.

For instance… Research shows that patients in A&E departments feel highly reassured when they are seen by a clinically qualified professional a soon as possible after they arrive. Setting this as an indicator (time to see a clinically qualified professional), and a target (time to see a clinically qualified professional is within 30 minutes), may mean that some departments merely deploy someone to say hello – not a good use of a professional's time.

3 points to take away

- indicators, although essential in every improvement process, will not by themselves motivate people to change.
- good communication bridges the gaps between measurement, understanding, and improvement.
- in order to influence people, indicators need to be presented in ways that are easy to understand and in ways that make changes to the system compelling and possible.

6. Frequently asked questions

Q. What role does qualitative evidence play when using indicators?

A. Perceptions are very real; they can drive or block necessary change. Qualitative research (about how people think and feel), is extremely important in indicator work – yet often (and wrongly), indicators confine themselves to quantitative data. It is important for those people aiming to improve the system to be very aware of the power of feelings and perceptions in understanding an improvement in a system.

Q. How closely related does the issue being measured have to be to the objectives of the system or organisation?

A. The two most essential features of an indicator are that it has to be intrinsically valid (measure what it claims to measure), and to be important and relevant to the objectives of the system or organisation it is measuring. This is especially true in managing the performance of a system. Focus on what is important, before moving on to what is interesting.

Q. What is meant by a balanced scorecard of indicators?

A. Any indicator will give only a very specific and limited perspective of a wider situation. Think of trying to watch a football match through a very small gap in a fence. It will only give a limited picture of the whole game. Different indicators (like different gaps in the fence), give different but complementary 'slices' of the whole situation. They need to be added together to get a picture of the entire pitch and an understanding of the whole game. That's why indicators are often used in baskets or sets; each measuring an important but different aspect of the system. This is the 'balanced scorecard' approach.

Q. Some indicators are composed of 'synthetic estimates'. What does this mean?

A. When specific data are not available locally (e.g. because there is no routine data collection of that sub population or of that particular geographical area), it is sometimes possible to estimate or synthesise such data. This can be very valuable to give local decision makers an approximate feel for the scale of an issue, although it is clearly unsatisfactory if an evaluation of a special and local initiative is required.

Q. Can we afford to measure ourselves?

A. The pressure on health organisations is to deliver frontline services, rather than invest in people with clip boards, stopwatches and tape measures. Measurement has a cost, and this cost should never outweigh the benefits it brings. However, the

question should perhaps be reversed: do we have sufficient enough resources so that we can use them without any systematic, valid information on whether we are actually delivering what we think we are delivering, or indeed are we addressing a need we only think exists?

Q. How can we be sure of the quality of commercially available indicators?

A. Health-related intelligence (like all intelligence), is an increasingly competitive business where there are multiple providers of numerous products, including measurement systems and indicators. The same critical appraisal process that is routinely applied to research findings should be applied to indicators wherever they come from. Commercially provided indicators, being driven by the market, can be highly responsive to user needs. However, the disadvantage is that they can sometime be difficult to 'deconstruct' because the way they are assembled may be part of their commercial value and thus subject to some confidentiality. This can make it difficult to appraise their suitability and validity. Nonetheless, commercially-provided measurement systems should not be ignored. They can make a valuable, stimulating and innovative addition to a responsive measurement process.

7. Criteria for good indicators and good indicator sets

Objectives of this section:
- to offer a systematic approach to designing, appraising, and choosing indicators and indicator sets (especially for Directors of Performance and Chief Executives)
- to offer a systematic approach to those people who have to make decisions on the basis of indicators and indicator sets about which they will not be completely familiar (especially for Non executive Directors)
- to offer a systematic approach to those people who have to deal with the next steps of measurement and monitoring of the systems (especially for Performance Managers and Team Leaders).

7.1. Critically appraising indicators

No indicator in the history of measurement and improvement is perfect for all purposes. No indicator will perfectly satisfy all the criteria and questions below. The important issue is that these questions have been considered and assessed systemically, and any compromises judged acceptable, and made explicit.

These questions are grouped into five sections, with comments that relate to each question – most of the issues are mentioned elsewhere in this guide.

The first two questions are the most important.

A. Do the indicators address the **important** issues?

B. Are they scientifically **valid**?

Don't proceed unless the indicator(s) you are assessing are both important and valid.

A: Importance and Relevance?

If you are not clear about the most important aims of the system you are measuring (such as its purpose, measurable objectives, etc…), then do not proceed until you have clarified this at a senior level. Only then will you know if the indicators you are assessing are important and relevant.

A1. Does this indicator measure a sufficiently important question/service?

Comment: People often fail to measure and address what is most relevant. Your indicators must focus on, and measure key parts of the process, and/or outcome. Indicators must be chosen and used in a way that relates very specifically to the objectives of the system in question. The indicators have to appeal to the people's perception of the importance and the possibility of improvement (sometimes referred to as "Perceived Public Value").

A2. If you are considering a set of indicators, is it a balanced set? (i.e. are all important areas covered without undue emphasis on any one area?)

Comment: Measurement often concentrates unduly on some parts of a system at the expense of other equally important parts of the system. Consequently, some parts are over-measured and others under-measured.

A3. Is the set of indicators you are proposing likely to clarify the consensus on the objectives of the system/organisation?

Comment: Using indicators that measure the right data; in the right parts of the system; at the right time, is a powerful way to develop and share the consensus.

B: Validity (Does this indicator actually measure what it is claiming to measure?).

If you are not sure if the indicators you are proposing actually measure what they claim to measure, then do not proceed until the proposed indicators have been tested (i.e. validated).

B1. Does this indicator really measure the issue?

Comment: Many indicators claim to measure important parts of a system or a service but often fail to do so. There are many reasons for this e.g. the issue being studied might be an outcome and the indicator being used is a measure of infrastructure or process. This can be further complicated when there is a poor or ill understood relationship between the infrastructure or process of a system and its outcome.

Do not proceed until you have clarified A and B. Then ask:

C. Is it actually **possible** to populate the indicator with meaningful data?

D. What is the **meaning**? What is the indicator telling you and how much precision is there in that?

C: Possibility (Is it actually possible to populate the indicator with meaningful data?).

If you are not sure if it is even possible to construct and populate the indicators, then do not proceed until this has been checked. This is particularly important for those people who are tasked to actually design (rather than just choose), indicators.

C1. Are sufficiently reliable data available at the right time, for the right organisations with the appropriate comparators?

Comment: You need the right data both for the issue in question and for appropriate comparators (place, people, organisation, time…). However, do not be seduced solely in the direction of data availability. The right indicators are based on the objectives of the organisation and the not just the availability of data.

C2. If not, is the extra effort and cost justifiable?

Comment: It may be desirable to know even more than you do, but is it worth it? Is it likely to change your decision?

D: Meaning (What is the indicator telling you and how much precision is there in that?).

If you have no idea what the results of any indicators you design or select actually mean when they have been populated and displayed, then do not proceed.

D1. Will the indicator be able to detect and display a variation that is important enough to warrant further investigation?

Comment: A key question!
The indicator should ideally be capable of identifying all the issues (and only those issues), that need further investigation. It should not identify random variations that should be ignored i.e. "noise".

D2. If the indicator is high or low, what does it actually tell you, and does it give enough accurate and precise information for you to be able to investigate further and take any necessary action?

Comment: A surprising number of indicators give you very little additional information because you may not be sure if an apparent outlier really means anything. You need to be confident you can judge the acceptable limits of the value of an indicator before pursuing it.

D3. Can the indicators be understood (and deconstructed), in order to understand the particular reasons for the results?

Comment: Often, people scratch their heads and guess the reasons for a particular result because they do not know enough about how an indicator is constructed in order to work backwards and understand the issues that may be causing a particular value.

D4. Can the implications of the indicator results be communicated to, and believed/appreciated by the right audience?

Comment: The compelling way in which results are displayed, interpreted, and communicated are key to subsequent action and any improvement.

Finally ask what are the **implications**? What are you going to do about it?

E: Implications (What are you going to do about them?).

If you do not understand the implications of an indicator in terms of whether the result suggests further investigation, then do not proceed until you do. Ensure you understand what actions might be possible if such investigation confirms the need to act.

E1. Is there sufficient understanding of the system so that any issues identified can be investigated further and addressed effectively?

Comment: Once you are clear there is an issue where further investigation may be warranted, you must be clear there is good evidence on how to act (or sufficient investment and research to find this out). Otherwise you will merely identify issues you do not know how to address, or worse, address wrongly.

E2. Are the results likely to induce perverse incentives and unintentional consequences?

Comment: You need to be able to act in a way that gets to the root of the issue, not by gaming or by manipulating the data.

E3. Can the indicator monitor the issue regularly enough so that further investigation and action can be taken before the issue is revisited?

Comment: The system must be sufficiently responsive so that problems are addressed early but not measured so often that the action has not had the chance to have had effect.

7.2. Here are some examples of how these questions can help you highlight some of the practical shortcomings of indicators, even those still widely in use.

Examples 1 and 2 have a public health focus and examples 3 and 4 have a more clinical focus.

Example 1:

Indicator title:

Mental health indicator in Health Profiles 2006 (subsequently dropped)

Defined as: the 'practice register of people with severe long-term mental health problems who require and have agreed to regular follow-up'.

Why was it problematic? The indicator was difficult to interpret: a high number could either mean that the system is treating high numbers, or alternatively, a high prevalence, or even both. Conversely, low numbers suggested either a low prevalence of mental health problems, or only small numbers of people accessing treatment, or both. Consequently, the results of the indicator were largely unhelpful to most people.

The indicator was dropped from the Health Profiles indicator set the following year.

Example 2:

Indicator title:

Life expectancy at birth (used widely as a summary measure of population health)

Defined as: the average number of years a newborn baby would survive, if he or she were to experience that area's current death rates as measured throughout his or her life.

Why is it problematic? Although it is based on a somewhat hypothetical calculation, this indicator has huge 'face validity' and is also very intuitive. It is a broad, summary measure and as such is influenced by everything that influences the length of life lived.

However, the consequences of this are that it can be difficult to deconstruct why a specific population has a particular life expectancy. There may be very many reasons; and the reasons for a low life expectancy in one population may be completely different from the reasons for a low life expectancy in another.

Example 3:

Indicator title:

Call to needle time in suspected myocardial infarction

Defined as: % of patients who received thrombolytic treatment within 60 minutes of calling for professional help. MINAP clinical audit.

Why is it problematic? There are many people who call for help complaining of chest pain and who do not meet a final audit definition of myocardial infarction.

Why is it used? It remains a good indicator of how often people receive a time-dependent element of treatment for myocardial infarction.

Example 4:

Indicator title:

BMI (Body Mass Index) measurement in people with diabetes

Defined as: Quality and Outcomes Framework DM 2. The percentage of patients with diabetes whose notes record BMI in the previous 15 months.

Why is it problematic? Measurement alone may give the illusion of something being done.

Why is it used? Getting a measure of the problem is really important, and developing more appropriate measures of change is hard.

8. Ten myths about indicators

The only useful indicator is one that covers the complete work of an organisation.

This is highly unlikely to be even possible. Indicators merely indicate. You are aiming for the most useful slices of reality that give the most comprehensive picture possible, with the least amount of unnecessary detail.

It is possible to design a measure that captures all that is most important about a system.

Again, this is highly unlikely. Health care involves large and highly complex systems. For instance, coronary artery bypass grafting mortality only covers a tiny fraction of acute activity, but is often used as an indicator for whole areas of the acute sector.

Homemade indicators are best: the only indicators that are of any use are those that you design yourself.

Rarely do you need to design new indicators. Resist the temptation. If you think it will be a better indicator than any other existing indicator, ask why no-one else has used it before. In addition, indicators that you have designed yourself are unlikely to have useful comparators, except with itself over time.

You only need very few indicators to understand how a system is working.

You would be very lucky if this were true. Most indicators (and sets of indicators), give you selected slices of reality. You need *many* slices to gain a reasonably valid understanding of the whole system. Moreover, you need to understand the relationships between the indicators you use, and the issues they are intended to measure.

Measurement eliminates uncertainty and argument.

Indicators exist to prompt useful questions, not to offer certain answers. Promoting a healthy uncertainty and stimulating the right degree of unbiased, informed debate, are what indicators are all about.

Unless the data are perfect, the indicator is useless.

There is a temptation to throw out the baby with the bath water (especially when the result does not conform to your prior assumptions). There are no such things as perfect data or perfect indicators. The skilled manager knows how to appraise the quality of the data and the subsequent indicator in context, and judge how important the indicator is to the whole decision making process. The real question is: are the data good enough for the purpose in hand?

It is possible to justify the result of any indicator.

Being too defensive and not sufficiently open minded often prompts people to explain away the result of any indicator (especially the indicators that suggest poor performance). Simply finding a plausible excuse for every indicator is tactically short sighted, and strategically dangerous. Be open and honest; otherwise you will be rumbled.

It is acceptable to improve the indicator rather than the system.

This eventually becomes gaming, and leads people to do anything to improve the result of the indicator, except address the problems it is designed to address. Again, you will be rightly accused of not engaging in the true spirit of improvement.

It needs to be a common event to make a useful indicator.

Events (e.g. deaths, infections or mistakes), need to be sufficiently common when trying to make statistically significant comparisons between different organisations, areas, or time periods. However, qualitative data (what people think or feel), can be very powerful from even small numbers of people; focus groups often tap into important issues that surveys or administrative data collections may never reveal.

Secondly, rare and significant events (e.g. adverse outcomes), can be very important indicators; certainly as a starting point to a more complete study to understand the underlying situation. Remember, indicators only indicate; they are no more diagnostic than a screening test.

Only local indicators are relevant for local people.

There is no doubt that indicators that are relevant to local people or practitioners are more likely to be believed. But you will find it difficult to know what the results mean if you have no consistent comparators or benchmarks from elsewhere. Indicators mandated and designed by other people or higher authorities may not always be perfectly relevant locally, but the little you lose in relevance will be more than compensated by validity and comparability.

9. Glossary

A guide to some of the common terms used when working with indicators

Basket (of indicators): A group of indicators that aims to cover a wide range of issues as validly as possible. A common way of using a basket is for people to choose which indicators they *need* locally. The idea is to construct (and often populate), a validated set of indicators that promotes consistency but still gives local users some control in selecting the indicators they want to use.

Balanced (set of indicators): A set of indicators which, taken together, reflect as much of a system as possible without duplication, overlap or gaps.

Benchmark: An externally-agreed comparator to compare performance between similar organisations or systems.

Control charts: A method of displaying the results of Statistical Process Control (See Section 4 (p13) 'Understanding variation').

Composite indicator: An aggregation of numerous indicators which aims to give a one-figure indicator in order to summarise measures even further. (ref: Jacobs, Goddard, et al; 2006).

Criterion: An area or issue which, according to good evidence, is related to the overall objectives and outcomes of the system or organisation being measured. It needs at some point to be made quantifiable as a standard, indicator or target.

Dashboard: A visualisation of the most relevant indicators in one place.

Data: Information that is fed into indicators. Without context and comparators, data rarely have significant meaning.

Funnel plot: A method of displaying the results of Statistical Process Control.

Gaming: To improve the result of the indicator directly, rather than addressing the underlying system that the indicator is seeking to address.

Indicator: A summary measure that aims to describe, in a few numbers as much detail as possible about a system, to help understand, compare, predict, improve, and innovate.

Information/Knowledge/Intelligence: Processed and accurate data; collated, linked, contextualised, interpreted, presented and disseminated in a timely manner to enable a decision-maker to be better informed.

Metadata: (literally: data about data) A description of the data that go into an indicator and how and why the indicator is constructed. The information on the spine of a book is the metadata for the

information inside the book. (Title, author, publisher…) (See Section 3 p9 'The anatomy of an indicator').

Metrics: Any set of data. An indicator is a particular sort of metric that identifies issues that may be worthy of further investigation.

Monitoring: The process of regular follow up for specific indicators, with a view to action when a particular threshold is crossed.

Outcome: An outcome is a measurable change in health status, sometimes attributable to a risk factor or an earlier intervention.

Outlier: A result outside the desirable range.

Performance: The degree to which a system delivers, as measured against specific and agreed standards and criteria.

Quality: A broad term to describe the multiple dimensions of an organisation's function. Dimensions might include effectiveness, efficiency, responsiveness and accessibility.

Repeatable/Reproducible/Reliable: Although some would argue these terms have slightly different meanings, for most purposes they refer to the degree to which a measurement is the same each time it is repeated (see 'validity').

Standard: The level at which a criterion is set (sometimes called a benchmark or a minimum standard).

Statistical Process Control (SPC):

Statistical analysis and display (e.g. control charts), which helps distinguish normal, everyday, inevitable variation from the (much more important), special variation. The latter indicates something special is happening which warrants a fuller understanding and often action.

Surveillance: Regular and systematic collection, collation and analysis of data. It can be used to spot emerging problems (such as important changes in disease rates), or monitor the important outcomes of e.g. a health care system.

Synthetic data: By using research from elsewhere and the characteristics of the local population, it is possible to 'synthesise' a locally useful estimate of data that would otherwise be missing.

Target: Whereas indicators imply only direction, targets imply direction, speed, and destination. However, targets are sometimes plucked out of the air with little evidence to suggest whether it will be achieved anyway without any effort, or whether it will be impossible to meet despite any level of effort.

Many indicators used in the NHS are given in the form of targets.
The advantage of a specific target is that it can increase the clarity of the timescale. The disadvantage is that specific targets are frequently wild guesses about what is achievable.

Trajectory: A predicted future direction and rate of change of the value of an indicator, as predicted by previous changes.

Trend: A comparison of the same indicator over time.

Validity: Accuracy; the degree to which a measurement truly measure the issue of interest.

Variation – common cause:
Common cause variation is the inevitable variation that is observed in any process. Such variation is characteristic of the whole system. (See section 4, (p13) 'Understanding variation')

Variation – special cause:
A departure from the norm due to a particular characteristic of the outlier, rather than to a characteristic of the whole system. To address such an outlier, the focus should be on the individual case/event/outlier, and not the whole system. (See section 4, (p13) 'Understanding variation').

10. Further reading

Background to indicators

Flowers J, Hall P, and Pencheon D. Public Health Indicators. Pub Health 119:239-245, 2005.

Thomson R. Appropriate use of data: the example of indicators. Chapter 9, Clinical Governance in Primary Care, 2nd Ed. Van Zwanenberg T, Harrison J. (eds). Radcliffe, Oxford 1998.

How to present performance data in compelling and meaningful ways:

INphoRM 4: Presenting performance indicators: alternative approaches. Battersby J, Flowers J. erpho. Dec 2004 www.erpho.org.uk/viewResource.aspx?id=7518 (accessed: 17 September 2007)

Tufte E. The Visual display of quantitative information. 2nd ed. www.edwardtufte.com/tufte (accessed: 17 September 2007)

Tufte E. Envisioning information www.edwardtufte.com/tufte (accessed: 17 September 2007)

Tufte E. Visual explanations: images and quantities, evidence and narrative. www.edwardtufte.com/tufte (accessed: 17 September 2007)

Smarter Reporting. NHS Confederation No 92. December 2003.

How to link measurement using indicators with improvement:

NHSI: Improvement Leaders' Guide Process and systems thinkings, Measurement for improvement, and Improving flow. 2005.

How to appeal to the emotional side of those responsible for change

Kotter JP, The heart of change. Harvard Business School Press; Cambridge; Mass. (2002)

Distinguishing between the different ways of using performance indicators to improve public services:

Performance Indicators: Good, bad and ugly RSS Working Party on Performance Monitoring in the Public Services. Bird S. (Chair) (2003)

Examples of how balanced setoff indicators can be used to give an overview of the health and needs of a population

APHO Health Profiles www.communityhealthprofiles.info/ (accessed: 17 September 2007)

Kelley E, Hurst J, OECD Expert Group on the Health Care Quality Indicator Project - Criteria for selecting indicators (2006) http://intqhc.oxfordjournals.org/cgi/reprint/18/suppl_1/21?ijkey=BT8Q5QCoHyR1w&keytype=ref&siteid=intqhc (accessed: 18 September 2007)

Using indicators online

Karolinska Institute Innovative methods of displaying indicators online – www.gapminder.org (accessed: 17 September 2007)

Examples of how indicators can be selected from a large database

APHO Indicator Database: www.yhpho.org.uk [Go to indicator database] (accessed: 17 September 2007)

The pros and cons of composite measures:

Jacobs R, Goddard M, Smith PC. Public Services: Are composite measures a robust reflection of performance in the public sector. Centre for Health Economics, York. CHE Research Paper 16 June 2006.

The shortcomings of league tables…

Adab P, Rouse AM, Mohammed MA, and Marshall T. Performance league tables: the NHS deserves better. BMJ 324 (7329):95, 2002.

…and the advantages of statistical process control

Mohammed MA, Cheng KK, Rouse A, and Marshall T. Bristol, Shipman, and clinical governance: Shewhart's forgotten lessons. Lancet 357 (9254):463-467, 2001.

Marshall C, Spiegelhalter DJ, Sanderson C, and McKee M. Reliability of league tables of in vitro fertilisation clinics. BMJ 316 (7146):1701-1705, 1998.

Edwards Deming W Critical Evaluations in Business and Management By Wood JC, Wood MC, (eds), Routledge, 2005.

Further technical briefings…

…are available from organisations such as the Association of Public Health Observatories, at
http://www.apho.org.uk

and include:

- Statistical Process Control methods in public health intelligence
- confidence intervals
- a practical guide to target setting in a multi-agency environment.

International comparators.

It is sometimes worth thinking about international comparisons of health data. This is increasingly of interest to those working in economic development in the regions where having comparable data and indicators with partner regions in Europe is important. Data are available on health in Europe though mostly this is at a national level. However some data are available at a sub national data and is worth reviewing:

OECD: Statistics Directorate
http://www.oecd.org/std

Health for all database of the WHO:
http://www.euro.who.int/hfadb

Eurostat:
http://ec.europa.eu/eurostat

The EU website via the EU health portal (http://ec.europa.eu/health-eu/index_en.htm) is a useful entry point to a range of relevant public health material from the European Union.

Appendix A: Full anatomy of an indicator

The 'people with diabetes' indicator is taken from the 2007 Association of Public Health Observatories (APHO) Health Profiles for England.

This is just one example of several indicators featured in the Health Profiles. Like all the other indicators in this resource, it has been chosen specifically for its potential positive.

Indicator name Prevalence of recorded diabetes ("People with diabetes").

Indicator definition Diabetes prevalence (from Quality and Outcomes Framework), persons, all ages, June 2006, per 100 resident population.

Geography England, Region, Local Authority: Counties, County Districts, Metropolitan County Districts, Unitary Authorities, London Boroughs.

Timeliness Data is extracted from the QMAS system annually in June and published in QPID (Quality and Prevalence Indicators Database) in September-October each year.

What this indicator purports to measure Prevalence of diabetes.

Why this indicator is important (rationale) Diabetes is a serious disease with serious consequences. It is the fifth leading cause of death globally and accounts for about 10% of NHS costs. The burden falls disproportionately on elderly and ethnic populations. We use the indicator in this context as a proxy for healthcare need and demand (a high prevalence of diabetes can indicate a less healthy population with higher service utilisation). The sequelae of diabetes include blindness, amputation, neuropathy, renal disease, heart disease and other complications such as amputation. It is treatable and preventable. Important modifiable risk factors are obesity, diet and lack of physical activity.

Reason to include this particular indicator To encourage better collection of the primary data to give more accurate estimates of disease prevalence. To monitor diabetes prevalence. To emphasise the burden of disease. To encourage preventative action.

impact on the health of the population, but also because it is:

- **valid –** it measures what it says it measures
- **meaningful –** it allows comparison of time, place and or people
- **possible to communicate –** to a wide audience.

Policy relevance Diabetes National Service Framework.

Interpretation: What a high / low level of the indicator value means A high value can indicate genuinely high prevalence and/or better detection and recording. Conversely a low value may indicate genuinely low prevalence or poor detection and recording. There is some evidence (by comparing QOF data between 2004-5 and 2005-6), of all these i.e. there were large increases in prevalence in some practice and slight falls in others, though the national average increased marginally and most practices had reasonably stable estimates suggesting that by and large recording rates had stabilised. In many areas the levels of recorded diabetes were close to those predicted by the PBS model i.e. we believe the indicator to be a good estimate of actual prevalence. (See the PBS diabetes prevalence model http://www.yhpho.org.uk/viewResource.aspx?id=7).

Interpretation: Potential for error due to the measurement method See above. Also because recording is rewarded through QOF points there may be potential for "gaming". There are a large number of codes used to record diabetes on GP systems which may lead to counting errors depending on how the data is extracted (see the QOF definitions for the codes used). There may also be potential biases in the attribution of practice populations to local authority areas but these are probably small.

Interpretation: Potential for error due to bias and confounding There may be under-sampling of young people, ethnic populations and other vulnerable groups e.g. the homeless and travellers in the numerator.

Confidence intervals: Definition and purpose A confidence interval is a range of values that is normally used to describe the uncertainty around a point estimate of a quantity, for example, a mortality rate. This uncertainty arises as factors influencing the indicator which are subject to chance occurrences that are inherent in the world around us. These occurrences result in random fluctuations in the indicator value between different areas and time periods. In the case of indicators based on a sample of the population, uncertainty also arises from random differences between the sample and the population itself. The stated value should therefore be considered as only an estimate of the true or 'underlying' value. Confidence intervals quantify the uncertainty in this estimate and, generally speaking, describe how different the point estimate could have been if the underlying conditions stayed the same, but chance had led to a different set of data. The wider the confidence interval the greater the uncertainty in the estimate.

Confidence intervals are given with a stated probability level. In Health Profiles 2007 this is 95%, and so it is said that there is a 95% probability that the interval covers the true value. The use of 95% is arbitrary but is conventional practice in medicine and public health. The confidence intervals have also been used to make comparisons against the national value. For this purpose the national value has been treated as an exact reference value rather than as an estimate and, under these conditions, the interval can be used to test whether the value is statistically significantly different to the national. If the interval includes the national value, the difference is not statistically significant and the value is shown on the health summary chart with a white symbol. If the interval does not include the national value, the difference is statistically significant and the value is shown on the health summary chart with a red or amber symbol depending on whether it is worse or better than the national value respectively.

The mission of the NHS Institute for Innovation and Improvement is to support the NHS and its workforce in accelerating the delivery of world-class health and healthcare for patients and public by encouraging innovation and developing capability at the frontline.

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The Association of Public Health Observatories - Better information, better decisions, better health.

The Association of Public Health Observatories (APHO) represents and co-ordinates the work of 12 Public Health Observatories (PHOs) working across the five nations of England, Scotland, Wales, Northern Ireland and the Republic of Ireland. APHO ensures effective joint working across the PHOs to deliver information and intelligence on people's health and health care for practitioners, policy makers and the public. Its high quality public health intelligence informs health policy and decision making at national level.

PHOs work in partnership with governments, health, academic and commercial organisations from local to national level. They have a lead role in key policy areas to:

* develop expertise and in-depth knowledge
* publicise significant work
* provide a single point of contact and information source
* develop training programmes for health intelligence staff and
  other practitioners

Further information can be found at: www.apho.org.uk