

## Value

*'In an attempt to arrive at the truth, I have applied everywhere for information but in scarcely an instance have I been able to obtain hospital records fit for any purpose of comparison. If they could be obtained they would enable us to answer many questions. They would show subscribers how their money was being spent, what amount of good was really being done with it or whether the money was not doing more mischief than good...*

[Florence Nightingale Notes on Hospitals 1863](#)

*"... the Trustees of our Charitable hospitals do not consider it their duty to see that good results are obtained in the treatment of their patients. They see to it that their financial accounts are audited but they take no inventory of the Product for which their money is expended.*

[Codman E.A. A study in hospital efficiency 1918](#)

*In health care, the overarching goal for providers, as well as for every other stakeholder, must be improving value for patients, where value is defined as the health outcomes achieved that matter to patients relative to the cost of achieving those outcomes. Improving value requires either improving one or more outcomes without raising costs or lowering costs without compromising outcomes, or both. Failure to improve value means, well, failure.*

[Porter M.E. and Lee T. 2013](#)

If she were still with us today Florence Nightingale would be surprised, and given her activist proclivities and many other achievements, <sup>1</sup> probably rather vexed, to learn that a century and a half later many, probably most, hospitals around the world still do not have records fit for the purpose she had in mind, - to measure the value of their services by linking outcomes with costs. So too would be [Ernest Codman](#) a Boston surgeon who over a century ago precisely documented the outcomes of all his operations including all the complications, and who was so perturbed by the failure of his colleagues to do the same and by the failure of hospitals to make this mandatory, that he set up his own "End results" hospital. He was not shy in his criticisms and unsurprisingly this endeared him to neither his colleagues nor the hospitals of the day. His career went into a steep decline and his ideas went into hibernation for nearly a century.

In the last decade or so however there has been some faltering progress towards the linking of outcomes and costs in 'value-based' healthcare' (VBHC) which raises three questions:

- why has it taken so long to take up the Nightingale/Codman challenges ?
- what has stimulated the recent interest and activity ?
- how does knowing any of this help in the implementation of VBHC ?

## Why the long delay ?

There have been four noteworthy constraints all of which have arisen, as they so often do in human affairs, from the unforeseen consequences of good intentions

### 1. Ethos and ethics

In healthcare in general and in large hospitals in particular there is often a conflict between economic value and human values – between what *can* be done within the limits of available resources and what we feel *should* be done. These human values arise from both traditional medical ethics and from the desire in the wider community to help those afflicted by illness or injury who cannot help themselves because of poverty or some other disadvantage.

These admirable moral principles have been implemented in practice over the centuries by religious orders and charitable organisations and are embedded in the ethos of most public hospitals such as [St Bartholomew's and St Thomas'](#) in London, both of which were founded by Augustinian monks in 12<sup>th</sup> and 13<sup>th</sup> centuries. The same ethos lies at the heart of many national health systems that provide, through collective funding from taxation or insurance, services that would otherwise be beyond the financial resources of any one individual.

The resultant conflict between economic and ethical forces comes in several shapes and sizes, but in the current context, clinicians moving into management often find it difficult to reconcile their professional obligation to optimise the care of the individual patient with the competing needs as managers to deliver these resources more equitably and cost-effectively across populations.

These tensions and how they are viewed differently by different hospital staff groups were well illustrated in [a study](#) of their attitudes to financial accountability and standardised processes of care. As shown in this simplified version of the [figure](#) from this paper, doctors and nurses working as clinicians or as managers and general non-clinical managers are clearly marching to very different drummers. This is not surprising given their respective roles and responsibilities, but these differences have to be accommodated in any system of VBHC as they can become acute through recourse to the '[rule of rescue](#)' that runs deep in most humans even where continuation of care seems [futile](#) to those involved as decision makers or observers.

### 2. Evidence based practice

The randomised controlled trial (RCT) is rightly viewed as a key weapon in the armamentarium of evidence based medical practice. This is because it provides a powerful way to determine with measurable confidence whether a drug or other intervention is better than nothing or than some alternative. It does however require at least two groups of patients carefully matched in age, sex, disease severity etc to test for differences that are then only attributable, at least in theory, to the intervention in question. This is essential for the type of frequentist statistical analysis needed to prove

or disprove the null hypothesis and to assess the significance of any differences in outcomes.

The problem of course is that such narrowly defined short term studies [may be necessary but are insufficient as guides](#) for the untidy, uncontrolled and often uncontrollable long term world of routine clinical practice. This is because of their [limited external validity](#) due to the infinite variety and [multiple pathologies](#) of unselected patients.

Nor are RCT's of any use for the long-term tracking of outcomes and costs needed for routine service management including VBHC. Fortunately there are very suitable though less often used methods of collecting and analysing 'practice-based' evidence to complement and extend the reach of 'evidence based' practice, most notably [Bayesian analysis](#) and [statistical process control](#). (SPC)

Bayes theorem is well suited to the generation of practice-based evidence as it [closely mirrors the thought processes of clinicians](#). This is because it helps them to quantify and track the levels of probability as these change from a *prior* status derived from a combination of their previous knowledge and experience, and from the initial history and physical examination to a revised *posterior* status as new information becomes available from the results of laboratory and other investigations and from the effects of treatment.

In the past there have been lively and occasionally acrimonious arguments between Bayesians and frequentists about statistical philosophies and methodologies with Bayesians gaining some ground in recent years in [both in general](#) and [in medicine](#). Also, although frequentism has traditionally dominated the analysis of RCT's it has been shown that [Bayesian methods can also be used](#).

SPC has a long and well proven track record in monitoring industrial processes to maintain production within specified limits in the quality of goods and services. It does so by distinguishing 'common cause' from 'special cause' variation through control chart methodologies developed in the 1920's by the [Walter Shewhart](#) and later promoted and taught by [William Deming](#). Over the next half century or so these methods were enthusiastically adopted in many industries, but not so much in healthcare, except in pathology laboratories where it is used for quality control. This is despite the need to address the [problems of variation](#) in medicine or which SPC is well suited, and persuasive arguments in favour of following in Shewhart's footsteps for both [generic](#) and [specific](#) reasons.

Over the last couple of decades however there has been a slow but steady increase in the use of SPC as documented in a practical [overview](#) and a detailed [metanalysis](#). Such reviews provide useful taxonomies of the wide variety of possible applications, but sometimes closer inspection of a single publication can be more instructive and memorable.

A good example is [a study](#) of the use of one form of SPC to show that the increased mortality rates in two very different groups of patients in the UK were due to special

cause variation. In the first case the patients were all children who had undergone cardiac surgery in the Bristol Royal Infirmary (BRI), and in the second they were all patients of a single general practitioner. In first case after a lengthy and detailed [commission of inquiry](#) costing around £15M it was concluded that outcomes for this type of surgery were substandard and that 30 deaths may have been preventable had the children been treated elsewhere.

In second, after another even more extensive and expensive [inquiry](#) costing around £21M, it was concluded that at least 215 patients had been murdered by their GP Harold Shipman.

The importance of this study is that it clearly demonstrated that the use of SPC would have shown [highly significant excess mortality](#) many years before they became even more painfully obvious by other routes. At the BRI such analyses might also have strengthened the hand of the anaesthetist [Stephen Bolsin](#) who had tried in vain to draw attention to his well justified belief that the mortality rates were excessive.

This power of SPC in tracking performance has been best recognised and exploited, probably not surprisingly, [by cardiac surgeons](#) although for some [their interest predated the BRI events](#). Also, the benefit of using SPC to track *lead* indicators such as the acquisition of clinician technical skills rather than the *lag* indicators of adverse events as the result a lack of such skills, has been demonstrated, again not surprisingly, by [Dr Bolsin and his colleagues](#) as well as by [others](#).

The message then is clear, - SPC deserves to be more widely used in both the routine monitoring of clinical performance and in measuring outcomes and costs for VBHC

### 3. [Activity based funding](#)

This seemed a good idea at the time. The time was the late 1970's, the place was the USA, and the problem was the remorseless rise in the costs of healthcare especially in hospitals.<sup>2</sup> This problem was not unique to the USA but was [bigger and growing faster](#) than elsewhere, both in absolute amounts and as a proportion of GDP. An estimate of trends in this metric by [US Congressional Budget Office](#) in 2007 predicted that by 2082 healthcare could at least in theory consume all of the GDP.

The solution seemed logical enough - just [change the funding model](#) from the traditional practice of paying hospitals what they were paid last year with a top up for growth and inflation, to one determined by the volume and complexity of the services provided. This was and still is determined by the number of patients in various diagnostic groups (DRGs) adjusted for disease severity and with fees for specific services. Other countries soon followed suit with similar casemix classification and funding models [including Australia](#).

This change did achieve one of its presumed objectives - a shift in control from the providers to government purchasers of services but didn't seem to do much to slow down the rate of cost increases. It also left in its wake the unhappy side effect of encouraging activity in *outputs* in the form of volumes of services, rather than in the *outcomes* that patients seek, - resolution of their problems. As a result of these and

other concerns, and as outlined below, several countries are now [moving away from activity based](#) funding and towards VBHC, a trend accelerated by a [shift in policy in the USA](#).

The management aphorism of ‘what gets measured gets managed’ is true enough as far as it goes but it should be expanded, especially in fee for service or DRG episodes of care funded healthcare systems, to include ‘what gets funded gets done.’

#### 4. Rational ignorance

Another cause of the slow uptake of VBHC arises where costs are completely or mostly covered by state or private insurance is that this leaves both the patient and the clinician unaware of the full costs of the care provided and with no great motivation to find out.

This is known to economists and political scientists as ‘rational ignorance,’ - a state of mind where the energy that must be expended in the search for information is not justified by the rewards of enlightenment. This is in stark contrast with the situation in countries where patients carry all or a much higher proportion of healthcare costs which leads to very different perceptions of the meaning of value. This was illustrated in [a survey](#) in the USA where “Out of pocket costs affordability” was ranked higher by 45% patient, well above “My health improves” at 32%. These system-driven differences in patient perceptions of the meanings of value need to be accommodated in the definition and measurement of VBHC.

### **Why now ?**

The inflection point for the recent resurgence in interest in VBHC seems to have been an oft-cited [book](#) published in 2006 by Michael Porter and Elizabeth Weinberg that probably also played a part in the 2016 decision [to shift USA Medicare payments](#) towards a VBHC model. If so, it is because it provides a comprehensive account of the deep-seated problems of the health care system in the USA; the reasons why various attempts to resolve them have failed; and what could and should be done about them. Some of the content of this book is only relevant to the USA, but most of the problems and solutions are global in incidence and importance. Some of these are well known but not always well managed, others are less well known and therefore even more of a challenge. They are best considered in two groups:

#### 1. Costs and quality

The two main world-wide problems driving the move to VBHC are well known - costs that are uncomfortably high and rising, and quality of care outcomes that are often uncomfortably low. The quality issues have been neatly encompassed as the [‘60:30:10’ challenge](#) - only around 60% of patients receive the care for which there is good evidence that they would benefit; 30% of costs are attributable to waste including the use of interventions for which there is little or no evidence of benefit; and 10 % of patients that suffer some sort of adverse event. For both costs and quality there are four important metrics that need to be accommodated in the design and implementation of any VBHC initiative:

*a. Unjustified variations*

There are significant unjustified variations from place to place in both costs and outcomes that have been well known since the pioneering work of [John Wennberg](#) half a century ago.<sup>3</sup> These have been comprehensively documented in atlases published in the [USA](#), [Australia](#), [UK](#). These variations are widespread and often substantial but have been strangely neglected as obvious targets for any improvement process including VBHC<sup>4</sup>. If one hospital or clinical service, or clinician is getting better outcomes and/or getting them at a lower cost than others, then it is important know how this was achieved and if this expertise could be applied elsewhere. The savings in healthcare costs that would accrue just from replication elsewhere of the results delivered by the best performing hospitals or jurisdictions can be of the order of billions of dollars as evidenced by studies in both the [USA](#) and [Australia](#)

*b. Low value clinical practice*

Rather more attention seems to have been paid to the overuse of some types of healthcare considered as being of low value because of an insubstantial evidence base as defined in physician consensus initiatives such as the [Choosing Wisely](#) program. Investigations in both the [USA](#) and [Australia](#) have used national casemix data sets for this purposes as these have the obvious advantage of being both very large and readily available, and interventions in this arena have [shown a modest decrease](#) in the use of one or two categories of low value care.

The disadvantage of this approach is that it only provides a top-down macroeconomic view of a limited set of the *processes* but not of the *outcomes* of care. It also presents physicians with a number of [cognitive](#) and [practical](#) challenges. As outlined below however, some microeconomic bottom-up systems of measuring outcomes and costs are now beginning to emerge that start at the level of groups of individual patients and clinicians. These are promising not least because they seem to be more enthusiastically endorsed and used by clinicians probably because results are more rapidly available and more obviously relevant to their daily clinical practice

*c. Falling value*

The evidence for this is both ancient and modern. The ancient data set even predates Florence Nightingale's criticism of hospital governance which might have been mellowed had she been able to cross the Atlantic to visit the Massachusetts General Hospital where, ever since 1821, they have been, assiduously counting the daily death rates and costs. However, no one seems to have thought it of interest to plot these two variables together on the same time axis and make

them known to the world until [Meyers and colleagues](#) did so in 2012.<sup>5</sup> The figure in this paper gives [a clear and fascinating illustration](#) of the trends in deaths and costs over these two centuries. The erratic mortality fluctuations in the 19<sup>th</sup> century were presumably due to recurrent epidemics, and the steady decline in the 20<sup>th</sup> century due in part to advances in medical science, and in part to the prevention of infections in the community and better management of the social determinants of ill health.

Equally clear from this graph however, and of relevance to drivers of VBHC initiatives, is the steep rise in costs over the last 70 years. This is mainly due to the added expenses of the medical advances that have changed the results of the value equation as defined by the death rate per unit cost. This can be demonstrated by roughly transcribing the numbers from these two curves and [replotting them as a value index](#), a variable that clearly shows a steady decline over this period of observation.

In more recent times [increasing life expectancy](#) has been noted in several countries between 1960 and 2009 but predicably at the cost of a higher proportion of GDP. This allows a rough calculation of value defined as the life expectancy gained from all causes per unit of GDP, which, as shown [here](#), has fallen. Similar patterns have been observed in the gains in life expectancy over a similar period [attributable to medical interventions](#) for which costs per unit gain have [increased](#) ie value has fallen, especially in older age groups

#### *d. Low or no outcome/cost correlations*

A striking [example](#) of a lack of any correlation between costs and outcomes can be seen in [a graph](#) that plots the cost of care for similar sets of patients in some USA hospitals against the hospital standardised mortality (HSMR). The correlation coefficient was shown to be zero and the variation from lowest to highest values on both axes to be about 400%. This type of analysis does not seem to have been widely replicated possibly because of doubts about the [validity of the HSMR](#) when used as a ranking tool, but the lack of any correlation between the deaths in any well-defined set of diagnostic categories and the relevant costs of care together with such gross variation between the best and the worst performances is disconcerting. Other studies have also failed to find significant positive relationships between regional USA Medicare spending on a few specified DRGs in the [quality and outcomes of care](#) or with [patient satisfaction](#) or in similar studies at a [hospital level](#). Another [USA study](#) found a negative correlation between Medicare spending and quality of care, and noted a beneficial effect in regions with higher general practitioner to specialist ratios.



e. *Widening perspectives and priorities*

Kenneth Arrow is reckoned to be one of the founding fathers of health economics as evidenced by his much cited [1963 paper](#) in which he explored the distortions of normal market forces by the peculiarities of the healthcare industry, most notably included high levels of uncertainty and the asymmetry between the information available to patients in comparison with the larger stocks held by physicians.

There is however another important asymmetry that he seemed to overlook: - the information held exclusively by the patient about the size and shape of their problems and about the effectiveness of the healthcare systems in resolving them. This is now being redressed by increasing [measurement and reporting](#) by patients of both the outcomes - (PROMS) and the experiences of their interactions with the healthcare system (PREMS). Obviously, no assessment of the value of health care can be complete without these two dimensions of patient opinion, but there are other important reasons for their use. These include evidence that there is often a [mismatch](#) between the importance attributed by doctors and patients to various aspects of disability in chronic disease, and that the use of PROMS [increase the chances of discovering](#) symptoms and adverse events that would otherwise go undetected. Also, despite some [early variable levels of enthusiasm](#), doctors often come to welcome the extra information provided by PROMS in both [improving patient care communications and in saving them time](#) in consultations.

Arrow's other healthcare market distorting force, the high level of uncertainty, is a very [real part of clinical practice](#) and is increasing, paradoxically related in part to advances in medical knowledge as discussed below.

2. The inescapable consequences of large numbers

The rapid increase over the last few decades in the number of diagnostic and therapeutic innovations and of the numbers of medical specialists and other staff needed to deliver these services has had several [linear and non-linear](#) consequences which are often difficult to [understand and manage](#). Some of these are well known, others less so:

a. *The cumulative risks of error*

As care processes become more complex and multidisciplinary they usually become lengthier and multi-staged which [increases the cumulative risks of errors](#) and adverse events. This is [well known in industry](#) where [the risk of error rises](#) in proportion to the complexity of the process and the time on the production line. So too in critical care units where in [one study](#) the chance of an adverse event rose by about 6% every day.



The important and often overlooked consequence of this inescapable arithmetic is that if we keep increasing the complexity of healthcare to gain the advantages of advances in biomedical science, as we should and will, then the reduction of the 10% to zero in the '[60:30:10 challenge](#)' will always elude us. This is because novel errors and misadventures will constantly emerge to replace or add to the list of the old ones that we have slowly painfully learned how to avoid. But as [Amy Edmondson has persuasively advocated](#) the pathogenesis of failure should be ranked at some point along a [spectrum](#) that extends from praiseworthy experimentation to blameworthy transgression. The vital metrics therefore include not just the total error rate but more importantly the ratio of misdemeanours to mishaps, of well-known to novel problems, and of the effective to ineffective organisational responses to all types of aberration.

*b. The diminishing returns of increasing complexity*

The rise and fall of ancient civilisations may seem far removed from the forces nudging the healthcare industry towards the measurement and management of value, but not so, as shown by the archaeologist and historian Joseph Tainter in his [disconcertingly instructive book](#), or in a more [concise journal article](#). He points out that an increase in complexity is a common human response that gives solutions that may [work well in the short term](#) but a [point of diminishing returns](#) is often reached whether on the grand scale of Minoan or Mayan civilisations or in the knowledge-rich modern industries of education, research and healthcare. The graph of the progressive [reduction in productivity in healthcare](#) in the USA between 1930 and 1980 is particularly striking and is reminiscent of other evidence of declining value as noted above.

*c. The increasing chances of interactions*

The number of possible interactions among any entities including humans, rises up an [increasingly steep curve](#). If 10 staff are involved in the care of a patient, they must manage not 10 inter-relationships and communication channels but up to 45. In the real world the numbers are much larger, often in the hundreds. [One study](#) of communication channels in a hospital shows [just how complex these webs can be](#). So too with the risks of potentially harmful interactions when several drugs are given at the same time.

These types of interactivity can also [generate complex adaptive systems](#) that have unexpected emergent properties that can be especially [difficult to understand](#) and manage. This [large and important topic](#) has many implications for VBHC which are beyond the scope of this account, except as discussed below, in the matter of prioritising potential applications.

#### d. *Bounded rationality*

In 1969 the polymath Herbert Simon was awarded the [Nobel prize in economics](#) for arguing convincingly for what seemed in hindsight, as is so often the case with bright ideas, to be both simple and obvious. At that time the dominant 'classical' theory among economists was that humans decide how to acquire and use money and other resources through a rational process of finding and using *all* available and relevant information to enable them to arrive at an *optimal* decision. Simon argued that humans cannot possibly either acquire or use the massive amounts of often uncertain information necessary and must therefore compromise by making *satisfactory* rather than optimal decisions.

We are also all prone to a host of environmental, psychological, and social constraints which combine with structural and situational uncertainty to generate states of mind identified by Simon as '[bounded rationality](#)'. This has given rise to a whole new science of behavioural economics, a field in which one of the leading investigators Daniel Kahneman also received a Nobel prize, an [award in which he acknowledged](#) the foundational nature of Simon's contributions. Kahneman has more recently produced a very readable popular science account of his lifetime's work in unravelling the [different ways of thinking](#) about issues and problems and how these can be distort our conclusions about the world around us. The significance of this for VBHC is that the rapid increase in medical knowledge has generated new subdivisions of medical specialists who have to bound their rationality within ever deeper but narrower domains of expertise. So too in the consequential growth of management domains and ideas.

#### **How does any of this help ?**

If the evidence and arguments presented above are accepted, then three organising principles emerge that should underpin any VBHC implementation:

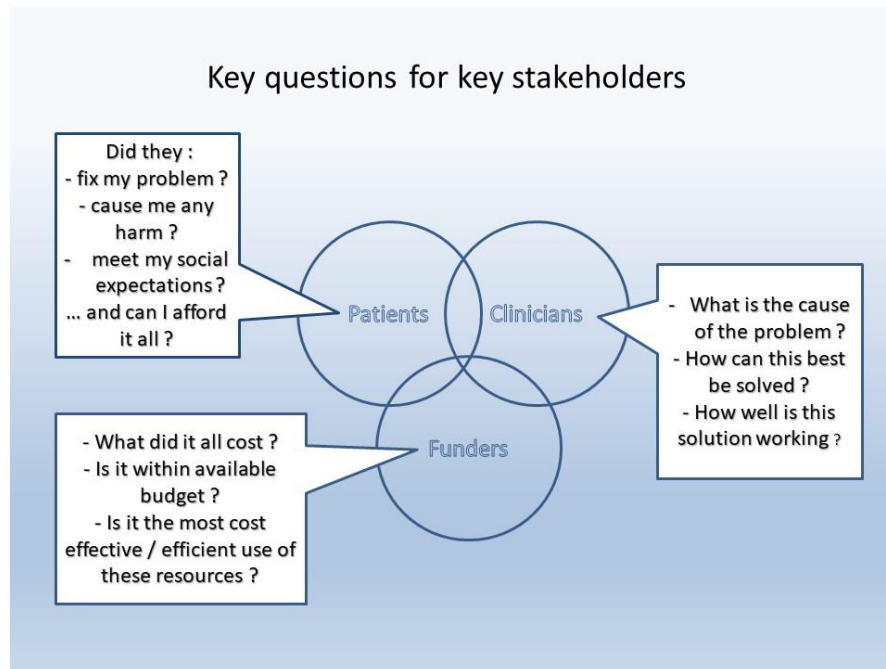
##### 1. Asking the right questions

The idea of just what is meant by VBHC [varies widely amongst all those involved](#), and the importance of accommodating these different perspectives has been well stated:

*'In any field, improving performance and accountability depends on having a shared goal that unites the interests and activities of all stakeholders. In health care, however, stakeholders have myriad, often conflicting goals, including access to services, profitability, high quality, cost containment, safety, convenience, patient-centeredness, and satisfaction. Lack of clarity about goals has led to divergent approaches, gaming of the system, and slow progress in performance improvement.'*

[Porter ME 2010](#)

These different and often conflicting interests and priorities especially those of three key stakeholders, - patients, clinicians, and funders can however be crystallised in a few key questions:



This simple model makes it clear that the central task is to clarify and quantify the problems to be solved in a way that accommodates the different perceptions and often conflicting priorities of the three key stakeholders. In short, data collection and integration for VBHC should be problem oriented.

This is hardly a novel concept in medicine, but the best known precursor is the 'problem oriented medical record' as [developed by Lawrence Weed](#) and as encapsulated in the SOAP acronym. This was meant to systematise and better document the sequence of a physician's thought processes as they went from the patient's symptoms or Subjective information through Objective findings on examination or investigation and thence to the diagnosis or Assessment and culminating in treatment as part of a Plan. This was logical and useful as far as it went but gave no explicit recognition to the need to record outcomes.

Acronyms are useful as shorthand in glossaries, but more so if they capture conceptual as well as literal meaning as does SOAP, and best of all if they roll easily off the tongue and thus help spread an idea by word of mouth. The glossarists have given us VBHC which has little aural charm, but 'PROMs' and 'PREMs' should be joined by 'CROMs' and 'FROMs' This would focus attention on the need to integrate the measurement of the outcomes and experiences that matter most to the patient with those that must also be considered by, and that constrain the actions of, clinicians and funders.

Despite the impeccable logic of the SOAP sequence the problem-oriented medical record as envisaged and promoted by Weed failed to gain long term traction for two reasons: - one obvious, the other less so, and both are relevant to the implementation of VBHC.

The obvious one was the requirement for data entry via complex, highly structured and time-consuming paper charts. These were probably intended to not only to reinforce the concept but to ease the path to computer data processing. Unfortunately, this idea was ahead of its time for the digital technology of the day. The technology has since advanced considerably but less so the ability of healthcare organisations to apply seemingly simple computerised solutions to complex human problems. VBHC will require substantial data processing support, but this needs to be carefully designed to answer the right questions.

The less obvious one was the implication, probably unintended, that the ‘subjective’ and ‘objective’ descriptors of the problem were intended to reflect the patient account and doctor assessments respectively. Given that the dictionary definition of subjective is: - *‘influenced by or based on personal beliefs or feelings, rather than based on facts’*, the consequent misinterpretation was understandable.

There are indeed important differences between patient and doctor perceptions of the nature of the healthcare problem of mutual concern, but they related not to so much to subjectivity and objectivity but to the priorities and practicalities that determine the ways in which solutions are found.

This has been well illustrated in a study of [how the medical record is used](#) not just as a journal of events but as a part of an active process by which doctors reformulate patients problems and make decisions to fit within the bounds of possibility as determined by their abilities and expertise and by the resources available to them.

This task of reformulation increases in difficulty in proportion to the complexity <sup>6</sup> of the patients’ problems and this in turn increase the difficulty of measuring global value from its component parts.

	<b>Low complexity</b>	<b>High complexity</b>
Number of component parts of the problem	Few	Many
Levels of uncertainty about diagnosis and treatment	Low	High
Patient-doctor agreement about priorities and actions	High	Low
Responsibility for care	Single clinician or small team	Fragmented across many specialties
Chance of unexpected emergent properties	Low	High
Examples	Elective procedures Single bone fracture	Multi-system disease in the frail elderly

It is therefore advisable to start VBHC programs at the lower end of the problem complexity spectrum where patient and doctor perceptions of value are more likely to be concentric, solutions are better known, and success can be more readily distinguished from failure.

## 2. Finding the right answers

Wherever the problem sits on the complexity spectrum, finding answers to these questions is rarely easy as the key data sets in most hospitals are widely scattered and are either not routinely collected or not easily quantifiable:

Dimension	Question	Sources	Format
Attribution	- What was the problem?	P,C	2
	- What was the diagnosis ?	C,CM	2,1
	- Was this interpretation correct ?	C	3
Intervention	- Investigations and treatments used ?	C,CM	2,1
	- Were they appropriate?	C	3
Resolution	How well were the problems resolved?	P,C	2
Safety	Was any harm caused?	P,C	2
Quality	What were the patient experiences of care?	P	2
Cost	What where the relevant costs ?	F	1
Value	Did the outcomes/unit cost = best use of available funds?	N	3

### Legend

C:Clinician opinion, CM Casemix extracted data set P:Patient opinion, F:Financial systems, N:New integrated calculation needed

1: Routinely collected as a digitally accessible entity; 2 - Only accessible as text from chart review or from retrospective sample surveys. 3 - Not asked routinely, or only collected in response to 'forensic' inquiry.

Ideally this morass of disconnected data would be reorganised for VBHC, or for that matter for any electronic health record, in the natural sequence of clinical practice:

Problem → Diagnosis → Treatment → Outcome

.. with costs accounting for each stage. This would replace, or rather supplement, the casemix juggernaut which currently dominates the centre ground of performance measurement based on diagnoses services and global costs.

This is no small task, but it can be eased by starting with some obvious low hanging fruit that can be identified by five characteristics:

*a. Low complexity*

For reasons explained above, it is advisable to road test VBHC systems by starting at the low complexity end of the spectrum of ill-health. This would ideally include elective surgery or other established interventions where both the nature of the problem and the likely solutions are well known and there is more likely to be agreement about the value of a clear and measurable outcome.

*b. High variability*

Also as discussed above, large variations in outcomes and costs are frequently seen in different clinical services treating the same disease processes in similar patients. These provide obvious target for early VBHC interventions.

*c. Amenability*

Variation can have many causes but a high priority for VBHC should be those that are due to a [failure to use evidence based best practice](#). This includes the ultimate loss of value, death, as *'amenable mortality'* has been shown to be [useful indicator of the performance of healthcare systems](#) in international comparisons.

This raises two important issues relating to the choice of any measurement of health system performance both in general and in VBHC in particular.

The *first* is the need to measure both the processes and the outcomes of clinical practice in conjunction with each other for both logical and arithmetic reasons:

- The logic is simple and obvious - unless the use or non-use of evidence based best practice can be linked with outcomes then assessing and managing performance and value will be ineffective
- The arithmetic is a matter of ratios - if the numerator eg mortality is small as it usually is in comparison with the denominator of the many patients treated, then evidence based best practice process aberrations will be detectable as lead indicators long before the lag indicators of death rates will raise alarm. This has been exemplified in [the management of myocardial infarction](#).

The *second* is the importance of only closely scrutinising outcomes over which there is good evidence that clinicians and other staff have some process control:

*'If the person or organisation whose performance is being measured feels powerless to influence the indicator, inappropriate measurement can also lead to demotivation, dysfunction, and crisis.'*

[Pringle et al 2002](#)

#### *d. Specificity*

Patient outcome reported measures (PROMS) come in [two varieties - generic and specific](#). Both are important but the specific measurements are the lower hanging fruit as they can be more readily implemented and interpreted by both patients and doctors, especially in low complexity elective type procedures. The [three categories of generic indicators](#)- physical, social and mental are admirably comprehensive and are useful for broad population 'wholesale' studies, but less so for providing more immediate assessment and management of the individual problems of 'retail' clinical practice. In the early days of VBHC it is the hearts and minds of the patients and clinicians that first need to be engaged, and if the microeconomic foundations are well measured and managed then the macroeconomics can only benefit.

#### *e. Demonstrable effectiveness*

If the central challenge in VBHC is to collect and integrate information about outcomes as perceived by patients, clinicians and funders, then it is sensible to follow in the footsteps of those who have succeeded in one or more of these areas. There are three noteworthy examples:

- Since 2009 patients undergoing hip and knee replacement in the UK NHS have recorded the severity of their symptoms before and six weeks after surgery and this has generated a [large trove of data about the effectiveness](#) of these operations and the incidence of adverse events. This program has provided invaluable data for the purpose of comparing the outcomes of different operations and in different places.
- In 2016 the University of Utah Health Sciences Center reported the development of a "Value Driven Outcomes" program that had contributed to significantly to [reduced costs and improved outcomes](#). The significance of this important innovation and how it was achieved is considered in more detail below
- Patient undergoing outpatient chemotherapy at Sloan-Kettering in New York have been shown to be [willing and able to collect PROM data online](#) and controlled trials of this methodology have shown [improved effectiveness and efficiency](#) of clinical practice monitored and managed with the aid of this type of technology.

### 3. Providing the right feedback

Once the key data sets are available the next step in VBHC is timely reporting and meaningful display of cost-outcomes matrices disaggregated down to a patient and provider level. This may seem a tall order but it was achieved several years ago as shown in the figures in the report of the [systems used in Utah](#), and elsewhere as in



[the graphic](#) displays shown by [Stowell et al.](#) Radar charts have also been used as an alternative way to [compare the costs and outcomes](#) of different forms of intervention for prostate cancer.

As well as costs and outcomes plotted one against the other, two other variables need to be included: - time trends and likely effect size. The first can be accommodated as advocated above by statistical process control analysis, the second by representation in the dimension of the point identifier on the graphic display. A persuasive demonstration of the power of showing the dynamics of such time and effect size variables can be seen in a [video by Hans Rosling](#) of international trends in various economic social and health service indicators over the last few decades.

### **Key points and possibilities**

Much of this review has been necessarily occupied by the patho-physiology of VBHC - about why it has taken so long to pick up the gauntlets thrown down by Florence Nightingale and Ernest Codman; why the need to link costs and outcomes has recently become increasingly urgent; why the arguments presented by Michael [Porter and colleagues](#) have resonated in health services around the world, and what are the constraints, often unrecognised that have to be overcome or bypassed.

However, the fine details of all this are probably mostly of interest to organisational pathologists, and hard-pressed clinicians and managers are more likely to need a short check list of the key requirements for measuring and optimising value. This list would most notably include:

- the selection of high priority targets by identifying disorders with high costs and/or poor outcomes and with high levels of variation among providers.
- the development of integrated patient and clinician assessments of outcomes.
- the allocation costs down to the level of the individual components of the services provided.
- the development of an integrated information system that displays key datasets from these diverse sources in simple graphics as soon as possible after they are generated.
- unequivocal and active executive involvement and commitment in design, implementation, operational support and promotion of all these systems.

This may seem a tall order, but as noted above it seems to have been admirably filled in work on VBHC at the University of Utah Health Sciences Center. This is apparent in both the development of an impressive [ITM platform](#) for measuring and reporting costs and outcomes, and in the use of this platform to demonstrate increased value through [improved effectiveness and efficiency](#) in a wide range of disorders. The latter publication was very reasonably lauded in an accompanying editorial by [Porter and Lee](#), especially the development of the 'opportunity index' as a means of selecting target areas, and the progress made towards an effective system of cost accounting.

As might be expected the [main Utah publication](#) has attracted significant interest with over 300 citations in the 8 years since publication, but on a relatively superficial inspection most seem to have only referenced it as part of reviews of the field or in narrower specialist domains. In only one instance however, [in Singapore](#) does there seem to have been an attempt to replicate an organisation- wide implementation.

Some Utah specialist eg [neurosurgeons](#) and [cardiac surgeons](#) have reported their continued use of the data base to examine their service costs and outcomes. This would suggest that once primed with a well-designed ITM system and high level executive support, clinicians will continue to explore ways to increase the value of the services they provide.

**Michael Ward**

**29/07/24**

## Notes

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<sup>1</sup> As is generally [well known](#) Florence Nightingale recruited, trained, and led a small band of women in the military hospitals treating soldiers wounded in the 19<sup>th</sup> century Crimean War. This pioneering enterprise subsequently became the model of what professional nursing should look like. She achieved this through her diplomacy and lobbying skills in speaking truth to power, whether in persuading the secretary for war Sir Sydney Herbert back in London to supply the essential material resources, or in nudging sceptical and/or over-burdened medical officers in the Crimea towards more effective methods of infection control.

Less well known is that she substantially enhanced the power of her leadership and interpersonal skills with innovative analytical methods that made her arguments difficult if not impossible to ignore. This can clearly be seen in the ‘polar’ or [‘coxcomb diagram’](#) that she devised and used to summarise the causes of death of soldiers in the Crimea.

In its original format it is not easy to interpret, but by roughly converting the areas on the diagram into numbers and replotting them in a more familiar and modern style of a linear histogram, [the message becomes very clear](#). This is simply that the death rates from ‘zymotic diseases’ – infections that were both dangerous and easily transmissible such as typhus, typhoid, and cholera, were many times higher than that from battle wounds and that she could dramatically reduce this mortality by insistence on simple hygienic precautions and other infection control measures.

On the strength of this and other analytical accomplishments she was to become the first female member of the Royal Statistical Society. This recognition would have had the support of the statistician [William Farr](#), one of the founding fathers of epidemiology and a long term [colleague adviser and admirer of her work](#). The ‘lady with the lamp’ thus not only illuminated and comforted her patients by night but also shed much needed scientific light by day on the outcomes of clinical practices and how to improve them. She was also the first female recipient of the Order of Merit.

After she returned from the Crimea, she set to work to introduce into UK civilian hospitals the same changes that had she had used to reduce the mortality on the battlefield. To this end she clearly understood the epidemiological significance and interventional importance of measuring and managing unjustified variations:

*‘These methods if generally used would enable us to ascertain the relative mortality of different hospitals as well of different diseases at the same and different ages, the relative frequency of different diseases and injuries, among the classes that enter hospitals in different countries and in different districts of the same country.’*

[Florence Nightingale: Notes on Hospitals 1863](#)

In short, she identified the key principles of the process of improvement in any organisation and implemented them in practice well before Walter Shewart and William Deming formalised them in the [PDSA cycle](#) in the next century.

It could well be argued that her contributions were as important in reshaping clinical practice by controlling infections in hospitals, as those of the more famous actions of [John Snow](#) in reshaping public health by controlling an outbreak of cholera by removing the handle of Broad Street pump.

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<sup>2</sup> This would have come as no surprise to the economist William Baumol who introduced the concept of ‘cost disease’ in the 1960’s to explain why the costs of employing people in some industries such healthcare, education and the performing arts increase much more rapidly than in others such as the production of cars, clothes, and computers. He attributed this to the disparity in labour productivity possibilities between these two groups [as demonstrable in data](#) showing that between 1998 and 2018 for example, costs in health care and education rose by about 200% while those in the production of consumer goods dropped by 100% . He famously first illustrated this problem with the limited opportunities for productivity increases by [a string quartet](#) and later applied a [similar analysis to the costs of medical care](#). One difference of course, is that to play a Mozart quartet today still needs only four players as it did in Mozart’s day whereas to investigate and treat many diseases now requires a large and still growing bevy of specialists.

<sup>3</sup> Although as Wennberg points out due recognition should be given an earlier pioneer in the study of unjustified variation. This should go [Dr J. Allison Glover](#), a medical officer in the Ministry of Health in the UK, who in the 1930’s noted that the wide variations in the chances of a child undergoing tonsillectomy in that era depended not upon any clinical differences, but upon which school they attended, which was just a proxy indicator for the operative enthusiasm of the local surgeons.

<sup>4</sup> This odd reluctance in the medical profession has a long history as it was experienced by [Wennberg](#) when he first tried to get his findings published in leading medical journals in the 1970’s:

*‘Naturally, this conclusion did not sit well with our fellow physicians. We published in Science only after being turned down by medical journals with wide clinical readerships, such as the New England Journal of Medicine and the Journal of the American Medical Association. Editors rejected our paper on the assumption that patient demand simply had to be the explanation for our observations, and thus the findings would be of no interest to their readers. But the sheer magnitude of the variation in incidence of hospitalization and surgery among these neighboring medical communities suggested that patient demand could not be the sole cause. And that suggested the importance of physician behavior as a major source of variation.’*

It must have been some comfort for him to subsequently see his Science paper frequently cited but opportunities to explore and exploit unjustified variations are still underutilised in clinical service improvement activities.

<sup>5</sup> It is rather ironic that it was also the Massachusetts General from which [Ernest Codman](#) resigned presumably in annoyance that the only ‘end result’ that seemed to be of interest was the final one, mortality, and not any of the precursor states such as complication rates and other outcomes that might have pointed to ways to reduce death rates.

<sup>6</sup> The term ‘complexity’ is used here as it is in [system dynamics or organisation sciences](#) and is distinguished from ‘complicated’ by the larger number, diversity and interactivity of the component parts and by the lack of predictability of outcomes from a given starting point.