

## Chapter

## 1

# Introduction and Scope of the Book

Jaideep J. Pandit

This book is about managing operating theatres and leading teams that work in them. A great deal has been written about leadership and management styles, but almost all of it can be condensed to a simple idea. Leaders use styles that make them liked, respected or feared. In turn management is about the effective use of goodwill, money or power. These elements are used in different combinations, and successful leadership or management is about judging when to use which style or adopt which means, respectively, and in what relative proportions. This book is not directly about leadership or management, but readers will see in the examples and vignettes given, how these styles and means can be used to attain the wider objective of theatre efficiency. Arguably, successful leadership and management rely on one more factor: the effective use of information. Not in the sense of propaganda or image, but rather in the ability to analyse and communicate complex data clearly, to both the wider team and the consumer. In this way, the strategy and goals of the organisation can be best understood. This then is the prime focus of this book – describing the processes in operating theatres in an objective analysis that leads to rational, data-led solutions.

Hospital operating theatres represent a very large part of hospital activity (in some centres probably the largest part). It has been estimated that up to ~46% of patients discharged from hospital have undergone some form of surgery. In the United Kingdom (UK), about three million anaesthetics are administered annually, and operating theatres collectively have an annual NHS budget of >£1 billion. Yet, the long-held perception of many who work in theatres is that they can be an underutilised resource. Last-minute cancellations of procedures on the day of surgery are frequent and costly both to the patient and to the hospital. It seems appropriate, both in terms of patient care and financial investment, that theatres work as ‘efficiently’ as possible.

Although several authoritative reports over the years in the United Kingdom and elsewhere have attempted to describe how to best manage theatres and operating lists, they fall short of being practical manuals to guide those who actually manage the service. The recommendations of these reports are broadly similar and include measures such as: effective administrative systems, accurate records for analysis and audit, optimally managing staff time, and good preassessment of patients to optimise medical conditions. This list is not exhaustive. Collectively, these recommendations seem very reasonable and appropriate to implement.

However, what is lacking from any recommendation or from anything that has followed, is a practical tool to apply in the real world, usable by those working in the theatre environment, especially those in leadership roles. Little contained in those reports helps guide individual behaviour, especially of the consultant or attending surgeons or anaesthetists. Without engagement of these key staff, attempts to improve theatre performance are unlikely to succeed.

Yet, consultant anaesthetists and surgeons are – alongside other non-clinical managers – often asked to run operating theatre suites in a managerial capacity. What is their training? Where are the courses or additional qualifications? Topics like ‘How would you schedule your operating list?’, or ‘Which patients would you prioritise on an operating list, and why, if time is constrained?’, or ‘How do you measure – and therefore minimise – the cost of operating?’ are not asked during surgical or anaesthesia training programs, so the thinking is not embedded from an early stage of their training. Rather it is left to ‘common sense’ to manage after these doctors are qualified. Coupled with this, few healthcare management training programs deal with these issues at this level, focussing generally on the wider questions of strategy such as the problems of the ageing population, scarcity of funding, etc. (all of which are undoubtedly

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important, but few of which help make practical day-to-day decisions in an operating theatre suite). Operating theatre management at a practical level does not form the major part of any MBA (Master's of Business Administration) program.

Moreover, advice is lacking on what to measure during the process of improvement. How do we know if we are heading in the right direction, and how do we know when we have reached the goal of 'efficiency'?

The main purpose of this book is to fill these voids. This book is intended for a wide audience. Throughout the book we use the term *theatre manager*. This is used to denote a generic person being tasked to run theatres: it could be a clinician, a non-clinician, someone senior or junior. In essence, the theatre manager is the archetype of anyone who has some responsibility or desire to improve theatre performance. Theatre managers (from a variety of backgrounds) who are tasked with organising a theatre suite will find a ready-to-use manual, which they can reference, to help them make daily planning decisions. They can readily access the toolkits provided to solve practical problems. Those undergoing training for such roles will find the book useful as a learning guide, and the reference lists provide a rich source of further reading material. Medical and nursing staff of all grades – including medical and nursing students – will find this book indispensable for several reasons. First, if managers are applying the principles contained, they will need to understand how and why decisions around their working environment are being made. Second, as they themselves have some planning responsibilities, they can also use the principles contained directly. Third, they will find the book valuable for training, especially to learn the language of the theatre environment.

### Core Principles

It is important first to understand some core principles underpinning this book. At time of writing there are very few similar books on the market and therefore, the first step is to understand some of the core terminology and approach (and therefore limitations) of what this book is about.

### Strategy versus Tactics versus Operations

When we talk about 'policy' or 'planning' or 'achieving efficiency', etc., we can hold the discussion at several levels (hierarchies of organisation).

The *strategic level* concerns the big themes and philosophies underpinning the system as a whole. Examples of strategic questions related to healthcare would include: 'Should the health system be funded by general taxation or via private payments or via insurance?'; 'Should hospitals be organised as a few, large tertiary centres with smaller centres undertaking a limited range of surgeries; or as many broadly equal-sized units all doing similar work?' or 'Given an ageing population, should we invest scarce resources into hospitals or into primary care?', etc. These are grand questions that set the envelope for the environment in which we all work. They are decided at senior governmental level, sometimes at regional or national levels, or sometimes through the ballot box in elections. These questions have nothing to do with this book. In the approach of this book, the strategic level is regarded as a given: i.e., we are where we are in the health service in which we work. We do not argue that the causes of any of the problems this book seeks to address are strategic ones.

At the other extreme, the *operational level* concerns the day-to-day matters that are often specific to a single centre. For example, achieving efficiency in a given hospital may require things to be done like ordering equipment or consumables in sufficient quantity and on time, making sure elevators work so patients can be physically moved, maintaining the temperature and lighting environment, etc. Again, this has nothing to do with this book; there is little need to write a book to remind readers of things that are self-evident (albeit important). In the approach of this book, the operational level is also regarded as a given: i.e., it can be assumed that all these matters are functioning well. The causes of any of the problems that this book seeks to address are not operational.

In between the strategic and operational lies the *tactical level*. These are the tactics to use, given the knowledge of any strategic envelope you are in and given any operational constraints. These tactics are often termed 'heuristics'. A heuristic is any approach to solving problems that uses a pragmatic method (not necessarily perfect) that is sufficient to attain the immediate goal. In other words, given (hypothetically) that we work in a health system funded wholly by taxation, and hospitals are structured in a certain way; and given that we have certain operational limits (a finite number of portering staff, elevators, etc.), what is the best way to maximise efficiency of a surgical list, or minimise costs? These

are the issues that this book is about; because these are the questions that face a theatre manager on a daily basis (notwithstanding the fact that they may also have some responsibility for reordering equipment and making sure elevators are fixed, etc.).

A military analogy may help illustrate the distinctions. Strategic questions might include: 'Shall we go to war, when and with whom?' Operational questions might include: 'How many boots does a division need; how much food is required by a regiment, etc.?' The tactical question is: 'Given we are at war, and given a certain size of army with constraints on its supplies, how do we actually win the battles?'

Or, to use the language of leadership: strategy is the leader's vision and direction of travel; operations are the necessary elements required for the journey; tactics are the tools and skills employed to get there.

## Quantitative Approach as Basis for Rational Discussion

Another core principle of this book is to assist the theatre manager by creating objective, *quantitative tools* that can be applied to dilemmas or problems. Only then can the ensuing discussion be *rational*. When faced with serious problems, such as a huge demand for surgery that creates very long waiting lists (patients waiting months or years for urgent interventions), the temptation is simply to conclude that staff are not working sufficiently hard. If only they worked harder, then there would be no waiting list. Unsurprisingly, such an analysis can lead to staff dissatisfaction and disengagement and a worsening situation. Instead, by studying the numbers underpinning the waiting lists, a more objective discussion can be had. This book shows how the objective principles can be used to defuse otherwise stressful situations.

Fundamental to a quantitative approach is an understanding of mathematics. All those running theatres have to be capable of numeracy – without exception. This is because the running of operating theatres requires mathematical knowledge and skills. We would not expect someone ignorant of anatomy to be employed as a surgeon. We would not expect someone ignorant of pharmacology to be employed as a physician. Similarly, we should not expect someone without some degree of numeracy and ability to draw and interpret graphs to manage operating theatres.

This does not mean that the theatre manager must always use advanced, abstract mathematics that

nobody else can understand. Rather, the mathematics in this book is quite basic – needing little more than Excel to solve most of the problems or a pocket calculator to perform any calculations. However, anyone who finds even the simplest of mathematical principles difficult should probably stop reading this book (and should also avoid becoming a theatre manager without further training in this domain).

## 'Time' as the Currency of Analysis: The Language of Probability

In the quantitative approach described earlier, the currency of our analysis is *time*. While 'patients' are undoubtedly important in a holistic sense – and we must never lose sight of that – erroneous conclusions result from calculations based simply on 'patient numbers'. This book recognises that a patient scheduled for surgery places defined *time* demands on the service. In turn, the capacity of the service to accommodate the patient is best measured in the hours or minutes of theatre *time* available.

In mathematical terms this distinction is important. The number of patients is a 'discrete variable' – one can have two or three patients, but no value in between. In contrast, time is a 'continuous variable' – one can have any value between two or three hours, measured in milli- or micro-seconds if needed. Using a continuous variable as currency of analysis in minutes or hours then facilitates calculation of *variance* (e.g., the standard deviation or range) of the relevant times. In turn, variance is easily linked to probability calculations. This instantly changes the language of debate. Rather than saying such-and-such will or will not happen, we can then say, using calculations based on variance, that there is a certain defined *chance* of something happening or not. As we will see, use of this mature probabilistic language to theatre problems is a very important aspect of this book.

## The place of 'Lean Thinking' – and Its Limitations

Some readers may be surprised that a core concept of this book is not 'Lean' or 'Six Sigma' thinking. In fact, much of the book is indeed about Lean/Six Sigma principles, but is just not branded as such, for reasons explained later.

Lean has shown great promise in industry, by seeking reductions in variations of inputs such as

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raw materials or manufacturing steps. However, the success of applications to healthcare is still unproven (Vest & Gamm, 2009). Many individual Lean principles can be and are adopted, but really Lean is a whole-system way of thinking, and few healthcare systems are close to that – certainly not the NHS. It is not the purpose or intention of this book to change the whole-system culture from the primary care doctor's surgery all the way through a hospital to the care home – this is what a true Lean approach would seek to do.

Moreover, Lean/Six Sigma approaches are generally focussed upon processes within a patient's journey at an operational level, whereas the focus of this book is the tactical level.

Another difficulty is that the introduction of Lean within the NHS has been piecemeal, and it is not embedded into system culture. For example, there have been relatively few studies of the causes of large waiting lists (Martin et al., 2003), and it is readily appreciated that what might be called the 'productive capacity' of hospitals encompassing all their activities is hard to estimate and not standardised (Buhaug, 2002). Consequently when the NHS introduced hard targets for waiting times in the early 2000s, it was trying to solve a problem without fully knowing its fundamental cause or without establishing the necessary consensus around the measures of demand and capacity that were vital to make progress. Many anaesthetists and surgeons in the United Kingdom have by now experienced waves of initiatives concerning Lean. This is usually accompanied by armies of newcomers in suits observing theatres, carrying clipboards and then circulating 'fishbone diagrams' or simply suggesting everyone should start on time. What has never been disseminated are the basic mathematical concepts underpinning the Lean principles. An analogy would be for a health service (quite reasonably) to prioritise the treatment of sepsis, but then (unreasonably) decline to define what 'sepsis' was or to promote teaching of the basic mathematics of oxygen supply and consumption. In short, the way that the NHS has tried to introduce Lean into theatre management in the United Kingdom has probably given Lean a bad name.

Furthermore, there is a fundamental disagreement about the causes of variation in the system and if it can be eliminated. Gallivan et al. (2002) measured 'length of inpatient stay' as the key measure of demand on a cardiac intensive care service and used queuing theory (see Chapter 5, Capacity Planning) to

conclude that, because of variability in this demand, they needed greater capacity to cope with admissions. However, several then-leaders of what was termed the 'NHS Modernisation Program' criticised the analysis, disputing that 'length of stay' was a correct measure of demand (but did not say what was preferable), and arguing that the variability in demand was caused by poor standardisation of procedures by specialisms and poor coordination. In essence the NHS was disinclined to support a conclusion to increase capacity (as this would be expensive) and advocated instead measures to reduce variability in demand.

The broad concept of eliminating variation emanated from an influential analysis of Toyota's success (Womack et al., 1990). The ingredients were the principles of 'eliminating waste' (e.g., time and consumable); 'do it right first time' (no trial- or error-led behaviour); emphasis on 'value' (in both activity and product); 'flexibility' (e.g., staff roles and production line activities); and the notion that the customer (i.e., patient) 'pushes' the system rather than is sucked through it. One problem is that 'Lean' can be anodyne and unobjectionable – who can object to doing things right first time? Many principles like these are rather vague (e.g., how do we know if something is pushed or pulled through the system?) and impersonal (what about the patient who wishes to linger a while, and neither be pushed nor pulled?). Therefore they can be interpreted widely; there is no set of clear criteria or test of whether a system has achieved 'lean-ness'. The danger of a self-fulfilling prophecy is that 'Lean' is always the system that works.

As we will see later (Chapter 5, Capacity Planning), it is possible for a factory to control its input and have little or no variability because all materials used and end-units of production are alike. But in hospitals we have the unpredictability of patients' response to treatment, a constant uncertainty in diagnosis and indeed changing goals. The patient admitted with abdominal pain may in fact need primary cardiac surgery. It is as if a factory designed to make cars suddenly needed to make a boat. If patients are the greater part of variability for hospitals, then the only way to eliminate variability and become lean is to eliminate patients (Morton & Cornwell, 2009).

## Proper Analogies for Operating Theatres

The fact that surgical operating theatres are not like factories or conveyor belts does not mean that we

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abandon quantitative analysis. The factory analogy fails because (a) the substrate of factories is fixed and unvariable (all the metal sheets, materials used conform to fixed sizes, shapes, etc.); (b) the same actions are performed on the conveyor belt to produce the output; (c) the output is also constant (all cars, trucks, cans, etc. that the conveyor belt produces are all alike, and designed to be so); (d) if time is lost by stopping the process for maintenance it can generally be sped up when restarted to catch up with production.

In contrast, the substrate for surgery and anaesthesia – our patients – are hardly ever alike; they are all different sizes, shapes, ages, with different morbidities. Second, our actions as doctors on the patients are hardly ever alike, even when directed to the same goal. Third, we do not seek the same result in all patients, but target the result to the needs of the patient. Fourth, if time is lost by cancelling a list, that time can never be regained.

In part, surgical operating lists more closely resemble professional service industries like law firms, accountancy partnerships or banks. An even better resemblance would be with a car repair shop (rather than a car manufacturer, like Toyota) or even antique clock restoration. Here the starting state of each precious clock is different. Although problems may fall into distinct patterns, the processes needed to fix the clock are highly specific to the clock. The time taken may vary greatly, but an experienced restorer will know broadly how long it will take, and this knowledge will underpin how much work is taken on. Unfortunately there is sparse literature on the economics of the antique clock industry or car repair shops. But nevertheless, this is the philosophy and approach guiding this book: to apply objective quantitative analysis to the processes by which we restore health to our patients.

### Focus on the National Health Service: Language of Theatres

Readers will find that there is an emphasis on the National Health Service (NHS) in the United Kingdom, and the primary examples provided relate to the UK NHS. The reason for this is that much of the published experimental and observational work underpinning this book was undertaken using NHS data. Therefore we use the term *operating theatre* by default – but we also freely adopt the American term *operating room* (OR). Similarly we use the terms *anaesthetist* and

*consultant* by default, but effortlessly switch to *anaesthesiologist* and *attending* when discussing US scenarios.

We focus much discussion on stereotypes of three patterns of surgical list: a ‘typical UK NHS list’, a ‘typical US list’ and a ‘typical UK private list’. As explained in Chapter 2 (Defining Efficiency), these notions are useful shorthand to show the extent of applications of several principles.

A second reason for UK focus is that the only other related book on the market (Kay, Fox & Urman’s *Operating Room Leadership and Management*) is already very US-focussed – in fact to the extent of having limited practical application in the United Kingdom. This book therefore provides a counterbalance and different perspective. The two books should be read in conjunction. Taken together they offer a comprehensive and complementary approach to operating room management. Indeed, one purpose of this book is to show how principles of management focussed on the United Kingdom NHS are nevertheless applicable to a wide range of countries in a wide variety of scenarios, including those encountered in the United States. Readers should constantly look for ways of adapting the principles to their own situation.

The chapters from international contributors take these principles further (Chapters 9–13). They demonstrate that many of the problems encountered by healthcare systems in the United States, the Netherlands, Belgium and Australia are common to those faced in the United Kingdom. The tariff structure in Queensland, Australia, discussed in Chapter 12, bears striking similarities (and shares deficiencies) with the NHS ‘Payment by Results’, discussed in Chapter 7 (Theatre Finances). The chapter on theatres in New Zealand (Chapter 9) shows how the principles in this book can be usefully adopted worldwide.

### Patients

This book is a dispassionate analysis of the tactical methods available to maximise our use of operating theatre resources. This does not capture the patient experience. Yet the book often describes shortcomings or failures of the service. When this happens it is patients who are at the sharp end, and it is they, and not anyone else, who so often do the suffering. We must never forget that, however sophisticated our analyses or distant the mathematics in this book might seem from real life, its fundamental purpose is the improvement of patient care.

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Chapter

2

## Defining 'Efficiency'

Jaideep J. Pandit

### Surgical Operating Lists: The Different and International Scenarios

The purpose of this book, like the efforts of theatre managers and those who work in operating rooms (ORs), is to achieve an 'efficient' surgical operating list. But what is an 'operating list', and what is 'efficient'? Simple though it might seem superficially, it is necessary to define these terms so we can all agree on what we are talking about and what we are trying to achieve. Most of our discussion relates to 'elective' surgery. This is where cases are planned in advance, ideally at the time to suit the patient. In Appendix 2E, we consider issues pertaining to the concept of efficiency applied to emergency surgery, where cases require operating promptly.

#### A 'Typical' NHS List in the United Kingdom

We first consider what a 'surgical operating list' means in the United Kingdom (UK) National Health Service (NHS). An elective surgical list is a list of patients to be operated on within a given operating room, usually serviced by a single surgical-anaesthetic-theatre staff team. Thus on a certain Monday in OR6, Mr Smith (a consultant general surgeon, with perhaps a trainee resident surgeon) operates with his anaesthetist (Dr Brown, a consultant, who may also be accompanied by a trainee resident, and always assisted by an anaesthetic nurse or practitioner) and a surgical scrub team (whose individuals may change from week to week but are all suitably trained; Figure 2.1). The list will be scheduled to be of a certain known duration (e.g., 4, 8, 10 or rarely 12 hours), and the patients will be listed, on a physical sheet of paper matching any electronic records, by their name, identifiers (date of birth, hospital number, etc.) and the operation they are to have. There may be additional details relating to particular features (obesity, need for post-operative high-

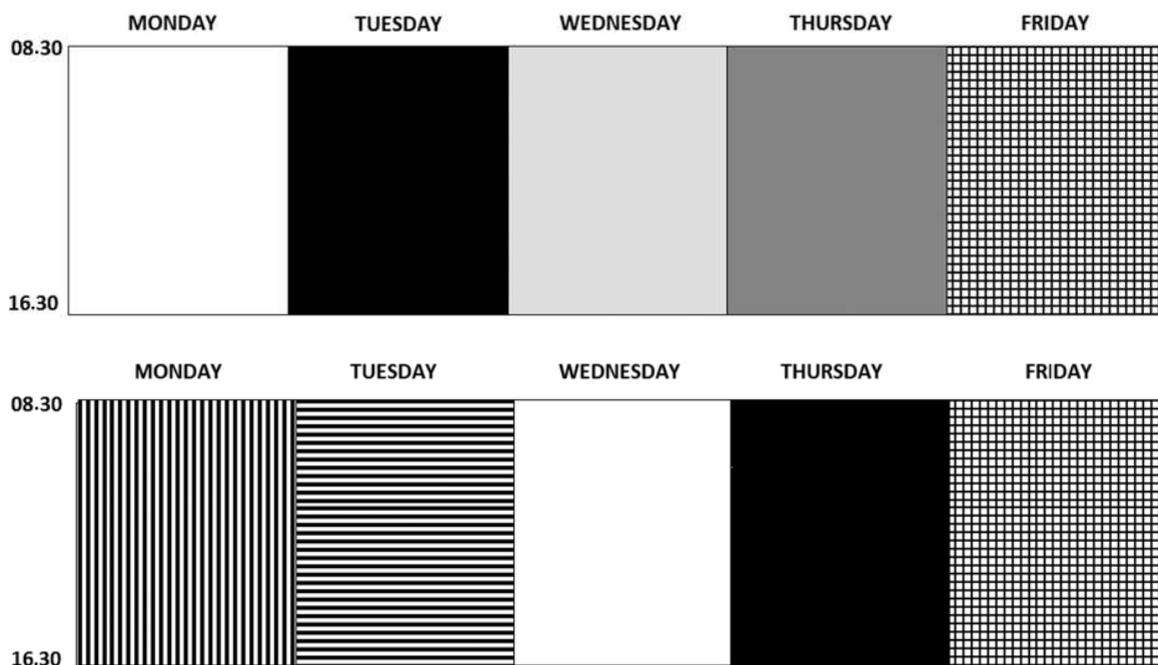
dependency care, special surgical instruments, need for X-ray, etc.). An example of operations listed may be: inguinal hernia, then varicose veins, then femoral hernia, etc.

For such a list, there will be a known start time, such as 08.30. Within the NHS it is not in fact universally specified whether 08.30 refers to the time the first incision is made, or to the start of anaesthesia, or something else. Local norms apply, and individual hospitals may have their own agreements or common understanding, but these are rarely strictly enforced. Commonly the agreed start time of 08.30 is taken to refer to the start of anaesthesia when the first patient of the day arrives in the anaesthetic room. In some centres the start time can be as late as 09.00. Consenting of the patients by the teams takes place before then, as does the WHO (World Health Organization) preoperative meeting. Given that the scheduled duration of length of the list is known (e.g., for an 8-hour list, the operations should all have finished by 16.30), at the end of the day there will either be an 'underrun' (if the list finishes before 16.30) or an overrun (if it finishes after 16.30). Of course, it might exactly finish on time at precisely 16.30, but that degree of precision is rare.

Because all NHS hospitals have such a high demand for surgery, there is always a waiting list; patients can wait weeks, months or even years to have the operation for which they were scheduled. This means that each surgical team or surgeon can be reliably allocated their list and can reliably fill it with cases, month after month, year after year. There is almost never an occasion when they do not have patients to fill the time allocated. This also means that individual surgeons can be allocated fixed operating days: e.g., Mr Smith every Monday, Ms Jones every Tuesday and so on.

This description may apply to patterns in many other countries. We will discuss later what 'efficiency' means in the context of such a list.

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**Figure 2.1** Illustration of organisation of a typical NHS list for a single OR over 5 days of a week. The times from 08.30 to 16.30 are shown on the side, with each day of the week, Mon–Fri shown for an OR. The top panel shows that, for each day, a different anaesthetist (along with different anaesthetic nurse and scrub team) are assigned to the OR. The bottom panel shows that each surgeon is also given their day in the same OR. This day-of-the-week assignment will not change (so Surgeon Black will always be on Thursdays, along with Anaesthetist Grey, and so on). In some centres, it is possible that anaesthetists will change the surgeon they work with week on week, but the surgeon assignment to a given OR will always be the same. Top panel: Anaesthetist allocations (different shade = different anaesthetist) Bottom panel: Surgeon allocations (different shade = different surgeon)

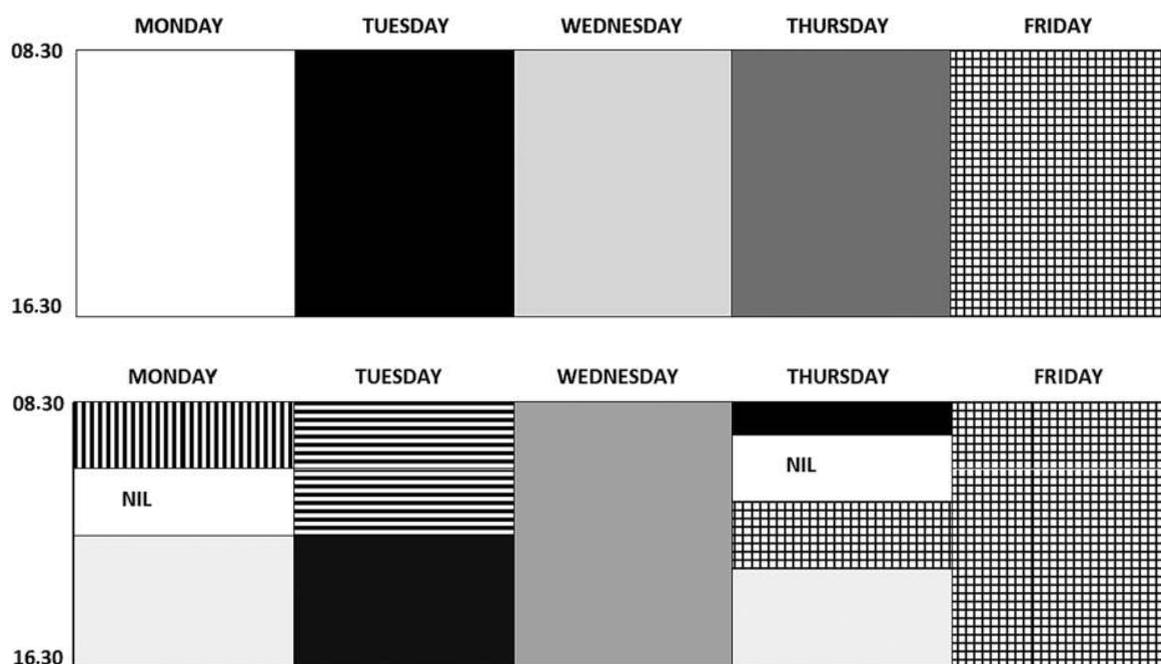
### A 'Typical' US List

The US exhibits considerable variation in patterns. Some may be close to what was described earlier, for the NHS in the United Kingdom. However, there are several ways in which the situation differs. Because US surgeons have a more variable caseload, they cannot guarantee to fill a regular allocation of time with cases each week. Second, the US system is designed to provide access to surgery very quickly, as soon as is possible from scheduling the patient for an operation. Therefore, a surgeon may operate on three cases on a Monday, then do a clinic on a Tuesday where they book one patient for surgery and operate on that patient on the Wednesday. In other words, from the surgeon's perspective, a 'list' may vary considerably day to day or week to week in its size and duration (Figure 2.2, lower panel).

However, the surgeon will nevertheless be assigned to a certain (not always the same) OR (let's

call it OR6 for this example), which will be staffed by an anaesthesiologist and scrub team (Figure 2.2, upper panel). This may be a trainee resident, or a nurse anaesthetist, supervised by an attending who in turn may be supervising more than one OR. (Note that UK anaesthetic consultants rarely if ever supervise more than one OR.) Therefore from the anaesthesia-scrub perspective, the 'list' is viewed as 'all the surgical activity in OR6 for the scheduled duration of operating', regardless of how many different surgical specialties use that OR.

It follows that from the perspective of the hospital, the particular OR will underrun if the operations are complete before the scheduled finish time and overrun if they are complete after the scheduled finish time. However, because the attending anaesthesiologist is supervising more than one OR, they will not finish their day until all their ORs are finished. Therefore, if they are supervising, say, four ORs and three



**Figure 2.2** Arrangement of one type of a 'typical US list'. As for the UK NHS list in Figure 2.1, the anaesthesiologist and theatre staff team assignment is fixed for any given day to one OR (upper panel; the specific OR assignment may change week on week). However, while the block time for the OR as a whole is constant, different surgeons operate at different times (lower panel). Each shade represents a different surgeon, and the blocks marked 'nil' represent gaps where the OR has no scheduled cases.

underrun but one overruns, they – as an individual anaesthesia provider – have in fact overstayed their contracted time, even though the majority of their ORs were underused.

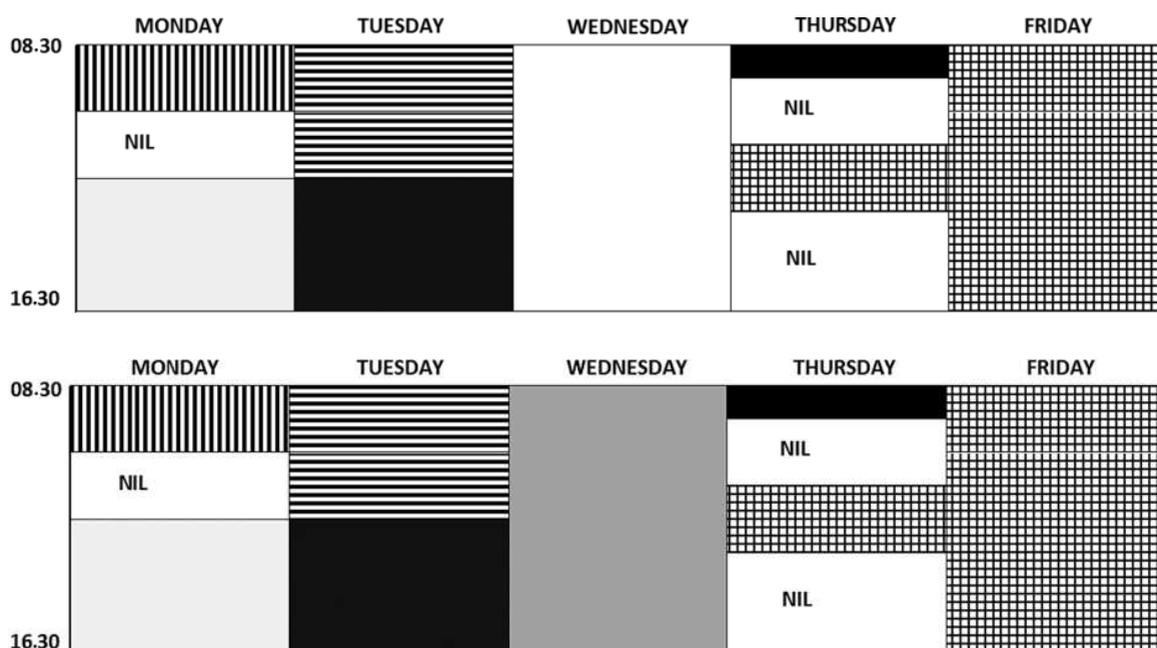
Consequently, perspectives of what is 'efficient' can vary across the staff groups, and between staff and the hospital. From the surgeon's perspective efficiency is likely to be related to measures like the speed of access to surgery from the time of outpatient clinic booking, or prompt start of cases so there is no in-theatre delay, or flexibility in accommodating a highly variable surgical schedule, enabling access to an OR any day of the week. From the hospital perspective, the efficient state is one where all the ORs made available to surgical faculty are as fully used with cases with no over-running. From an anaesthesiologist's perspective, efficiency may be being fully engaged in activity throughout the day (i.e., with no downtime where there is no surgery), and finishing on time without overrun.

## A Typical Small Private Hospital List in the United Kingdom

In the United Kingdom, hospital consultants are allowed to undertake private practice so long as it does not interfere with their NHS work. Private work is often located in smaller hospitals that do not generally have an intensive care unit; the cases tend to be day cases or short-stay cases in a fitter population than is encountered in the NHS. Consultant surgeons and anaesthetists are not employed by these private hospitals, but have 'admitting rights'; i.e., rights to practise there. Whereas patients are not charged for NHS treatment, they are for private health care, with fees paid to surgeon, anaesthetist and private hospital either directly or via an insurer. The perceived advantage is that private treatment guarantees treatment by a consultant, whereas in the NHS care may be given primarily by a trainee resident, albeit one supervised by a consultant.

Because overall, private health care forms only a small proportion (~10%) of the overall market,

Chapter 2: Defining 'Efficiency'



**Figure 2.3** Anaesthetist (top panel) and surgeon (lower panel) assignments to ORs by day of week for a 'typical UK private hospital'. Note that each surgeon works with their own anaesthetist, so the shades for surgeon correspond to those of anaesthetist (e.g., Surgeon Grey always works with Anaesthetist Grey) etc. Of course, depending on availability, Anaesthetist Grey may ask a colleague to cover (e.g., during vacation) or in turn cover another anaesthetist's work, by mutual agreement (e.g., on Wednesday Anaesthetist White is covering Anaesthetist Grey's normal work). Sections marked 'nil' represent no activity.

a typical surgeon's caseload in a private hospital is likely to be very variable week on week, similar in that regard to the typical US list described earlier. Moreover, a consultant surgeon will generally work with the same consultant anaesthetist (in part because, as they both arrange their schedules so as to avoid conflict with NHS duties, they are available for private work at similar times). A given private OR may therefore facilitate Surgeon A accompanied by Anaesthetist A for an hour, followed by Surgeon B accompanied by Anaesthetist B for 4 hours, and so on (Figure 2.3). The private hospital will need to provide the OR and associated staff, including an anaesthetic nurse/practitioner, but the dilemma for the hospital will be whether to make these resources available for the whole day, or only for part of a day. If employed for a whole day, then on many days there may be very little work for these staff to undertake. Sometimes, therefore, these private hospitals make use of contractual arrangements that ensure a minimum hours commitment, with additional payments made at

more premium rates if staff make themselves available when needed. These aspects of the 'small UK private hospital' are therefore very different from both the typical UK NHS hospital and the typical US hospital described earlier.

Consequently there are different perspectives on what is 'efficient' in this context. Broadly from the surgeon/anaesthetist perspective the efficiency relates to how quickly from booking a patient can receive the operation and how flexible the hospital is in accommodating the surgery on any given day at any given time. From the hospital perspective, the challenge is to accommodate as many surgeons as possible reliably into one OR (rather than, say, staff several ORs in parallel for only a few hours each day).

### The Emergency List

In many hospitals, emergency cases (unwell or critically ill patients who are not scheduled for surgery, but who arrive via the emergency department or as