The long game

Sustainable healthcare design considers whole-life cost, allows for changes in clinical need and reduces energy consumption in a targeted, strategic way. So what's stopping us from achieving it?

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If we are to successfully deliver healthcare to the planet's six billion people, there are some important principles that we need to adopt:

- healthcare is accepted as a priority for all and not a privilege for some
- healthcare must be a system beyond political manipulation
- all must benefit but all must take their share of responsibility for their health
- healthcare provision is recognised as a foundation of a successful economic and democratic nation
- the costs of the provision of healthcare must be continually scrutinsed by those who administer it and those who benefit from it
- the standards and quality of healthcare provision must be continually improved as nations develop.

At first glance you may think that these principles are beyond the remit of the designers of healthcare systems and facilities. Nothing is further from the truth. Designers have a significant part to play in the new world of healthcare provision. This essay discusses a framework to illustrate the influences that planners and designers can bring to bear.

The framework (Figure 1, opposite) consists of five continuums that test those who are involved with the provision of healthcare systems and facilities. Should the approach by the team be consistent with the left hand side of the model, then we can generally accept that the development will be sustainable for the long term.

However, should it be concluded that the approach is more consistent with the right hand side, the conclusion will be one of 'business as usual' and business sustainability will not be strategically achieved. It is important to note that although each topic is independent, as we move through the framework there is a mutual interdependence and an accumulated benefit. This is the added value gained by holistic thinking.

Whole-life cost versus first cost

Almost all decisions are made on the basis of cost but too often the only cost considered is the initial cost. The ongoing operational cost is usually part of another budget or in another portfolio. This separation often occurs in private sector systems but always occurs in the public sector. We must actively encourage bringing together the build and operational costs in order to expand the opportunities to provide real sustainable solutions. One example is the provision of new facilities at the expense of a number of older facilities being closed. If the holistic whole-life cost benefit through the elimination of the older facilities was always considered and placed above the initial cost, then we would have some extremely strong business cases that would undoubtedly improve the provision of our healthcare estate. The holistic view would take into account the benefit of spatial flexibility together with the cost of carbon emissions, maintenance, staff morale etc. Unfortunately, in order to be successful with this approach we have to address two areas of commercial discomfort. The first is the introduction of best value as opposed to cheapest first cost and the second is

accepting that our strategic planning will offer those other than the individuals involved the most benefit. A narrow-plan acute facility with a flexible footprint may be initially more expensive to build than a deep-plan buiding with less flexibility, but when a whole-life cost analysis is carried out, that expense may have a payback of only six years. There are additional benefits in the more flexible option – however, to date, the costing of flexibility within a business case has been beyond us all!

Future versus current needs

It is widely recognised that the design of healthcare facilities must be flexible. Unfortunately the majority of new hospitals – when designed – consider flexibility as the number of future additional beds. This is easily accommodated with a small amount of available land adjacent to the new build block; a façade that allows a possible future alignment at specific levels; additional capacity for site-wide infrastructure services; and the planning of an accessible corridor to satisfy existing and future adjacencies needs.

Interestingly we are finding that the development of new drugs, less intrusive surgical procedures, scientific breakthroughs involving new therapies, efficiencies brought about by new technologies and the need to carry out more treatment in a community setting suggest that bed numbers in the acute environment will need to be reduced, not increased.

Rarely in the briefing or design stage of a project does this become a stated requirement. The removal of in-patient beds usually means that a ward is closed, with all the associated inefficient estate liabilities such as heating, ventilation, lighting, cleaning and security.

A further debate on flexibility considers the internal remodelling of floor plates to create improved process efficiency with ongoing clinical developments. There seems to be an acceptance by many that deep-plan spaces allow for efficient spatial remodelling. This does not stand up to practical scrutiny given that most partitions in an acute healthcare setting are used as minor service distribution routes, and partition removal at one floor level can cause disruption to at least the immediate levels above and below. Couple this with the noise, vibration and dust generation that a remodelling project can generate and we quickly appreciate that any significant remodelling/refurbishment option where existing clinical services must be maintained can become a three-floor isolation project. Additionally we should remember the contractor's access requirements and the inevitable disruption this can cause.

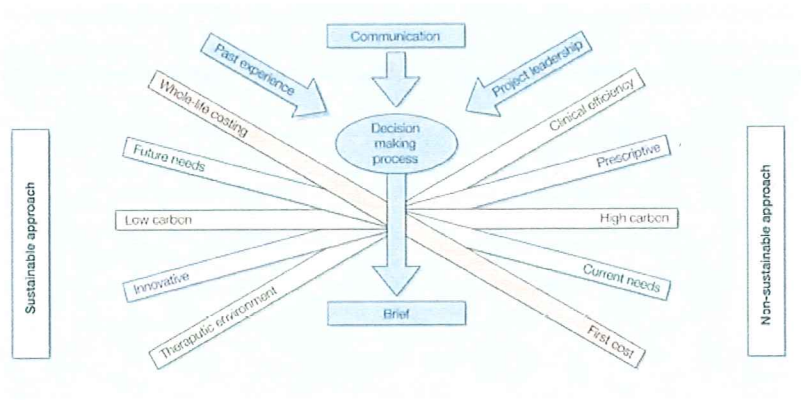

Figure 1: A framework for the provision of a sustainable healthcare estate

So when considering how flexible our final design solutions are, we must consider how we reduce bed numbers and not increase them and the impact of a major remodelling exercise. Finally, we can really apply the acid test to our design solutions by asking ourselves: "If in 20 years these were no longer required as acute hospital buildings, what could they be?"

Low carbon versus high carbon

The low-carbon agenda in healthcare has been with us for a number of years. Attempting to reduce carbon in acute facilities raises significant challenges:

- the need for large quantities of air with specific temperature and humidity requirements is largely clinically driven
- the acute environment requires a reliability based on 24/7 usage
- the estate needs to provide resilient systems often requiring back-up.

Hence any low-carbon technology must pass the availability, reliability and maintainability test.

A recent report[1] issued by the UK Sustainable Development Unit (SDU) concluded that the NHS had the following carbon emission profile: 18% travel, 22% building energy and 60% in the procurement process. This is a useful piece of work because for the first time designers can take a realistic view on the potential for saving carbon.

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When we focus on building energy we can consider three directions of travel. The first is the passive approach, the second is the active approach and the third is using low carbon technologies.

A framework has been developed that – if followed – will allow designers to focus initially on the best value (passive) priorities (such as a building's orientation, passive ventilation systems, and glazing spec) before developing solutions for the more expensive low carbon technologies (such as renewable energies like wind turbines and ground-source heat-pumps).

One of the real opportunities is related to the provision of natural ventilation in general patient areas. This requires a major consideration of the building footprint and may also then become a key driver in the

business case for single-patient bedrooms. Of course, it is recognised that many climates will not allow natural ventilation all the year around, but given the likelihood that energy prices will continue to increase, we may regret not considering mixed-mode technical solutions at the time of design – in the future every little will help.

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Innovation versus prescription

Almost every country, region and state will have its own codes and guides for healthcare briefing and design. Spatial planning and engineering loads and their respective systems are often the major focus of these guides and are often extremely useful. However, rarely are these documents kept up to date, which is essential in a changing healthcare environment. This is particularly relevant in terms of changing models of care, which has implications on spatial requirements, and also the low-carbon agenda, which has implications for engineering loads and systems.

Two examples illustrate the need to think clearly about the prescriptive codes. The first involves UK Health Technical Memorandum 55, Windows (HTM 55). This states that a window opening cannot be greater than 100mm in a patient area. Since this document was published, the thermal efficiency of building fabric has increased significantly, driven by global warming issues but at the same time the internal heat gains have increased equally significantly, driven by digital information and communication systems. Given these two changes, it would seem sensible to relax the constraint on window opening dimensions to enable designers to continue with a natural ventilation strategy. There are two conditions that will occur if this prescriptive guide alignment is not carried out. The first is an elevated internal temperature creating uncomfortable thermal conditions for occupants. The second is the design or retrofitting of a mechanical cooling system. The first affects the quality of the therapeutic environment whilst the second increases carbon generation and subsequent emissions due to the increased energy needed to power fans etc. Arup's solution to this issue at Northern Ireland's Altnagelvin Hospital is to include a 100mm opening at low level, and another at ceiling height (Figure 2, below).

The second example involves the requirement in some US states to seal the external envelope of healthcare buildings. There seem to be a number of reasons for this, but a significant one is that of poor external air quality. Whatever the reason, the outcome is that all designers will need to integrate a full air conditioning system into the facility with the associated spatial, energy, carbon emission and maintenance as well as plant replacement implications.

This second example has more damaging implications, in that once we have eliminated the need for natural ventilation, a deeper plan solution can be developed which may then affect future flexibility and the creation of a more therapeutic environment for patients, staff and carers.

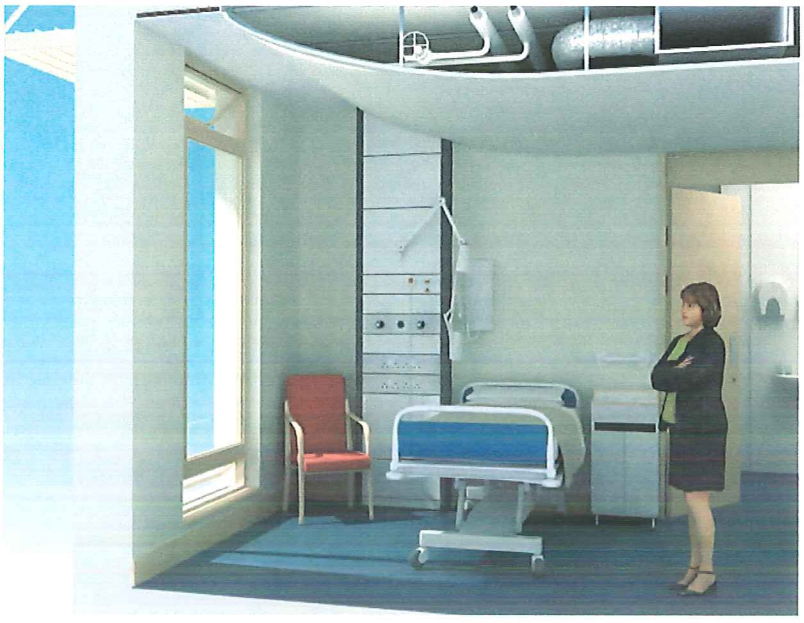

Figure 2: A design solution to overcome building codes that restrict window openings to 100mm: there is a 100mm opening at low level and then a larger opening at high level, where the ceiling has been cut away to give maximum height. This system is in use at Altnagelvin Hospital, Northern Ireland

Therapeutic environment versus clinical efficiency

Although it could be argued that these two forms are not specifically at either end of the space-planning spectrum (and neither should they be), there will need to be some compromise to find an optimum solution. The basic premise emerges from the early Nightingale open wards of 24 beds within a pavilion arrangement, connected by a hospital street. This layout enabled a single nurse positioned at the end of the unit to observe all patients during the night shift. This was a layout based on limited staff numbers, and hence it is the mid-19th-century's version of clinical efficiency. Having 24 patients in a single room can hardly be considered therapeutic! Isambard Kingdom Brunel's design for Renkioi Hospital in Turkey (Figure 3, opposite) illustrates this.

The current concept of designing for clinical efficiency is often based on the mantra that departmental adjacencies equal clinical efficiency. Unfortunately

this has often pushed designers towards deep-plan building solutions that, although satisfying the basic building economics of floor to wall and floor area ratios, tend to significantly reduce the development of natural daylight and clear wayfinding – the former being essential to high-quality environments and the latter being a component in staff inefficiency.

If we develop further the clinical motives for the mantra, we find staff travel distances at both ward and interdepartmental level at the heart of the logic. However, modern ergonomic digital modelling as part of an industrial logistics planning approach should be used to consider tasks undertaken; people movement and separation; automated/robotic handling systems; and the storage and distribution of consumables, drugs and equipment.

Further components of the therapeutic environment include the reduction of hospital acquired infections (HAI), thermal comfort, user control of their environment, acoustically relaxing spaces, calming artificial lighting, effective way-finding, intuitive connections between car parking and entrances etc, natural daylight and patient privacy and dignity. The ultimate goal for hospitals must be to create non-threatening environments for patients, a feeling of clinical confidence for carers and an environment that supports high staff morale.

Currently a major discussion in many countries developing their acute healthcare facilities is that of single room occupancy. It is my view that their introduction is essential and is a major stepping-stone in the development of healthcare for the future. Not only is the introduction beneficial to the therapeutic environment on the grounds of patient privacy, dignity and infection control, it also represents a sound planning basis for future clinical needs where more therapies may be delivered within the patient room.

The biggest challenge in this final element of the sustainable framework is the financial justification. Florence Nightingale's book *Notes on Hospitals*, originally printed in 1857, discusses – perhaps for the first time – the need for a clinical 'evidence base'. This is something still being requested today, based on improved clinical or financial outcomes for any and all expenditure. It is probably impossible to identify clinical outcomes that are driven wholly by therapeutic environments and make them scientifically repeatable. This is because no two patients are the same in the pre- or post- treatment phase of their illness. If we are to consider the financial justification for creating therapeutic environments then we would need a metric such as length of stay; however there is a weakness in this approach. In the mid 1970s when the average length of stay (ALOS) in the UK was around 11 days, a 10% reduction would have been worth the research effort, but with the current UK ALOS at around 3.5 days the benefit of a 10% reduction (i.e 3.5 hours) would be questionable, given the disturbances in the normal clinical operational procedures.

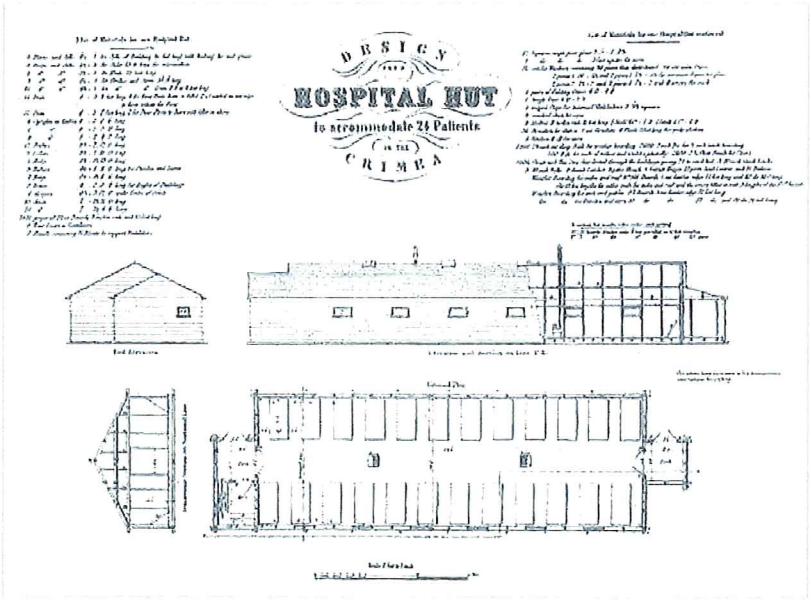

Figure 3: Brunel's c.1855 design for a prefabricated field hospital in Renkioi, Turkey: with only a single nurse on duty, 24 beds in a single room with a hospital 'street' in the middle was then considered an optimum ward layout

However, rather than concentrating our initial focus of attention on the clinical benefits to patients, perhaps we should be concentrating on improving staff morale. After all, they are the ones deployed in highly stressful environments often in unfriendly shift systems. Perhaps we could justify a number of the concepts in the therapeutic environment by exploring with the staff their needs. This may reduce sickness levels and improve staff morale, the former being a clear financial benefit while the latter being one of the foundations of patient care.

About the author

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