Hospital Building in the NHS

Things that go wrong

JANE SMITH

Few advanced nations regularly take a whole decade to complete a 500 bed hospital.

PETER STONE¹

"And still manage to get it wrong," might be the rider added by many doctors. Criticisms of British hospitals are many and bitter. Some cannot be divorced from NHS politics. It is not due to policy alone that large sums of money were spent on teaching hospitals while patients in asylums lived in squalor, nor was it due to policy that elsewhere district general hospitals were postponed as their money went to paper over the cracks in those same asylums.

But other criticisms are more specific to many of the new hospitals built since 1948: they took years to build and their costs escalated; their roofs leak, their cladding falls off, they are ugly and grow shabby within years; mistakes in one hospital are repeated in others. Critics point to the perennial problems of storage space, and there are plenty of examples of sheer incompetence: drains going uphill, mortuary floors with no fall for drainage, piped gas systems installed upside down.

The critics point to Europe and America, where they see large, well built hospitals run without problems: to the Middle East, where British planners and architects can build good looking hospitals fast; and to the private sector in Britain, where again building is fast and the quality good.

Private hospitals take care over the hotel aspects of their services: the BUPA hospital at Harpenden.

Inherent difficulties

Hospitals are inherently complicated, and their design is a compromise between competing claims. Half the cost of an acute hospital goes on mechanical and electrical engineering. Labour intensive and organisationally complex, hospitals must nevertheless provide a calm, humane environment for people who are ill. The values that one might want a hospital to express architecturally conflict with the needs of clinical efficiency and high technology medicine.

The work of hospitals is also constantly changing. Operating theatres now need antipollution systems; what provision should be made for nuclear magnetic resonance in five years' time? And there are longer term changes: shorter lengths of stay, increasing throughput, higher dependency patients, and an aging population have all influenced ward design. Although the need to design flexibly to meet such changing needs has always been an underlying ideal, it has not always been met, and change in some hospitals has proved difficult.

The problem is compounded by the length of time it has taken to plan and build new hospitals. Planners have been tempted to incorporate changes up to the last minute, which has meant redesign, delay, and consequent increases in cost.

A cumbersome bureaucracy

In 1982 the *Architects' Journal* compared the planning, designing, and building of a 40 bed NHS community hospital in Mold with those of a 40 bed acute hospital built by BUPA in Harpenden.² Despite the BUPA hospital being acute and costing three times as much as the NHS hospital it took only a third of the time to plan and build: two years compared with six. Construction alone took half the time at Harpenden that it did at Mold because BUPA used a management fee contract, involving the contractor early and giving him an incentive to finish on time and to cost. Part of the difference is accounted for by the way the private sector consults its users. Even at its best the NHS's way of planning buildings is cumbersome.

In the early days of the hospital building programme many planners simply floundered. Schemes got into regional programmes without much thought to their content; they were brought forward because of political pressures and delayed by arguments over the site. Project teams were appointed to draw up the briefs for these ill thought out schemes, and with inadequate data on caseloads often had to start from scratch to work out what was needed. Responsibility was diffused between the project team and the region, and the Ministry of Health often interposed because at that time it knew more about hospitals than anyone else.

As well as building notes and other guidance the ministry also introduced Capricode—the capital projects procedures—to enable regions to plan schemes logically and control costs. Capricode takes a scheme from the initial estimation of content and preliminary cost, through policies, layout, and a budget cost, through departmental and room layouts, with ever more accurate costing, to tendering and constructing, commissioning, and evaluation.

Wards

Besides arranging for light and ventilation, all hospital plans should provide for the greatest economy in administration. . . . The wards should be of such a size and, if possible, so arranged that the head nurse may have all her sick under her eye at once.

FLORENCE NIGHTINGALE, *Notes on Hospitals*, 1859

One reason why a standard hospital design will never be adopted fully or go unmodified is because of the challenge it presents to those who think they can do better. This applies not only to whole hospitals but also to seemingly straightforward parts of them such as wards.

Thinking on wards has undergone several changes since 1948. As with hospitals generally, the first people to consider ward design were the Nuffield team. At that time (1950s) Europe and America were much further forward in the use of two, four, and six bedded rooms, together with single rooms. This reflected a greater demand for privacy and convenience as living standards rose and, in America, the insistence of insurance companies that their patients should not be in rooms with more than four beds. In Britain, however, long open wards in the Nightingale tradition persisted—and had their drawbacks. They were noisy, their ancillary rooms and sanitary facilities were inadequate, distances within them were long, and there was often little day space.

After studying what actually happened on wards the Nuffield team advocated better utility rooms, a treatment room for each ward, more sanitary facilities for the 70-90% of patients who might be ambulant, and more day space. They calculated that 20-25% of beds on a ward should be in single rooms—for patients who might infect others, patients susceptible to infection, seriously ill or dying patients, those likely to disturb others, and those needing special attention; some of these rooms should be central, with others at the edge of the ward. These guidelines have survived, and on wards designed today 20-25% of the beds are in single rooms.

The team designed two ward blocks—a 64 bed unit at Larkfield Hospital in Greenock and an 80 bed unit at Musgrave Park Hospital in Belfast—to try out its designs and experiment with team nursing. The Belfast ward had six bed bays, with beds set parallel to the walls—a form that has now become common, though the Nuffield team's suggestions on ward sizes have not been taken up. The English ward has settled down at about 28 beds for an acute ward (and slightly fewer for geriatric and children's wards), typically with four six bed bays and four single rooms.

Small bays permitted sexes and specialties to be mixed within the

Nucleus adult acute ward.

same ward, and flexibility in the use of wards was a major concern in ward design in the '60s and '70s. The emphasis in hospitals such as Greenwich and the best buy hospitals on compactness and close

Although regions are responsible for planning and managing schemes, they have to seek approval at various stages from the DHSS on major schemes (currently those over £5m). In the past it often took the department over 12 months to process submissions; it went back over previous decisions, and got bogged down in the details of sinks and coathooks. Regions often planned on anyway, at risk of having to change things if the DHSS objected. The DHSS itself admitted these shortcomings, though it often criticised regions for vague thinking about schemes and their content. Few criticise the logic of Capricode, but it did become a bureaucratic mechanism that itself contributed to delays and multiplied the excuses for getting it wrong.

The DHSS has now simplified Capricode, putting emphasis on an early option appraisal. Thus if the system works properly a project team should know what it has got to plan.

But the project team itself is cumbersome. In an organisation such as BUPA a small team of professional planners will draw up the brief—using DHSS guidance and its own standards—and will consult a group of selected future users; in practice most users tend to comment on equipment rather than layouts. In the NHS representatives of the users—doctors, nurses, administrators, and others—are expected to help actually construct the brief, in the early days with no standards and little guidance. The fact that they take time to learn the rules of the game and need time to consult with those they represent slows planning down. Because the

users are doing other, full time jobs at the same time as they are planning, there may be no great cost in their taking a little longer, so long as they keep to a realistic timetable. There may be more scope in cutting down construction time by experimenting more with different types of contracts.

Tendering and building

Many schemes came unstuck when they went to tender. The DHSS always insisted that if tenders were for more than the budgeted cost the planners had to trim those costs. At worst—and this often happened—the necessary redesign had unforeseen repercussions elsewhere, it delayed the construction programme, and consequently it increased costs. At best the quality of the finishes was sacrificed, with long term repercussions on maintenance. The concern about costs at this level seems a little obsessive, because the capital cost of a hospital is exceeded by its running costs after about three years, and the cost of good finishes is often very small in relation to the whole and in relation to their value. Hospitals abroad do not stint on their finishes, and private hospitals know their value because their livelihood depends on it.

But the greatest problems arose from schemes going to tender with incomplete information. Only comparatively recently have engineering services been accurately costed and integrated with the

interrelations of departments led to "peripheral banding" of wards. In these hospitals, and in many others built to a racetrack design, wards formed continuous strings around the outside of a building, with the bed bays on the outside, separated by a corridor housing the nurses' station from internal ancillary rooms and short corridors leading to main circulation routes.

The idea behind the linear form of these wards was progressive patient care: the beds closest to the nurses' station accommodated patients who needed the greatest supervision and were fully served by medical gases; further away the amount of immediate observation and servicing steadily diminished until, in the mark 1 best buy ward, there was an eight bed bay at the far end for low dependency patients. Very seriously ill patients were taken out of the ward altogether and concentrated in intensive care units.

The other aim of peripheral banding was flexibility: ward boundaries could contract and expand into their neighbour's space in response to demand. In practice this degree of flexibility has not worked, partly because sisters do not like to see their territory expand and contract day by day and partly because of practical reasons such as nurse call systems not being linked to the right nurses' station. Longer term changes in ward boundaries have proved possible. At William Harvey Hospital, Ashford, Kent, for example, the wards were designed in units of 120 beds, with two high dependency sections of 21 beds each and two lower dependency sections of 39 beds each. In practice, because there are few low dependency patients, the 39 bed areas proved too large and have been split into wards of 19 and 20 beds, which work reasonably well despite the positioning of ancillary rooms and day spaces no longer being ideal.

In 1978 the Medical Architecture Research Unit evaluated three wards at St Thomas's Hospital: a Nightingale ward, a ward of four bed bays built in the 1950s, and a modern ward of four and six bed bays and single rooms. Rather to everyone's surprise the Nightingale wards came out best. They were economical to run and were liked by patients and nurses for their easy companionableness and ease of observation. Since then there has been a "back to Nightingale" movement in ward design. The emphasis has shifted away from flexible boundaries and progressive patient care and on to ease of observation for all beds: the proportion of beds that could be seen from the nurses' station in peripherally banded wards was often small.

But a traditional Nightingale ward is out of the question. It would not meet fire regulations, the need for flexibility between specialties and sexes, or the needs of modern nursing. The current challenge is to achieve both high visibility and compactness—to keep a large number

South Western region's acute ward.

of bathrooms and toilets close to beds, with ancillary rooms close by to keep walking distances short.

In the nucleus acute adult ward, which comprises four six bedded bays and four single rooms, over half the beds can be easily seen from the nurses' station, but the elongated shape of the nucleus ward means that one bay is well removed from the nurses' base and that day rooms (shared between two wards) are some distance in the other direction. Dissatisfaction with the nucleus ward has prompted some regions to try their own solutions. The North Western region for example, has produced a geriatric ward—designed in a compact form so that it can be added on to existing hospitals—in which nearly all of the beds can be seen from the nurses' station. The South Western region also has a standard acute ward with high visibility, which is being used in hospitals built to nucleus briefs in Western super Mare and Cheltenham. Both of these plans, together with some sketch plans produced by members of the DHSS works group, which achieve over 80% visibility, meet the twin aims of visibility and compactness by "wrapping" the bays round three sides of a core formed by the nurses' station and ancillary rooms.

architectural plans. Their costs used to be estimated and their positioning left till later—on site. These practices again led to increased costs, and worse. At Bangor Hospital in north Wales the waste pipes from the pathology department ended up running through the kitchens, and the positioning of ventilation equipment made the kitchen unworkable.³ As a result of these problems—and of continual criticism about them from the Public Accounts Committee—the DHSS has simplified Capricode and tightened up regions' procedures on appraising, tendering for, and managing projects. One of the main goads was the debacle at Liverpool's teaching hospital (see box).

The Public Accounts Committee criticised the Liverpool hospital (and others of its type) for being constructionally suspect, expensive to build, hard to manage, and hard to modify.⁴ There was a certain irony in that the DHSS had itself eschewed that sort of development—for those sorts of reasons—and promoted horizontal, low rise, easily flexible designs. It was no accident too that Liverpool was a teaching hospital under a board of governors. With no professional works staffs of their own, susceptible to the demands of powerful consultants, and with political influence through their direct relationship with the DHSS, boards of governors gave plenty of scope for mismanagement of large schemes.

Liverpool was lucky to get the chance to build two main phases at once. British hospitals have traditionally been built in phases,

and most later phases have come a long time after the early ones; in some cases they have never appeared. So, although design guidance has always urged those planning hospitals to conceive them as a whole, rarely have they been built as a whole. In the time between phases practices, people, and needs change so that even if the later phases are actually built there is little chance of an architecturally coherent hospital.

The chances of building large hospitals in single phases are even less now. Apart from the presumption that nucleus sized hospitals are what is needed generally, the DHSS has told regions not to let contracts for more than three or four years. It is a sad comment on hospital building that one of the determinants of the size of a nucleus hospital—the need to keep building contracts short—resulted from the inability of now defunct authorities to manage longer contracts.

A new vernacular

While the Public Accounts Committee was criticising large hospitals of the Liverpool type for being constructionally suspect and hard to manage others were criticising them for being impersonal: "A hospital that relies entirely on telephones for communication and lifts for transport cannot be wholly successful."⁵ They were criticising racetrack wards for needing more staff, flat

Liverpool Royal Infirmary

Liverpool is an extreme case but it illustrates many of the things that went wrong in the '60s and '70s. Phases II and III were started in 1968 and due for completion in 1974 at a cost of £11.8m. The contractor got into financial difficulties early on and the site was dogged by strikes and pay claims. In 1975 the contractor went out of business and first one then another contractor was brought in to finish it. There were extra costs for remedying defects, for increasing the content of the hospital, and for bringing it up to current regulations on energy use, the housing of animals, and—most important—fire safety. In 1976 the DHSS told the Public Accounts Committee that the final building, still not complete, would cost £54.19m—much of it due to inflation. The hospital consisted of a two storey podium surmounted by a 12 storey ward block and five storey clinical block—a pattern typical of large hospitals in the '60s and still fairly typical abroad. Its problems with fire regulations arose partly from changes in the regulations in the eight or so years since it had been designed, but not entirely: the 4½ acre podium roof was made of flammable material, and there was inadequate compartmentalisation and inadequate fire escapes.

roofs for leaking, and large areas of glass and internal rooms for consuming more energy.

Some of these criticisms are easy with hindsight, and they are not confined to hospitals. Hospitals are the latest in a whole range of buildings built in the '60s to suffer from failure through the use of high alumina cement. Similarly, current moves towards smaller buildings on a domestic scale and constructed with traditional materials and pitched roofs (as exemplified by some nucleus hospitals) are not confined to hospitals. These days factories, offices, and hospitals may all look like suburban semis.

Communications

Even if the brief is good, the design brilliant, and the construction sound a hospital will fail if its users do not use it as intended.

What are the ideal criteria for emergency ventilators/resuscitators, and do any of the machines on the market measure up to this ideal? Have any machines specific advantages over the others, particularly in relation to carrying and using them in physically awkward conditions. What are the advantages/disadvantages of having a cylinder of air compared with carrying a cylinder of oxygen?

In most cases in which respiratory assistance is required the most urgent need is to clear the patient's airway. In this reply I have assumed that the questioner can recognise and relieve airway obstruction and that he does not intend to use any resuscitator/ventilator before undergoing the appropriate training. The minimum criteria for an "ideal" emergency ventilator are that it should be portable and compact; simple and with clear controls; reliable and safe; flexible enough to permit its use with patients of different ages and sizes; economical in its use of driving gas; able to deliver both 50% and 100% oxygen; and that it should have an audible failure alarm. At least four devices at present available meet many of these criteria (Blease, Dräger, Penlon, Pneupac). The choice depends on the purchaser's specific needs. The only advantage of air over oxygen is that the former may be used in an environment in which fire or explosion presents a potential hazard. Air will not adequately oxygenate all patients who require resuscitation; most resuscitators have the facility to deliver either 100%

And this often happens because of a failure to communicate the brief—and its assumptions—to those commissioning the hospital. In 1955 the Nuffield study team said that proper timetabling in outpatient departments would remove the need for a large waiting area.⁶ Twenty two years later the waiting area in surgical outpatients at St Thomas's Hospital was being criticised for being too small because "the strict appointments system envisaged by the designers was never implemented."⁷ In tightly planned hospitals such as nucleus even minor changes in policy can create severe problems. Education centres shared between doctors and nurses work well in some hospitals, through cooperation and good timetabling; in others they do not. As part of the project to build a low energy hospital on the Isle of Wight a social psychologist has been appointed to help train the staff in energy conservation, because all the designed in equipment will be useless if it is not used properly.

A vested interest in denigration

In fact the record of health authorities in building hospitals is not as bad as it might seem to an insider. Planning and building are undoubtedly more disciplined now, but even in the '70s a report quoted to the Public Accounts Committee showed that among public building authorities the NHS, although its record on time overruns was poor, was fairly good in containing costs. The NHS was third best out of 10 for controlling costs, with 71% of its schemes within 5% of the contract sum. Hospitals also had a much lower rate of failure of construction than new houses, factories, or offices.

Some of the criticisms of English hospitals are accounted for by what Enoch Powell called a vested interest in denigration, but, looking back, critics might be forgiven for wondering whether England ever had a hospital policy. The patchwork of large teaching hospitals (expensive to run and in London at least possibly in the wrong places), other "unfinished" hospitals throughout the country, and now little nucleuses suggests a failure of nerve as much as of money. It is as if the NHS was never sure of what it wanted from a policy, it couldn't manage it, it couldn't pay for it, and now that it is capable of managing a building programme it hasn't got a policy.

References

- 1 Stone P. *British hospital and health care buildings: designs and appraisals*. London: Architectural Press, 1980.
- 2 Nightingale M. Buildings update. Hospitals part 1. *Architects' Journal* 1982 July 21:61-75.
- 3 Committee of Public Accounts. *Seventeenth report. Session 1980-81*. London: HMSO, 1981. (HC255.)
- 4 Committee of Public Accounts. *Ninth report. Session 1976-77*. London: HMSO, 1977. (HC532.)
- 5 Bion J. Charing Cross Hospital. *Architects' Journal* 1976 July 28:165-9.
- 6 Nuffield Provincial Hospitals Trust. *Studies in the functions and design of hospitals*. London: Oxford University Press, 1955.
- 7 Anonymous. St Thomas's Hospital. Phase 2. *Architects' Journal* 1977 May 4:839-43.

oxygen or oxygen diluted with air, and this is adequate for any emergency need.—J C STODDART, consultant in charge, intensive therapy unit, Newcastle upon Tyne.

Gray AJG. Portable lung ventilators. *Br J Hosp Med* 1981;2:173-8.
Stoddart JC. Transporting the injured patient. *Trauma and the anaesthetist*. London: Baillière Tindall, 1984:176-83.

Corrections

Can we have safer cigarettes?

In error in this paper by Tessa Richards (17 November, p 1374) it was not mentioned that the meeting was initiated and sponsored by the Chest, Heart and Stroke Association.

Medicolegal: Dr Gee v the BBC and two doctors

We regret that errors have occurred in our two previous reports on this case (17 November, p 1386; 24 November, p 1460). The doses of tri-iodothyronine and thyroxine should have been in µg not mg.