

Open Infrastructure Planning for Emergency and Urgent Care

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ABSTRACT

This paper stems from the development of research currently undertaken at the Bartlett, University College London and Loughborough University School of Civil and Building Engineering, Open Scenario Planning for Healthcare Infrastructure (OPHI). The study has investigated the concepts, tools and techniques that enable innovation and support the financial planning of built infrastructure. The aim is to improve decision-making for healthcare pathways across locations and settings through development of a framework for the rationalisation of existing property and buildings.

Evidence and analysis is drawn from case studies of Accident & Emergency/Trauma, Urgent Care and service re-organisation within six English Foundation Trust Hospitals, examining their strategic estates planning approach. The study sets out a process to determine scenarios of a shifting pattern of patient-centered requirements and clinical priorities by testing strategic options for clinical effectiveness rather than functional arrangements. The ideas and direction of the research were also supported by case studies from elsewhere in Europe. Most notably, at the Inselspital (Island Hospital) in Switzerland, the Canton of Bern has set out a 2025 to 2060 strategy for an 'Open Development Framework'. Organised through principles of Open Building this directs the future development of the hospital as a set of high-level objectives driven by clinical priorities incorporating planning and design innovation through the mapping of two divergent operational scenarios.

The paper sets out the findings of the study with the Trusts in England that respond to these emerging radical solutions and the appropriateness of their introduction within the context of UK service reorganisation for patient-centred, integrated care overcoming organisational commissioning boundaries. Findings suggest the emergence of new, clinically-led business units, supported by mobile multi-disciplinary teams on and off-site, for the planning of admission avoidance, referral patterns and long term care of chronic conditions.

This work is informing an outcome for a Strategic Scenario Planning Framework to enable decisions based on explicit values of stakeholders, together with the specific competencies required of these stakeholders. This framework aims to inform multi-factorial decision-making for patient care; clinical capacity, technology innovation, access to and utilisation of, the built infrastructure whilst developing the quality and efficiency of the Trusts' performance.

KEYWORDS

Open Scenario Planning, Open Building, Change-ready Hospital, Estate, Accident & Emergency/Trauma, Urgent Care

CONTEXT FOR THE STUDY

Background

Healthcare infrastructure planning, design and its project (and asset) management involve a complex interaction of factors that determine the distribution of its resources. In the planning process, these factors are interrelated and interdependent. The delivery of efficient and effective project proposals often relies on an iterative, multi-stakeholder decision-making process over variable time periods. Infrastructures must respond to fluctuating local demand, changing contexts, and innovative ways of doing things. Against this backdrop, buildings, technologies and workforce must enable rather than constrain development. What is more, the structure and influence of healthcare regulation, the power, distance and unequal relationships between stakeholders in any health care system and the volatility in healthcare commissioning, bring high levels of uncertainty to the planning and building design process (Mills *et al.*, 2009).

This study investigates a new approach to the planning, design and the project (and asset) management of healthcare buildings and infrastructure. This Open Planning approach marks a shift from traditional strategic asset management and master planning, towards a dynamic planning approach. It uses scenario-based organisational, programme and project discussions as systematic tools in making decisions about existing and future service transformations in healthcare, and the interaction of these service transformations within the built infrastructure through which they are delivered (Astley, 2009, Mills *et al.*, 2010). The principal aim of the study is to bring preparedness for uncertain futures to the forefront of health and social care system decision-makers' minds and to provide them with a common approach and language to enable a discussion of intangibles.

The study addresses current knowledge about this research problem in the following way:

At a general level

- the changing operating context for the UK NHS
- transformations in service delivery and the estates response
- the relevance of scenario planning and open scenario theory and methods
- tools and competencies to facilitate open scenario planning in practice

And at case study level

- A&E and the acute Trusts
- existing strategic estates planning procedures for A&E
- open building and planning concepts in the A&E context
- tools and models to support open scenario planning for A&E

PRACTICAL VIEWS OF STRATEGIC HEALTHCARE INFRASTRUCTURE PLANNING

Strategic planning techniques for large sites have evolved since the 1950s from Herbert A Simon's work on the theories of master planning; a plan as an outcome of complex decision-making processes. However, the architecture of master planning for healthcare sites has increasingly been seen as a starting point according to Astley (2009) and for clients an architectural prescription of complex processes. For Verderber and Fine (2000) and CABE (2011) the term '*master plan*' has more recently regained some of its original meaning, and can be seen as a comprehensive plan or description (both visual and written) of the potential of a place. This can describe a process by which healthcare organisations undertake analysis and prepare strategies to plan for major change in a defined physical area.

Recently, the risk of long term development programmes for such a large-scale approach to site planning, associated with private finance procurement, has been illustrated by the cancellation of hospital building projects through spiralling costs. New planning techniques need to support the strategic distribution of services across settings and enhance the relationship for an open, change-ready, estate strategy that is better aligned to the clients and their community partners commissioning and business processes. In current circumstances and in the future, demands will intensify for adaptable and agile planning and design responses to the driving forces underlying change in healthcare systems.

In their study of flexibility in hospital investment at Addenbrooke's Hospital, Cambridgeshire and the impact of PFI, Neufville *et al.* (2008) conclude that conventional forecasting does not provide planning and design with a sufficiently wide range of possible futures, opportunities and building flexibility, which results ultimately in the underperformance of the

infrastructure. Furthermore, estates thinking and practice needs to deliver highly flexible hospital and other health care infrastructures that are suitably adapted in scale and scope as these demands evolve (Neufville *et al.*, 2008). Today, many advanced case studies are starting to apply 'master planning', where design recognises a number of possible futures for the hospital, inter-changeable developable 'blocks' and supported by future quantitative measures to inform infrastructure strategy. As Mills *et al.* (2011) argue, it confirms the importance of defining and assessing value during open planning and design. Mills advances the emergent understanding of open building and planning, looking again at the fundamental interaction between people, and the emergent processes and product in early stage scenario development and reflects on how value could retrospectively be measured.

Mahadkar *et al.* (2011) depict how a Strategic Asset Management (SAM) framework can relate to open building levels. The various 'levels' are arranged within a pyramid to depict the 'control' each level has over the other, the lower levels exert a higher control than the top and similarly the top layers are less 'constrained' than the bottom layers. Cuperus (2001) explains that each of these levels are separated yet co-ordinated and there is decision-making and consultation between each level. They connect a decision-making party or stakeholder to an object under construction or in transformation (Kendall, 2009). The SAM framework incorporates different types of decisions between the levels, for example, 'ergonomic' decisions that look at adaptable workplaces with user adjustability that promotes safety will be included within the 'furniture and equipment' and 'fit-out' level. This is a different organisation of information for estates strategy than currently provided. Large scale strategic planning is a multi -faceted process that requires experience and engagement directly in the field for an understanding of changing requirements within organisational thinking. It is dependent on policy makers, community needs and economic climate, as well as many other time-variant factors. This approach offers a more responsive 'open' decision-making approach to design and project management strategy.

THE RELEVANCE OF SCENARIO PLANNING

Scenario planning has its foundations in the 1940s within military and business sectors in the USA and, since the 1970s in France, to the work of Godet around strategic scenario planning for public policy and for firms and business sectors (Chermack *et al.*, 2001, Godet, 2001, Varum and Melo, 2010). Schoemaker (1995) describes scenario planning as a disciplined methodology for examining possible futures, over a range of issues, from which organizational decisions may be derived, considered and implemented. Despite the substantial experience of using scenario planning in business practice (for example, within Shell since the 1970s); in foresight

exercises at government level (Foresight, DBIS, UK) or at the inter-governmental level (for example, The European Foresight Monitoring Network), there is little evidence of this thinking and practice in the healthcare sector. Neither does this form of investigation feature strongly in investigations within the field of construction and project management according to Goodier *et al.* (2009). However, a trace of scenario based thinking is emerging in healthcare infrastructure, although there are few published examples.

The most recent study using scenario techniques, and relevant to the current controversies around the future of the NHS, was conducted by the Centre for Innovation in Health Management at Leeds University (Ross *et al.*, 2010). This used scenario development at the strategic level of the whole NHS system. In addition some others understand the forces at work in changing the nature of radiology, and the uncertain impacts this would have on radiology as a technology, its practice in hospitals and on its professional workforce (Enzmann *et al.*, 2011). Scenario planning for healthcare, offers an approach that avoids linear projection, prediction or forecasts from which conventional master planning can then follow, but what is necessary is to understand scenarios on a number of levels of physical and spatial constraint (Astley 2009).

The open process is designed to stimulate decision makers to consider change that might otherwise be ignored. The actual practice of engaging with decision makers and other stakeholders allows narratives or stories to be derived and selected that have powers of explanation of potential that are greater than the accumulation of quantities of data (although quantification may be an essential part of the process). In a complex and changing sector such as healthcare, this approach provides an important tool in planning; however its relationship to infrastructure design has not been clearly made. This paper demonstrates the application of scenario planning alongside open design approach, and also demonstrates the application of a new combined *open* Scenario Planning approach that is responsive to future trends, identifies possibilities and begins to untie the levels of the building and infrastructure from the activities it contains. Its objective is to help clients and commissioners inform vertical and horizontal planning across the spectrum of care in order to deliver measurable future spatial efficiency.

SCENARIO PLANNING AGAINST CHANGING EMERGENCY AND URGENT CARE POLICY AND OPERATIONS

The operating context for Accident and Emergency ('A&E', as it is widely known in the UK), the case study area of this study, has to be considered within the current and expected changes within the hospital sector and within the NHS overall. The future of the NHS has received significant attention in the official reports in recent years (BMA, 2006, Darzi Report,

2008, Ham, 2009, Nicholson Report, 2009, Wanless Report, 2004). The movement towards an integrated model of acute, primary and social care has led to a blurring of traditional scales and settings which may lead to opportunities for both collaboration and competition (Mills *et al.*, 2010). The prospect of continued churn in institutional arrangements proposed by the current government for the NHS in England underline the need for adaptability of healthcare infrastructure, including the hospitals which currently support A&E.

Studies within the last ten years have given priority to investigating ways in which the numbers of attendances at A&E departments can be reduced together with reductions in waiting times (British Association of Emergency Medicine, 2005, Cooke *et al.*, 2005, Dr Foster Intelligence, 2006). Extensive research conducted recently across the A&E departments in the NHS in England has analysed the trend for structural growth in A&E attendances and admissions to hospital (Nuffield Trust, 2010). These, according to the Nuffield Trust, are derived from a combination of increasing numbers of single cases (in specific non-elderly age groups); a lowering of the threshold of severity for admission to a hospital bed following A&E attendance; faster discharges from hospital as a result of improvements in clinical and medical care (resulting in greater bed availability); inadequate out-of-hospital care and poorly managed patient pathways within primary care and its relationship with A&E. Greater efficiency in hospital 'bed days' appears to operate as supply pull supporting a lowering of the threshold of severity for admissions from A&E.

Recent literature points to clear evidence to deflect demand towards minor injuries units, walk-in centres, integration with general practice, earlier discharge and care have all been attempted at various times and places within the NHS. However, detailed examination of actual experience and assessment of effectiveness and efficiency gains is patchy and only occasionally rigorous (Carson *et al.*, 2010, Cooke *et al.*, 2005, Fisher *et al.*, 2010). Clearly, there are many other organisational, behavioural and cultural factors at work, and planners and designers of A&E care pathways need to establish new forms of thinking and practice surrounding the relative functions of emergency medicine in both hospital and primary care settings such as dynamic and agile scenario planning approaches alongside robust evidence-based research.

A&E infrastructure is of a highly varying quality and departments have evolved over many hospital building programmes over the past forty years. Nearly all the functions of emergency medicine take place within hospital buildings, with some significant, but not widespread, use of related or separate sites and buildings to accommodate minor injuries units, walk-in centres and some larger GP practices. Given the current evidence about the structural nature of increasing demands on A&E units, and despite some

successful initiatives to diversify the provision of emergency care, the existing sites and buildings of major hospitals will continue to provide most of the functions of accident and emergency medicine in the near future. What is needed therefore are new approaches like those recommended by CABE (2009) to adapt and reconfigure buildings, to be extended or reduced; to accommodate service change; to be responsive to new or changing functions in healthcare; and to be capable of integrating new technologies associated with climate change and sustainability.

RESEARCH DESIGN AND METHODOLOGY

Foundation Trust Hospitals (FTs) and design industry partners supported an investigation for a fresh approach to strategic site planning and design. Case study research was performed using an iterative grounded theory development and action design research approach. The strategic estates planning approach of six FTs within England (Milton Keynes, Southampton, Salford Royal, Taunton, St Thomas's and Guys and Brighton) were investigated and a new open scenario planning approach was trialled. This approach was designed using strategic scenario planning concepts developed using open building principles, which enabled the team to witness first-hand the multi-institutional and multi-stream approach adopted by the FTs to execute their estates planning processes.

A scenario and value-based research method was devised, with case study analysis underpinned by open building theory. These case studies were part of a wider action and iterative grounded theory approach that continue to inform two longitudinal trust studies. Workshops aimed to analyse the strategies and techniques used by these self selecting Trusts. However while this was largely a convenience sample, it can be said that they do represent a range of different organisational types (foundation, teaching and non-teaching full service), that showed different geographical distributions, variances in local health economy, market structures, dynamisms or ability to respond to change and in decision-making competencies. The rigidity of estates planning approaches and techniques was observed at two levels: first, through a detailed document analysis of the guidance recommended by the DH; and second, through active engagement with the estates planning teams within the Trusts.

What was clear from this level of expert engagement was that there was a need for a rapid scenario planning research approach as clinical Emergency Departments rarely have more than one or two hours for workshop activities. The workshops were structured around multi-disciplinary teams from the Hospital Trusts including: Strategic Planning & Estates teams, Clinicians and nursing teams, held over a morning or afternoon time-slot, located in the Emergency Department. Examples of operational

changes and pilot schemes elsewhere, evidence-based measures conducted nationally and internationally, targeted literature review of current thinking were also used to enable rapid and focussed discussion of key issues around Emergency Department reconfiguration.

WORKSHOP FINDINGS

The A&E is nationally overwhelmed, with attendance increasing in most Trusts. This may be due to a number of causes which Trust workshops and interviews confirmed. Attendance rates for 2008-09 and 2009-10 reported by HES & QMAE (HESonline, 2011) indicate more than 60% of people attending A&E were discharged with no follow-up or referred to a GP, and of the first treatment recorded of those attending A&E, 50% were either just given advice or sent away (*Figures 1 & 2*). These inappropriate attendances were one of the central themes in the workshops.

Exploratory methods for discussion and development of scenarios evolved using diagrams, which were presented to Trusts and industry partners to understand wider service and societal changes and their impact on A&E (*see Figure 3*).

Through the workshops two key delivery scenarios were examined and tested with Trusts: i) 'Exploded - or Upstream - triage' - triage and assessment being carried out in stages and settings outside the hospital, such as with Paramedics, GP Out-of-Hours & Urgent Care centres, etc. (*see Figure 4*), and ii) The 'Big front door' - a more all-encompassing view of A&E directing all emergent patients through one entrance/gateway allowing early assessment by senior staff, as well as bringing primary care services into the Acute setting (*see Figure 5*).

There is a great deal of discussion & debate about how best to 'filter' the flow of non-ambulance attendance at A&E. The need to restrict or limit access, allowing better ambulance access (fines are associated with time to arrival), or widen the 'front door' to enable faster assessment and turn-away rates. 'Frequent flyers' - a small minority of individuals who are in regular attendance and admission into A&E - account for a disproportionate cost to the service. An expanded ambulatory care system operated by some Acute Trusts, providing a more comprehensive acute medicine service, is also effectively keeping people away from the 'front door'. This study has shown that whilst many trusts have various approaches to planning A&E services, few have developed robust and open scenario planning approaches. Detailed here are some of the key principles of open infrastructure scenario planning as it is applied to emergency and urgent care.

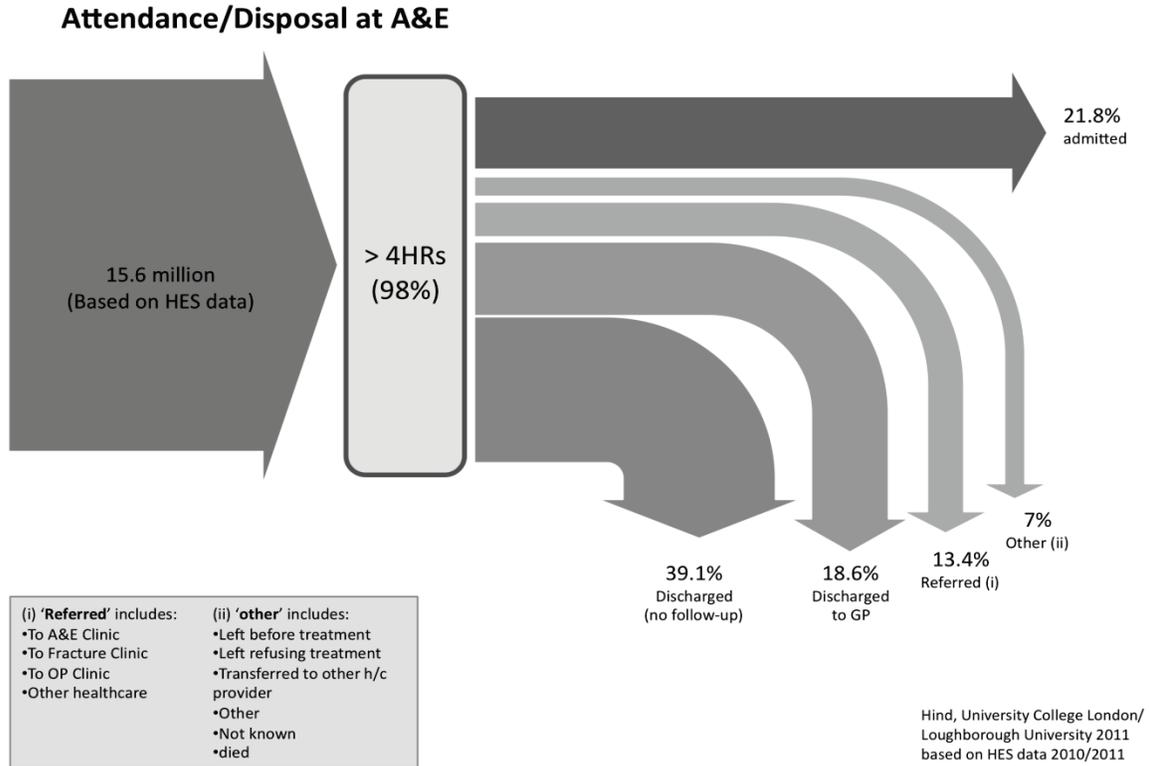


Figure 1 - Number of Attendances to NHS England A&E Departments 2010-2011 showing proportion of admitted patients, modelling HES 2010/2011 data (Hind UCL/Loughborough University 2011)

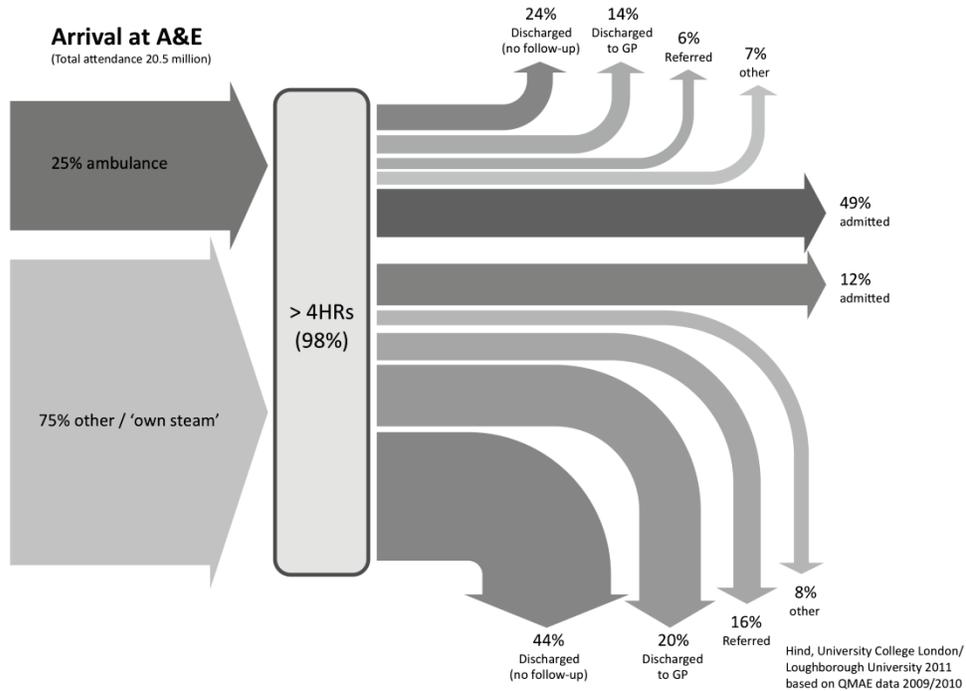


Figure 2 - Number of Attendances to NHS England A&E Departments 2009-2010 showing proportion of admitted patients and how they arrived at A&E (both groupings split into proportions of 100% for each method of arrival), modelling QMAE 2009/2010 data (Hind UCL/Loughborough University 2011)

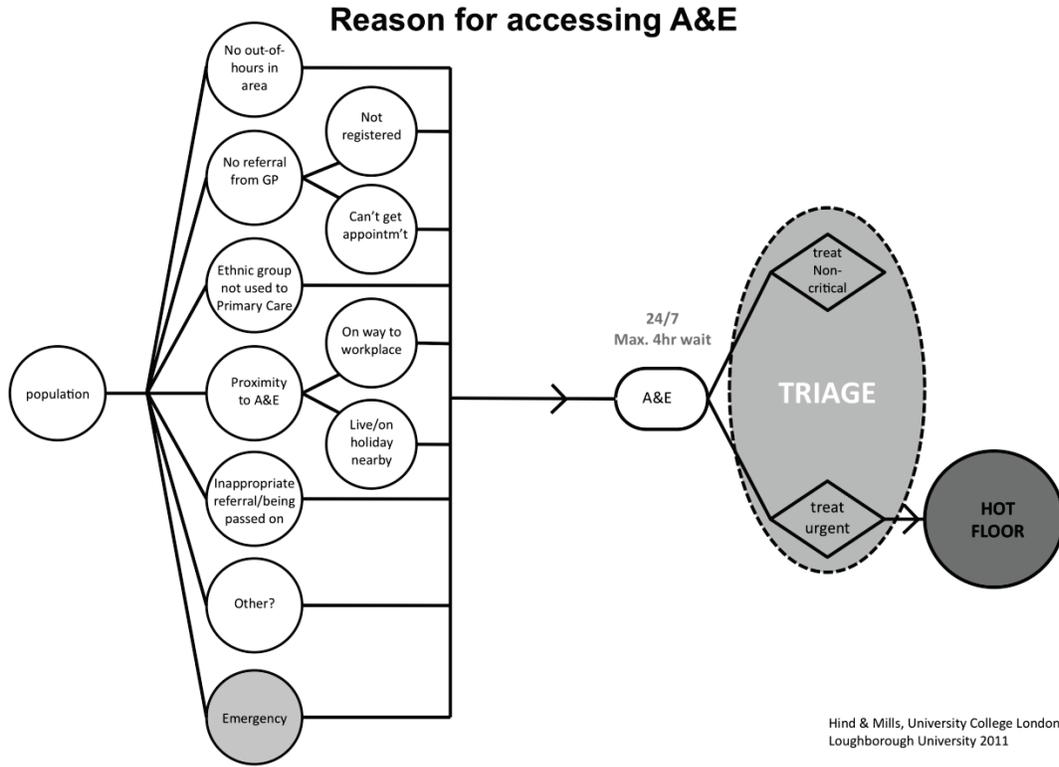


Figure 3 - dividing the population into reasons for attending A&E (Hind, Mills UCL//Loughborough University 2011)

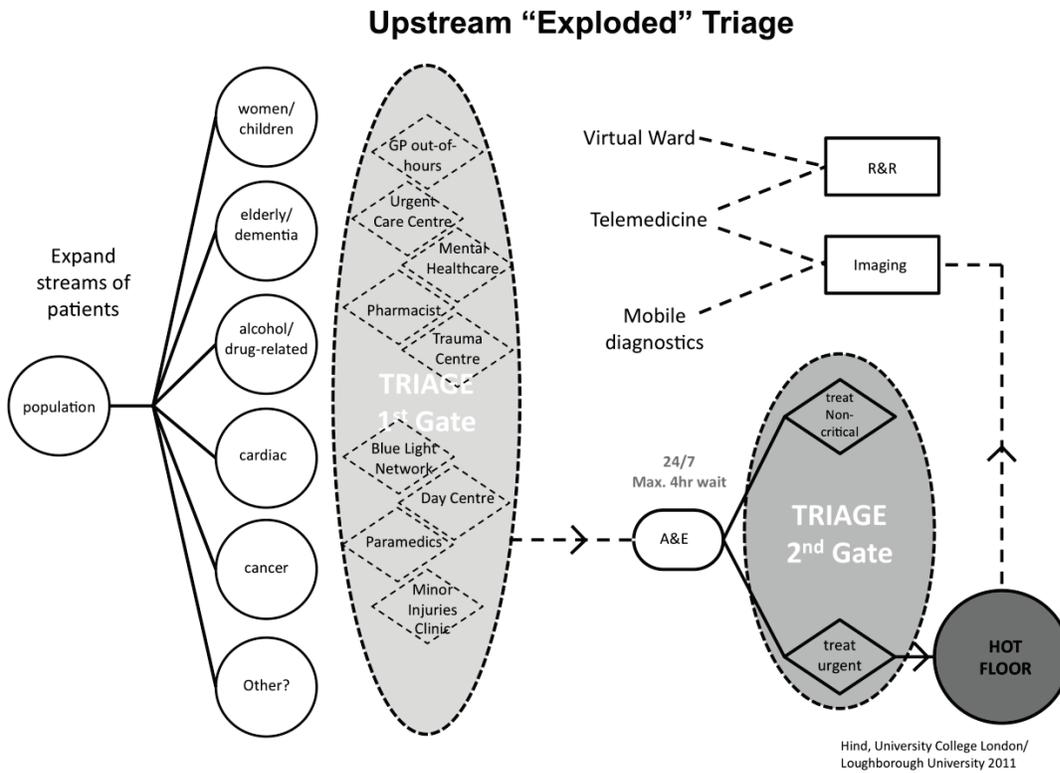


Figure 4 - dividing the population into patient pathways with potential for upstream '1st gate' triage outside of the hospital. (Hind, UCL//Loughborough University 2011)

PRINCIPLES OF OPEN EMERGENCY PLANNING

The workshops with Trusts provided the following key principles to developing Accident and Emergency departments that are able to cope with changing volumes.

- **Tidal Flow and Flux.** This concept describes the nature of change in the department by clinical staff. A&E is arranged to meet variable target needs - making sure the right people are in right place at the right time. It was considered by all Trusts as the 'front line', informing and impacting upon services behind. Furthermore, delivering services and managing people outside of hospital environment was important. Whilst there is a certain level of predictability in capacity planning the service, there was no absolutely clear model of care, in terms of space and service – *"it ebbs & flows"*. It is essential, for workshop participants, not to have 'red lines' around areas, fixing activity to a specific area, as there are varying numbers of the more acute patients week by week. The design of an A&E department layout must therefore deal with any pathway that is chosen at any given time, responding to a number of changes over time.
- **Acuity Streaming.** Streaming into hot (acute - 48-72hr), warm (ambulatory 24hr) & cold (elective daycare/'minors') zones, placed patients into the correct *'temperature'* of activity with potential for team zone separation and variable specialist assessment. Some trusts had put in place a step-down *'discharge lounge'*, which would act as a 'holding area' for patients who are currently located in HDU/waiting. These patients would be seen and treated with 'clothes on' to in part encourage discharge, rather than admission overnight (see Figure 5).
- **Spatial Proximity and Flexing.** Another emerging strategy for change involved linking Resuscitation areas to cope with varying flow and flux. It was noted that Children's & Adults' departments could be separated from each other, but that the separation of Children's Resus' from Adults Resus' was not good practice. This then links the two departments as *flexing space*. (Figure 6). Proximity of services meant efficiencies in operation (for example HDU beds help Resus as well as 'Majors' and nursing staff crossover).
- **Built-in Redundancy.** The creation of flexible space utilising non-specific rooms, are seen by Trusts as high priorities in order to accommodate change. Trusts also make use of 'soft space' such as administrative offices and storage areas, to allow for potential future expansion of clinical space. For one participant *"[We] need to build-in both redundancy and potential expansion"*.

- **Co-location around Diagnostics.** Surgery, Medicine, Paediatrics, A&E are currently co-located around diagnostics, but the technological advances in mobile imaging may end this need. Some imaging is already carried out using mobile equipment within A&E departments. Layouts could be limited or at least constrained by the necessary proximity or availability of staff and equipment. Similarly, Trusts identified a need for close proximity between 1st gate & 2nd gate triage - cost effectiveness & access to appropriate treatment. (Figure 4)
- **Change-ready estate - Shell & Core/Fit-out Space.** There is a general understanding amongst trusts that "things will change". There is a clear need for 'change-ready' planning at both small and large scale, as well as compromise in reaching reconfiguration over the long, medium and short term. Experiences of ongoing change, and of new space planning around services that became rapidly redundant with changing needs, were recited by participants. One A&E department reported 13 separate changes in space in order to reach the current layout and were planning further reorganisation.

CONCLUSIONS

A&E clinicians were generally enthusiastic about the organisation of new change-ready concepts - both spatially and ideologically - recognising the expanding and contracting need for services on a daily or weekly basis. The need for change-ready spaces, with services & activities inhabiting areas as needed was discussed at length. Some estates teams understand and use existing open building principles (of shell & core), even in relatively old buildings, however many believe that there are opportunities to incorporate wider and less spatially constrained planning principles and to carry out short term space fit-out which may still suit existing business case frameworks.

All trusts interviewed faced the same or a similar dilemma that there is often not an opportunity for a new-build option on a green site, therefore from their perspective, open building is usually constrained and cannot always deliver an optimum value solution (only a best possible solution). Some trusts faced significant constraints as a result of existing previous master planned facility locations or service operations that restrict *'forward planning'*. Urgent and expedient expenditure of capital budgets due to short term national and regional funding cycles limit the potential (or opportunity) for longer term thinking and planning. Furthermore capital funding for enabling works and general infrastructural changes (such as for roads and mechanical services) were seen by some Boards as a none-necessary cost in favour of the purchase of equipment or care

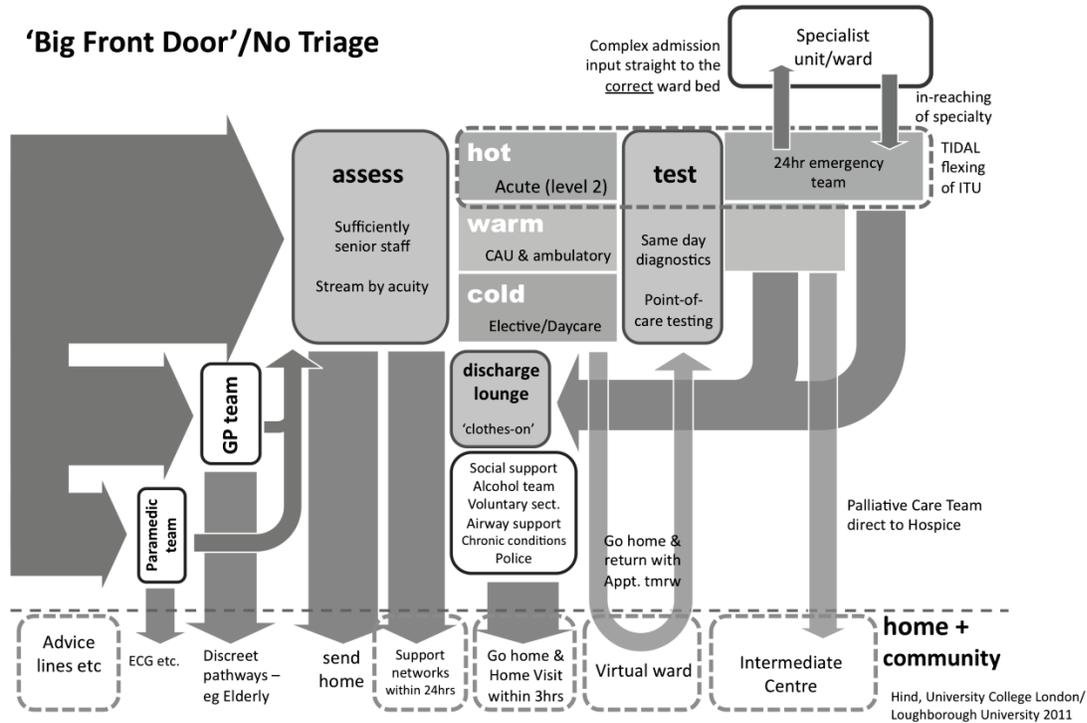


Figure 5 - streaming population through acuity, bringing forward some assessment and care delivery upstream, with in-reaching of community, social and specialist services (Hind UCL/Loughborough University 2011)

A&E Tidal Flow

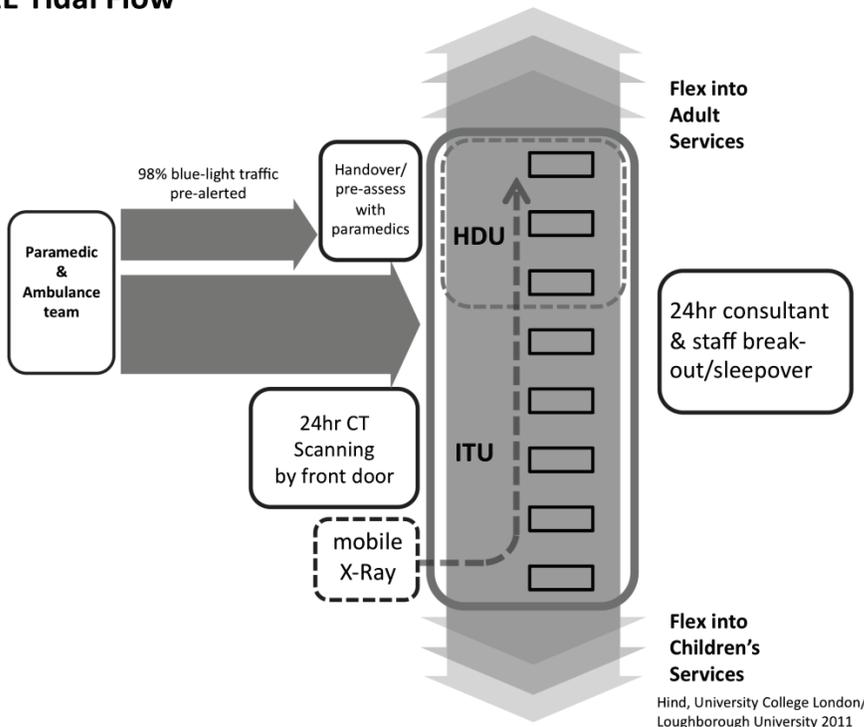


Figure 6 - Tidal areas and flux describe the nature of change in the department by clinical staff (Hind UCL/Loughborough University 2011)

innovation. This seems to indicate a need for more coordinated *open* funding mechanisms.

What is clear is that existing building stocks will play a significant future in Trust based open infrastructure planning scenarios and that limited funding will be able for radical redevelopment. A&E departments are starting to be seen as critical to future planning of services and inward investment which many have lacked, particularly in recent capital expenditure programmes. As a result of the funding downturn, capital developments in A&E over the next five years - and possibly up to thirty years - are likely to be within existing building envelopes.

Outside of internal project planning, learning and discussion of the built environment aspects of emergency medicine have been almost entirely absent from the strategic debates about the functioning and future of A&E departments. There are national guidelines and codes of practice to inform estates departments within hospital trusts, but most work within the established focus of known policy, specification and cost. This study has shown that there is some evidence of increasing attention to planning and design within strategic thinking about health care buildings. Within this debate the need for adaptable space accommodating the tidal nature, or 'ebb & flow' of normal Emergency Department procedure is considerable, along with wider scenario based consideration of changes in service, greater mobility of imaging equipment, and staffing levels.

FINDINGS

- Clinicians in Emergency Departments rarely have more than one or two hours available for workshop activity, so the need to focus quickly on issues and draw out scenarios was essential.
- Clinician teams were clearly focussed on short-term change (occurring in the 1-5 year period), and the obstacles to be overcome in the immediate future as well as innovations in the field. Developing longer-term (the 5-20 year timeframe) and wider service vision was made possible through the multi-disciplinary groups, enabling consideration of spatial and infrastructural limitations and opportunities using the scenario planning workshop method.
- Whilst there has been a steady upward trend in A&E activity over the past thirty years, and increasing burden and cost of A&E demand there are opportunities to improve approaches for an open infrastructure planning to minimise the disruption of changing demands and to maximise asset value.
- Literature and broader industry findings support the argument that Accident & Emergency Services cannot be considered in isolation as an island of special patients. It reflects weaknesses and strengths in other services and as such should be the focus for integration and the testing of innovative new approaches.

- The development of 'The Big Front Door' model, and its use for debate and discussion with clinical teams, demonstrated that whilst attendances are currently rising in A&E, there is a possibility of reconfiguring services around acuity. This study has shown many trusts vary in the approach employed to 'filter' the flow of non-ambulance attendance at A&E, the need to restrict or limit access, allowing better ambulance access, or widen the 'front door' to enable faster assessment and turn-away rates. The evidence still remains inconclusive, however this study starts to elucidate some of these approaches against a responsive, scenario-based *open* approach to infrastructure planning.
- This study has presented six key findings in scenario-planning for A&E, including: tidal flow (to accommodate the movement of key staff and patients); acuity streaming (the design around patient and treatment severity); spatial proximity and flexing (the arrangement of space according to staffing patterns and to cope with flux in demand); built-in redundancy (flexible, universal and non-specific rooms); co-location around diagnostics (supporting efficient operation and through-put) and change-ready estate (variability in shell and core/fit-out space to accommodate change).
- Open scenario planning can be a valuable form of analysis for decision-making at a number of levels. The Inselspital considers a high strategic level, where the thinking and techniques of scenario planning can be applied to whole sectors of an economy or at the strategic level of public policy. Through the application of Open Building principles for 'flexing' at the micro-level, to handle uncertain futures, or even at the inception of a project and in its development within an organisation, or part of an organisation. The application of flow can also be understood on a larger building scale and in the development of strategic and integrated business cases that create a buffer and resilience in capacity between organisations and buildings. Advancing networks such as "Trauma" are having significant impact at a clinical scale, but planning for built infrastructures must keep pace.

ACKNOWLEDGEMENT

The authors wish to thank the UK Engineering and Physical Sciences Research Council (EPSRC) for funding the work of Health and Care Infrastructure Research and Innovation Centre (HaCIRIC), which has in part funded work at Loughborough University and University College London (The Bartlett). Additionally, the time given by all the collaborating NHS and design professionals, and Prof. Andrew Price who is funded by the School of Civil and Building Engineering, Loughborough University.

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