Design the Smartest ED

The Royal College of Emergency Medicine

This report is authored by Susan Robinson, Philip Astley and Grant Mills as a record of the "Design the Smartest ED: Process, Space and People" conference held at Downing College in Cambridge on July 7-9th 2014. This event was possible because of the inputs of the following people.

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PREFACE

The opportunity to build or refurbish an emergency department happens rarely, but when it does, it provides the chance to design a modern space that inspires and intuitively supports effective, efficient and safe patient care. In doing so it is important that it provides the flexibility to meet future developments in healthcare technology and increasing patient volumes. To achieve this, it is important that senior clinicians are engaged with the planning process to ensure the design facilitates the delivery of modern emergency medicine, promotes the well-being of patients and enhances the experience of staff.

It was whilst working with Phil Astley and Richard Hind from the UCL, on the new Health Building Note for emergency departments (ED)[1], that I realised the need to challenge old fashioned dogma regarding design. This is the challenge addressed by the Smartest ED conference.

This document reports on a conference held at Downing College, Cambridge in July 2014. It facilitated a purposeful interdisciplinary dialogue between clinicians, and service and space designers. It created a supportive conference environment that we hoped would permeate through into the planning and design of projects (new or refurbishments) across the world. We aimed to achieve a common understanding of ED in terms of process, space and people. The conference used lectures, practical exercises and the review of retrospective and live case studies. This was supported by multiple break-out opportunities to discuss specific challenges with both faculty and, clinical and design specialists amongst the delegates.

Participants were challenged to consider their processes, before attempting to design - because simply transferring old processes into a brand new building will not be successful. From my own experience I know it is vital clinicians ensure their processes are the very best they can be. If we can do this then the design of space might just facilitate the delivery of effective modern emergency care.

The feedback we received was overwhelmingly positive; we believe the interdisciplinary nature of the course and the open environment embraced by all participants was key to this. This document aims to summarise the information presented during this event so it can be shared with colleagues who were not able to attend; maybe to inspire action in the pursuit of the smartest ED.

Susan Robinson, Course Organiser

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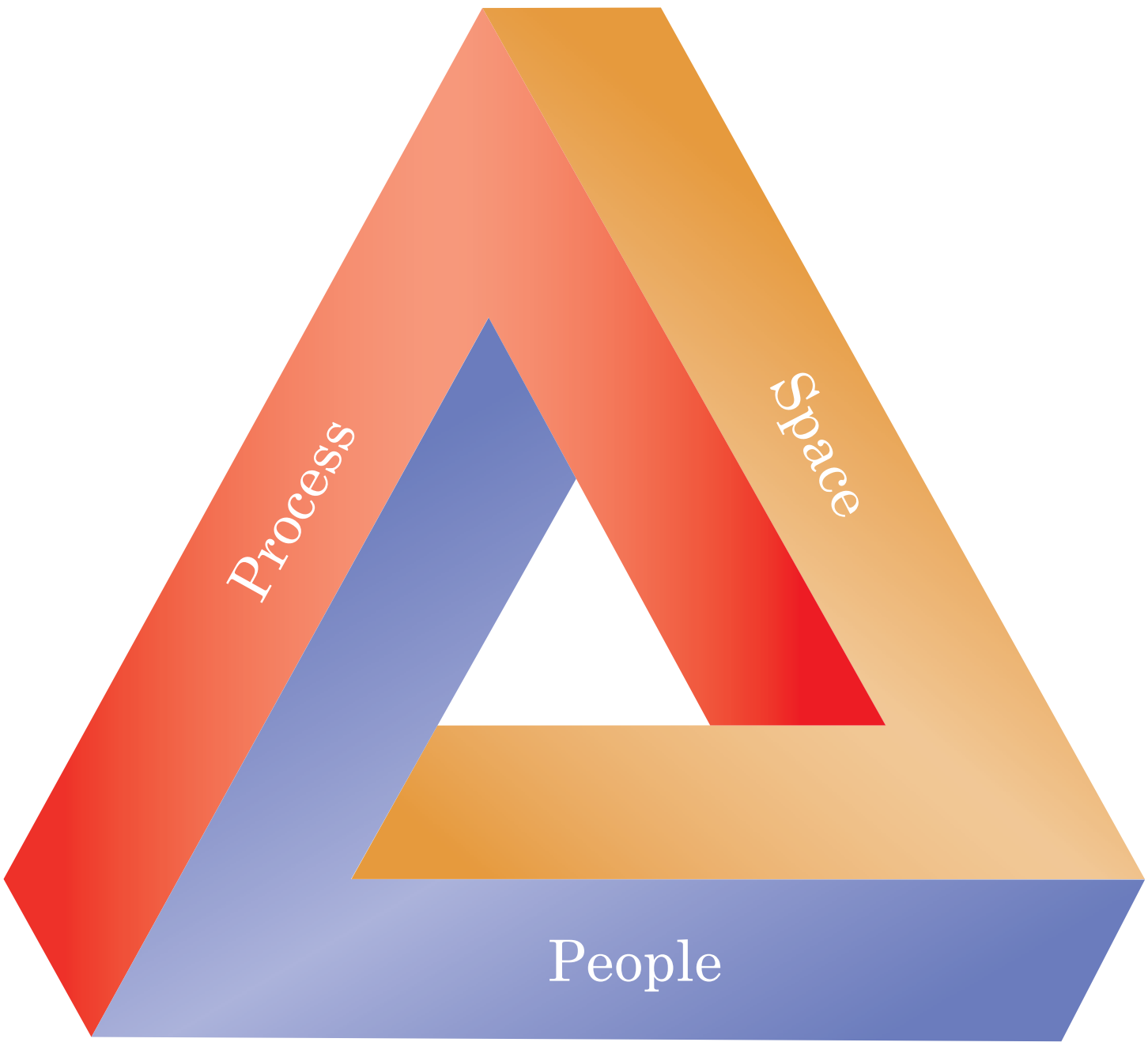
1. DH, 2013. Health Building Note 15-01: Accident & Emergency Departments: Planning and design guidance, In: Department of Health (Ed). Crown, London.

This conference set out to challenge the way that we think about the integration of three things: Advancing ED process design (Processes); Spatial ED design that is responsive to clinical service (Space); both of which that contribute to a team dialogue (People).



KEY SUPPORTERS

The Royal College of Emergency Medicine is amid an emergency crisis. The money given to the NHS to fix the problem in 2014 (circa ~ £640m) was a valuable short term fix. However, there are still significant problems from within and outside the ED. One of the most critical is “exit block” that is harming some 500,000 patients every year and wasting more than one million patient hours.

Exit block is a problem that has wide reaching consequences, on for example ED recruitment, and in tying up ambulance crews. But there is significant optimism. We are incrementally aligning policy and tariff funding, we are delivering multi-agency working and strengthening the employment landscape. This initiative, run by Sue, is another that will almost certainly support future effectiveness and efficiency in ED operation.

The value of spatial design is often underexpressed. RCEM fully support this interdisciplinary dialogue and we are proud to be part of an important event such as this, which ascribes greater value to spaces that support clinical services.

Cliff Mann, President of the Royal College of Emergency Medicine

I invited delegates to “See things not as they are, but as they might be” and emphasised the need for ED staff, estates professionals and architects to work together in interdisciplinary teams to develop a common language. Their challenge was to be creative in how they drive patient safety, efficiency and staff satisfaction. I am pleased to say that all participants rose to this challenge.

James Lennon, Senior VP & AP International Leader Team ED, HKS

There is significant need for greater interdisciplinary working at the front-end of healthcare projects. The challenge is the rapid pace of changing diagnostic technology and advances in clinical service design. To keep pace with these innovations, professionals in the built environment must be agile in melding the science of ED medicine with that of architecture (and project management). This is an excellent endeavour which I wholeheartedly support.

Prof. Andrew Edkins, Head of School, UCL Bartlett School of Construction & Project Management

The conference provided an excellent opportunity to explore important issues relating to the spatial design of Emergency Departments. We were delighted to have been involved with the Royal College of Emergency Medicine in the build up to this conference and we hope it will be the trigger for future valuable research.

Prof. Andrew Price, Professor of Project Management at Loughborough University

1. ESTABLISHING A DIALOGUE

"Thinking about the relationship between space and cognitition is underexplored (given that the average ED doctor is interrupted 9.7 times an hour)"

Setting the scene on the complexity of the problem and value of interdisciplinary communication.

Key Processes, Metrics & Goals in the UK
Susan Robinson explained the critical need for a shared understanding of the key processes that operate within the ED, and the metrics by which ED's and their staff are judged. Without this, a new facility may not facilitate the effective delivery of processes against key metrics and standards.

Challenges include the increasing consumerist expectation (with many now viewing the ED as the health equivalent of the open all hours supermarket), difficulties in the recruitment and retention of staff and the sheer number of processes that make up the system.

Regular, ongoing and incremental improvements in working processes, rather than a single large scale review triggered by a new build project, is the only way to keep pace. Delegates heard that measures of quality, clinical outcomes and patient experience are driving change and the impact of poor performance is becoming clearer. Reports such as those by Francis and Keogh, the regulators (Care Quality Commission and Monitor) and the press are publicising the risks and assigning responsibilities for poor outcomes. Design teams must pay greater attention to key processes in the ED such as triage and assessment, infection control and the provision of privacy and dignity. Designing in quiet space for staff to think and process complex information is critical given the average ED Doctor is interrupted 9.7 times an hour. The ED Doctor spends two thirds of the time managing 3 or more patients. The average ED Doctor has 7 "breaks in task" an hour [2]

2. Acad Emerg Med 2000;7:1239-43; Ann Emerg Med 2001;38:146-51

"Consider three levels of planning - strategic, site and operational"

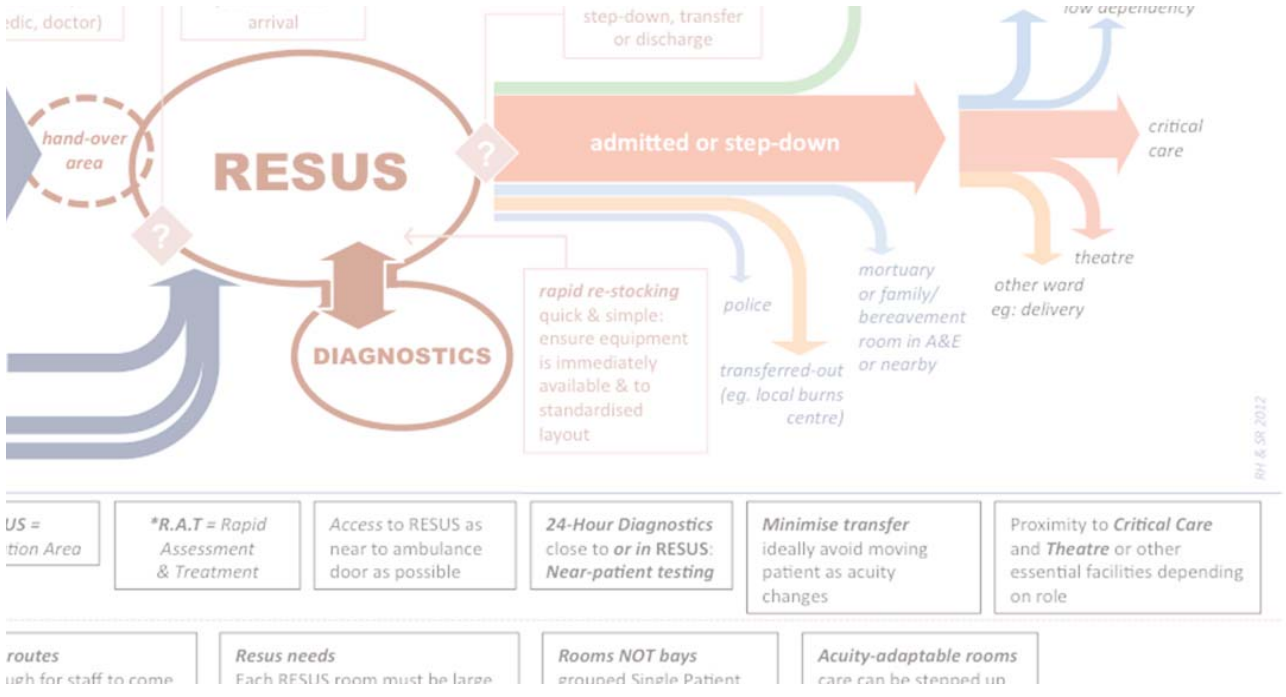
"Think about the functional intent of waiting spaces and the management of patient behaviour"

Understanding the HBN 15-01

Richard Hind provided an overview of the updated health building note (HBN 15-01), which was published in 2013. The standard was deliberately non-prescriptive and focused on the clinical process, rather than the spatial solution. It aimed to illustrate the intended outcomes of design at three levels of planning: strategic (wider commissioning and provider partnerships), site (adjacencies across the whole hospital between the ED and other departments) and operational (zones, flows and local adjacencies within the ED). The guidance was designed to outline the nature and volume of flows through the ED system. This can then be used to facilitate local discussion within the design team as to how these processes operate for a specific ED. HBN 15-01 also provides 10 thematic perspectives such as resilience, culture, security, support and infection control, while critical design considerations include: spatial requirements focused around patient activity and equipment, standardisation, acuity adaptability, single patient rooms, chair centric areas, interruption-free zones, quality natural lighting, and communication.

Contemporary EDs and their Operational Methodologies

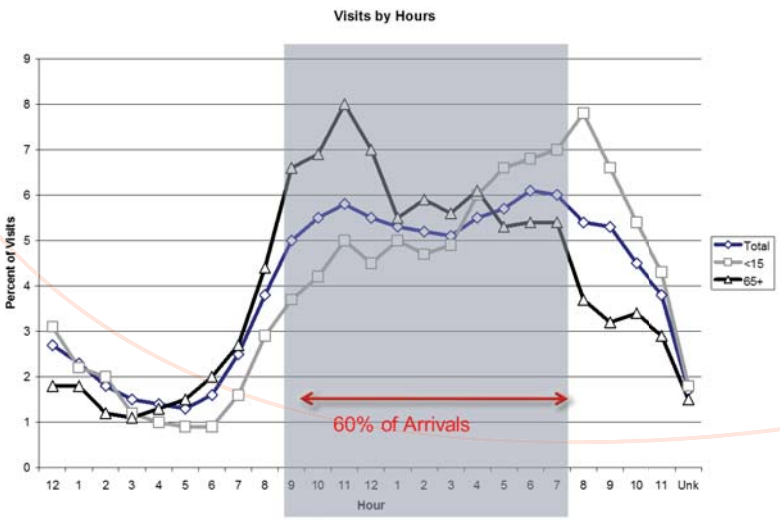
Frank Zilm detailed the operational methodologies that have been used to design contemporary ED environments in over 65 projects and described the nature of the design process. A number of key design principles were presented, which included defining waiting spaces with greater functional intent such as results waiting, using chair centric strategies, and managing patient behaviour (for example mental health). Three fundamental topologies of ED layout were presented. These were the "ballroom" (treatment rooms around a central core of support areas), the "pod" (clusters of rooms around multiple support areas), and linear/inner core" (a long support space banked on either side by rooms). All can be evaluated against efficient patient flow, minimising staff travel, maximising staff interaction, staff scaling, resilience, flexibility to accommodate future growth and the overall net/gross ratio. Three case studies demonstrated the practicalities of each topology: Mease Countryside Safety Harbor, Florida (a ballroom), Tampa General Hospital, Florida (a Pod space) and St. Vincent Infirmary Medical Center, Arkansas (an example of a linear design).



2. ADVANCED ED DESIGN

"The last thing we want is for the building to be the constraining variable"

Investigating specific methods of demand analysis and queing theory and simulation.



Demand Analysis

Frank Zilm outlined the methods for analysing demand (which determines the number of treatment rooms required). This required analysis of special cases (such as low acuity, those with mental health, behavioural problems or older people) that, once understood, could help ensure that the building does not become a constraint at peaks periods of demand. The fundamental two units are "arrivals" and "length of stay". In terms of arrivals, demand changes from one year to the next (due to changing population, population health demographics and consumer expectations), which has a significant impact on the design of new facilities. Increases of demand of 25-50% during the hospital planning period are not uncommon, requiring remedial actions such as the conversion of single rooms to twin rooms. As such, it is important to look ten years into the future. There are variations in seasonality (seasonal index visit variation around the average that can be used to compare hospitals), utilisation rate, arrival by day of week, and by hour. All of which can be further interrogated by patient age and condition. Scenario planning techniques can be used to investigate what would happen to treatment rooms at peak demand. A range of scenarios from "lean and mean" and "what if we're wrong" can be explored to predict the influence of events on demand. For example events such as policy change, closure of a nearby hospital, population growth and a change in the patient mix. The length of stay, across the full care pathway, must be considered to include lean process improvement and adaption to common reasons for delay. Management of low acuity patients, those patients with behavioural problems and older patients are all known to be reasons for delay, as are the separation of paediatric flows and use of dedicated staff and age adaptable spaces.

"Time is a non-functional thing. If there is a gap, we cannot store capacity. Down-time is waste"

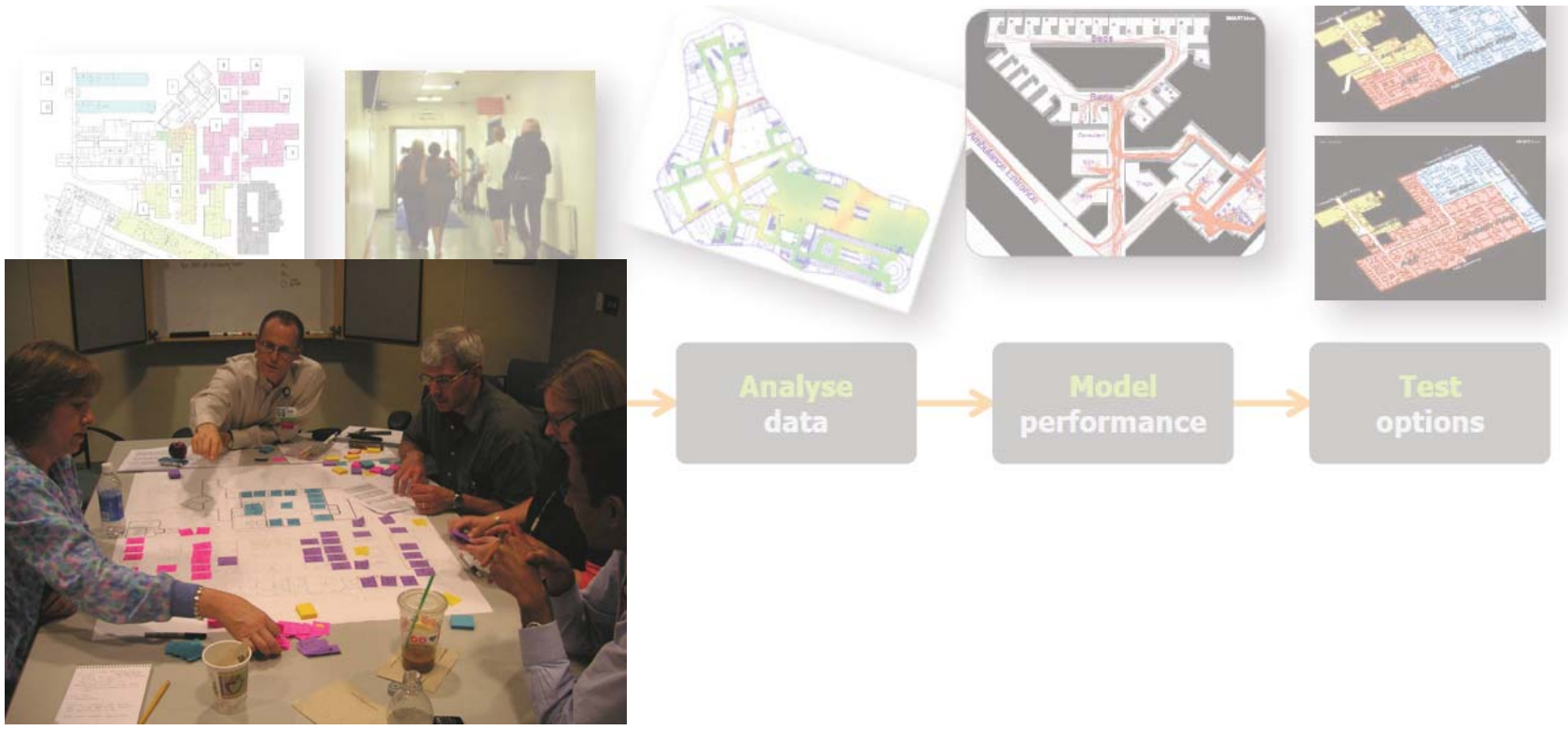
"Gather evidence in real-time to ensure that facilities are designed to optimise operational processes and enhance patient experience"

Fundamentals of Queuing: Theory and Simulation

Frank Zilm described the fundamentals of queuing theory and simulation. Simplistic and deterministic rules for understanding the relationship between demand (number of patients x length of stay) and capacity (and utilisation) can be applied, but there is considerable variability that requires more advanced simulation. Focusing on queuing is important for a number of reasons, such as patient safety, patient and staff satisfaction, and the ripple effect and cost on other operational areas of the hospital. Mathematical queuing theory tools (which describe a single flow) can be used to model random/average arrival and length of stay. Advanced simulation tools (such as Simul8, Flexsim, ExtendSim) can illustrate changing rates of arrival (by hour and day) and can model multiple queues. These can test changes in process and layout flow. Paper simulations can also complement computer simulations to facilitate discussion on a building plan.

Smart Space: Optimising the Interface Between Space, People and Processes

Becky Hayward outlined work being undertaken to understand the interface between space, people and processes. Congestion problems are identified and alleviated using real-time visual CCTV surveys, threshold sensors and virtual reality / 3D dynamic patient flow modelling. The importance in gathering evidence to ensure that facilities are designed to optimise operational processes (to minimise consumption of resources) and to enhance patient experience was emphasised. This approach uses scenario planning, options development and patient flow modelling in conjunction with acquiring robust data on space utilisation, energy consumption, patient throughput, as well as the experience of patients, visitor and staff alike. Various advanced simulation techniques were demonstrated using case studies from Queen's Hospital (Romford) and RUH Bath.



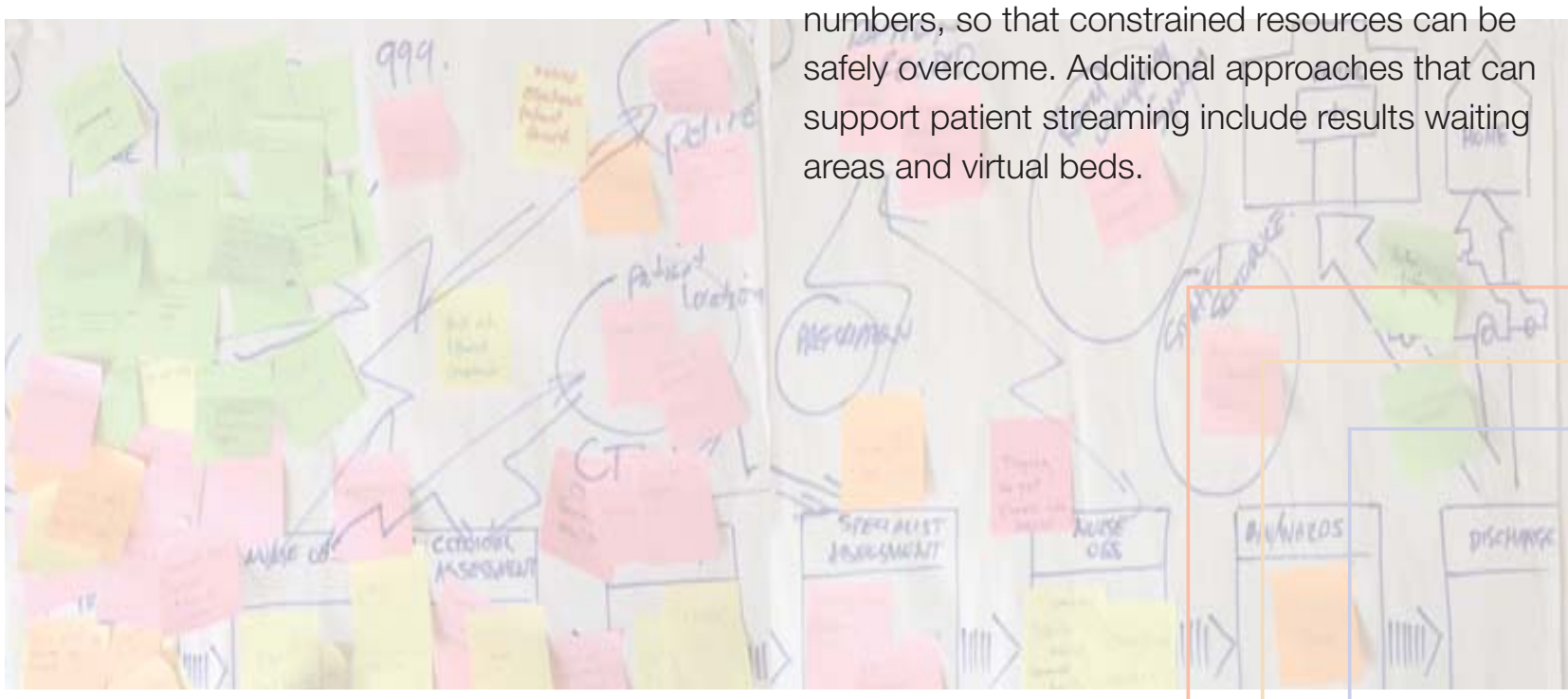
3. DESIGNING FOR ACUITY ADAPTABILITY AND SPLIT FLOW

"Splitting flows into acuity levels will increase throughput and responsiveness"

Exploring advances in the modelling of flow using principles of acuity adaptability

Lean Design: the Split ED

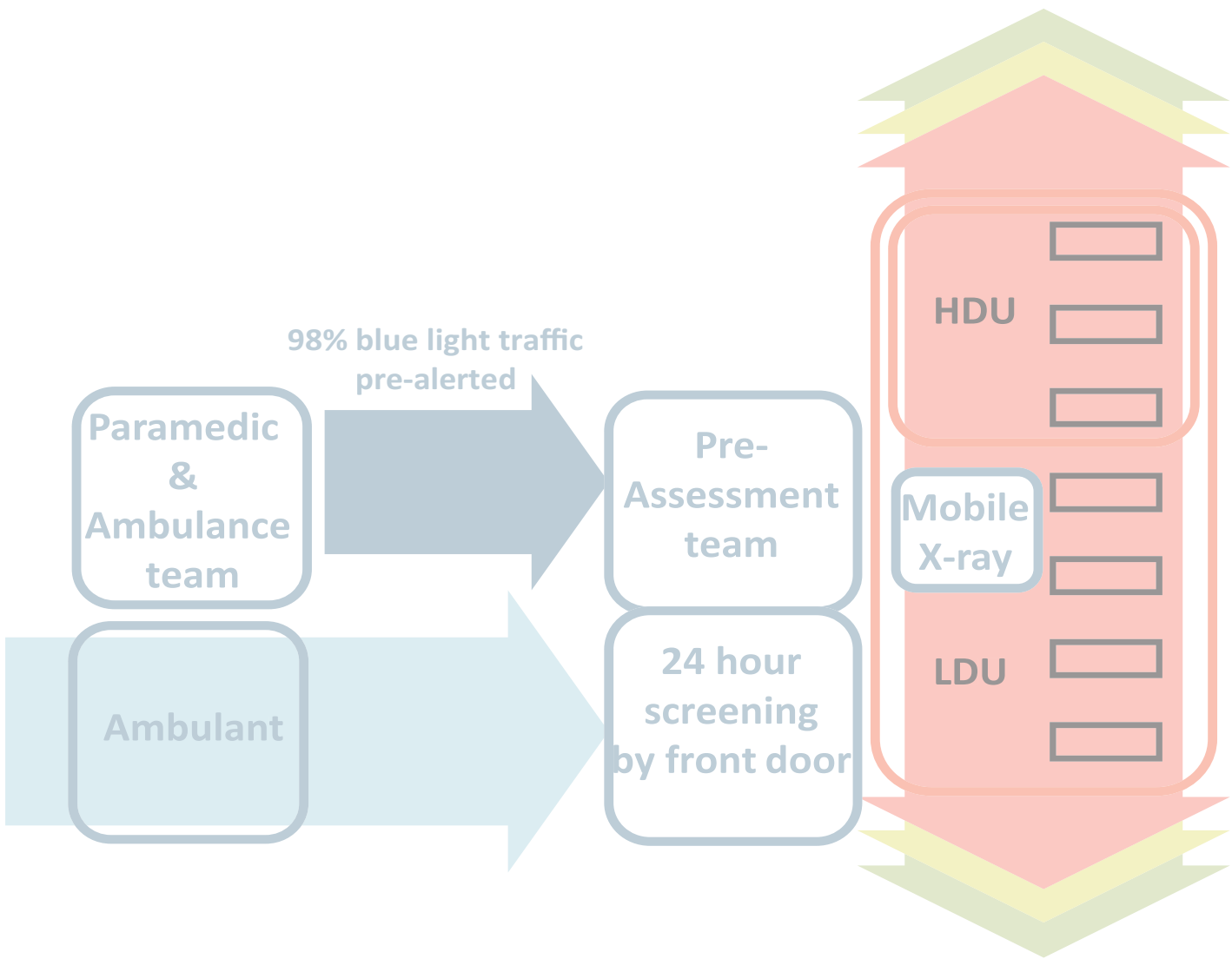
Jody Crane described the general application of lean principles (e.g. value stream mapping, waste elimination, flow and continuous improvement) to understand site-specific split ED flow. Value stream mapping models the flow of various service activity groups (called families – categories of patients that have similar diagnostic and treatment pathways). Patient categories are split by acuity level to increase throughput and deliver a more responsive service. The ratio of walk-ins to ambulance arrivals, the acuity mix, admittance rate and hospital status will inform the design of a teaching hospital or Trauma centre. In addition patient type, chief presenting complaint, anticipated resource response and triage level can characterise the patient segment. Arrivals using any triaging system can be used to describe the hourly acuity variation. As examples of different acuity streams - new super-fast-track approaches (such as a patient specific group technical trolley) can be located in or near triage at specific times to promptly treat patients who require low resource utilisation. Mid-level acuity requires physicians in triage and multi-disciplinary assessment and treatment by an intake team. Acuity streams and delivery methods can also be responsive to real-time inpatient bed numbers, so that constrained resources can be safely overcome. Additional approaches that can support patient streaming include results waiting areas and virtual beds.



"Acuity adaptable design and the seperation of systems into levels can increase adaptability"

Decision Management for Acuity Adaptability
Phil Astley and Rachel Northfield explored front-end decision making and the need to engage in the consideration of acuity adaptable design and be responsive developments in technology. Design strategies should enable the clinical team to better monitor the change in patient condition. The design, particularly of treatment spaces, should flex up and down to respond to high to low acuity levels.

Research has shown that front of house areas must be adaptable to change. In a 15-20 year period community based screening strategies will support ED capacity planning. All of which indicate that it is time to rethink the ED front door and to think about the thresholds between it and other acute wards (such as emergency assessment units). Acuity adaptable design places the patient in a single space that can adapt to changing patient acuity. It allows the patient to remain in a single room, therefore reducing medication errors and it increases health professional contact time. There are potentially significant impacts of this on team resource, the cost and scale of buildings and so further research is needed to demonstrate the benefits of acuity adaptability



4. ED DESIGN CHALLENGES

Discussing the challenges posed by specific patient groups.

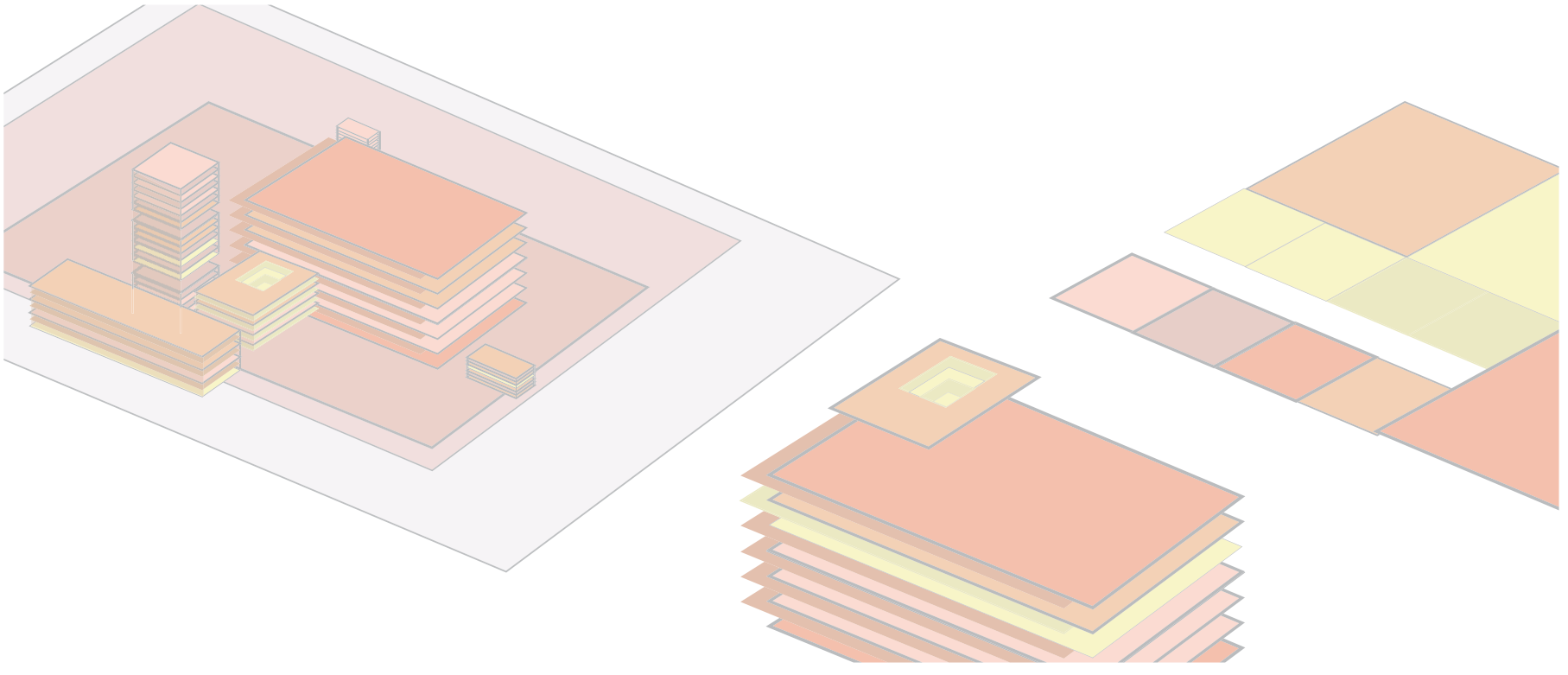
Older Patients

Efthimia Pantzartzis presented a series of ED design features that respond to those older people who might present with sensory, cognitive and physical impairments; which may be more pronounced in those with dementia. These case studies were collected on behalf of the Department of Health and were part of a national dementia programme which provided £50m capital funding to 116 NHS and social care pilot projects. The key considerations in designing an ED department are: accessibility, navigation and travel distance, information and communication, safety and infection control, security, staff support and waiting times. A range of design elements were described that responded to thirteen key design criteria for example: (1) Reduced safety risk (e.g. matt, even coloured floors, handrails, and flexible control lighting), (2) Provision of a human non-institutional scale, (3) Good visual access, (4) Promote orientation (e.g. visual cues, clocks, calendars and memory boxes), (5) Support way-finding and navigation (e.g. colour-coding, art, signage), (6) Privacy and dignity (e.g. screens, blinds and cultural difference), (7) Movement and engagement (e.g. legible layouts, outside access, short corridors and resting points), (8) Appropriate stimulation and acoustics, (9) Independence (e.g. toilets with handrails, hoists, safety alarms/ devices), (10) Support diet and nutrition, (11) Access to natural light (e.g. roof-windows), (12) Optimum lighting and contrast (e.g. adjustability), and (13) Contact with friends and family (e.g. outdoor access, seating areas).

"Great EDs have a flat length of stay across the time-axis"

Staffing the ED

Jody Crane and James Lennon explored the critical connection between staffing and ED space design. Defining arrival demand and variation in that demand, provider (physician, nurse, etc.) productivity and variation in that provider capacity can be used to determine how many people can be seen per hour and therefore how many rooms are needed. There are significant variations in demand, for example seasonal variations account for significant changes. To design spaces we must consider strategies to cope with the demand for the busiest hour, on the busiest day, in the busiest week of the busiest year. In addition, staffing strategies need to accommodate variations and integrate part-time staffing, preferential vacations and snowbird scheduling. There are variations in patient arrival (e.g. weekend volume is lower than weekday, Mondays are often the busiest and have the highest acuity and paediatrics will have higher attendances at the weekends and evenings). The acuity of arrivals can also be used to characterise the variation. Furthermore, the level of occupancy and boarding needs to be factored into the demand calculation. Ideally, local time studies / activity analysis case studies will be undertaken in which nurses and physicians are followed, to understand how time is spent and where improvements can be made. The adherance to the ideal / ratio-based rules, such as 4:1 patients to staff, does not take into consideration day-of-week variations. There are also variations in length of stay in response to changing demand, but successful organisations are responsive to demand changes and keep a consistent length of stay. The impact of misaligning staffing and demand is significant and large scale savings are possible if day-of-the-week and hour-by-hour staffing can be designed to respond to demand.



"Pre-wired surge capacity design features could, in a disaster, enable a five times increase in capacity"

Disaster Preparedness by Design

Mik Pietrzak demonstrated the importance of disaster preparedness to cope with surge capacity through design. Work funded by the military showed how the design process can accommodate regional and facility contingency. Scenario-planning can help in understanding of possible threats, and support the indentification of minimal impacts and resource responses. Examples of pre-wired surge capacity design features were included in parking areas (e.g. for demountable tents). Responses were scalable to respond to different disasters (e.g. single treatment rooms scalable to twin rooms, corridor space to accommodate hallway beds, chair centric treatment, multiple triage-based / lobby treatment, infection-separated triage, flexible garage-based solutions, multiple helipads, movable labs and de-contamination areas). Pre-wired surge capacity design features could, in a disaster, enable a five times increase in capacity, as demonstrated at Tampa General Hospital in Florida. The alternative option to hard plumbing and wiring is the freestanding ICU bed option (such as the aeromedical base unit) and other folding bed systems. In addition point of care testing (e.g. POC Tech) can support quick diagnostics and treatment and so achieve higher throughput. Finally, wider infrastructure resilience strategies such as power, water, air and communication require greater exploration.

Advanced Technologies and Design Implications

Mik Pietrzak described the new technologies that are challenging the future design of EDs to improve clinical outcomes, efficiency, safety and patient / staff satisfaction. Specifically, new approaches include hand washing agents and monitoring regimes, new non-touch technologies, advanced textiles and nano-technologies/coatings, whole room decontamination/UV/fumigation, safety and environmental control flooring, bathroom solutions, advanced ventilation systems and advanced diagnostic technologies.

"Human Factors Ergonomics (HFE) is the study of human interactions with things and people in systems at a Micro (individual), Meso (team) and Macro (organisation)"

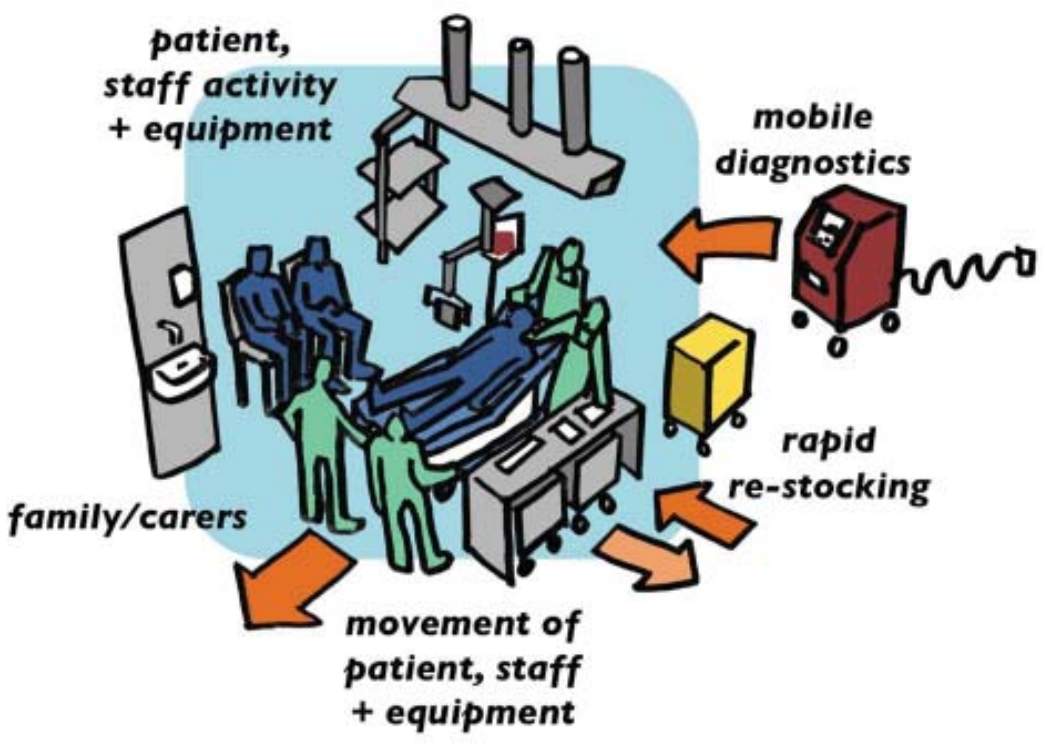
Improving Staff Experience Through Ergonomics and Design

Sue Hignett showed how ergonomics and design can be used to improve staff experience and the importance of these fields to the health sector. A National Quality Board Concordat (2013) was signed by leading policy and regulation authorities. This is a commitment to raising awareness and promoting higher capability / best practice in human factors principles and practices in healthcare. Studies into the development of smart pods to reconfigure urgent healthcare delivery were detailed as were applications of task and link analysis to understand clinical functionality. Activity location analysis showed that junior doctors spent more time in the nurses stations (51%) than the treatment bays (34%) and senior doctors spent more time in the treatment bays (54%) than the nurses stations (39%). It also showed that synchronous communication and direct care were performed by all staff groups more than report writing and reading patient information. The work of the Proactive Safety Risk Assessment Toolkit (The Center for Health Design, CA) was shown to define the risk components of infection control, patient handling, medication safety, falls, behavioural health and security.

"There is often a rush to fix the 'business case' and a reliance on traditional guidance. Clinical leads can feel rushed to 'sign-off' design"

Decision Making and Design Freeze

Phil Astley and Anne Symons highlighted the need for strong clinical leadership to challenge design adjacencies, rethink clinical support spaces and define new medicine management systems in ED. A project continuously needs to engage in design review. This can ensure service and equipment changes (and advanced technology) are implemented and that design requirements for these technologies are planned. The client's key role is to get the level and timing of engagement and governance right. Considering the client and user as co-investigators, so they perform their own gathering of evidence, is key. It is important that design is unique (e.g. responding to specific local staffing ratios). In addition, it is important that the team agree with innovation and new concepts (e.g. chair centric, acuity adaptable, staff changing). Finally, the patient's view point should be taken. A wholesale review of current design guidance on clinical support areas in ED is required to understand the introduction of new technology and medical management, patient monitoring and storage items.



5. ED DESIGN CHARRETTE

Participants were formed into interdisciplinary teams and provided with a brief to design an innovative new emergency facility to serve a given catchment population. Interdisciplinary teams were made up of ED consultants, clinical operations managers and spatial designers. Participants were tasked with developing a design layout that addressed operational issues at a department level. They were to think about adjacency, zones and patient flows. Teams considered split process flows and responded to various patient types and acuity-level presentations. Design solutions were required to be flexible and adaptable to changing demands.

The groups developed design scenarios, the majority of which proposed flexing between acuity levels. These were supported by technology, mobile equipping and mixed low dependency with chair clinic concepts. Teams described large front of house spaces for patient hand over at the front door.

Five design solutions were selected by judges to be presented by their teams. They received comments and feedback. The winning design solutions used a linear design challenging the notion of what is fixed and what is flexible equipping to enable acuity adaptability. They were expandable, and used innovations at the entrance such as chair centric, tablet computer use, self-check in kiosk, tracking technologies, physician directed queues, specialist (patient specific) group rooms, diagnostic and infection control technologies and results waiting areas.

The winning designs had carefully considered the rapid and multiple screen / diagnosis and treatment procedures that were required close to the front-door and the streaming of patients and their penetration into the building. They had also considered the location and movement of family and friends. Natural light for staff and patients was a key priority as was compactness and streamlined design with no wasted space.

Key design challenges included: The position of the central nursing station, the use of a single or split waiting area, split entrances for pediatrics, ambulance and walk-in, determining the right number of cubicles for majors, minors and resus and the number and location of toilets.

Some designs were criticised because the location of Trauma/Resuscitation was too isolated, to allow good supervision in period of minimal staffing (e.g. starving the main central nursing station to attend to Resus). Additionally, some designs fell down on the mixed acuity flows (e.g. trauma flows crossing lower acuity spaces). The potential problems of family members disrupting staff and issues of privacy and dignity were also raised in evaluation.

All teams created workable solutions and many remarked on the benefits of the interdisciplinary dialogues that they had with their team. A panel of judges awarded a prize for the winning design.

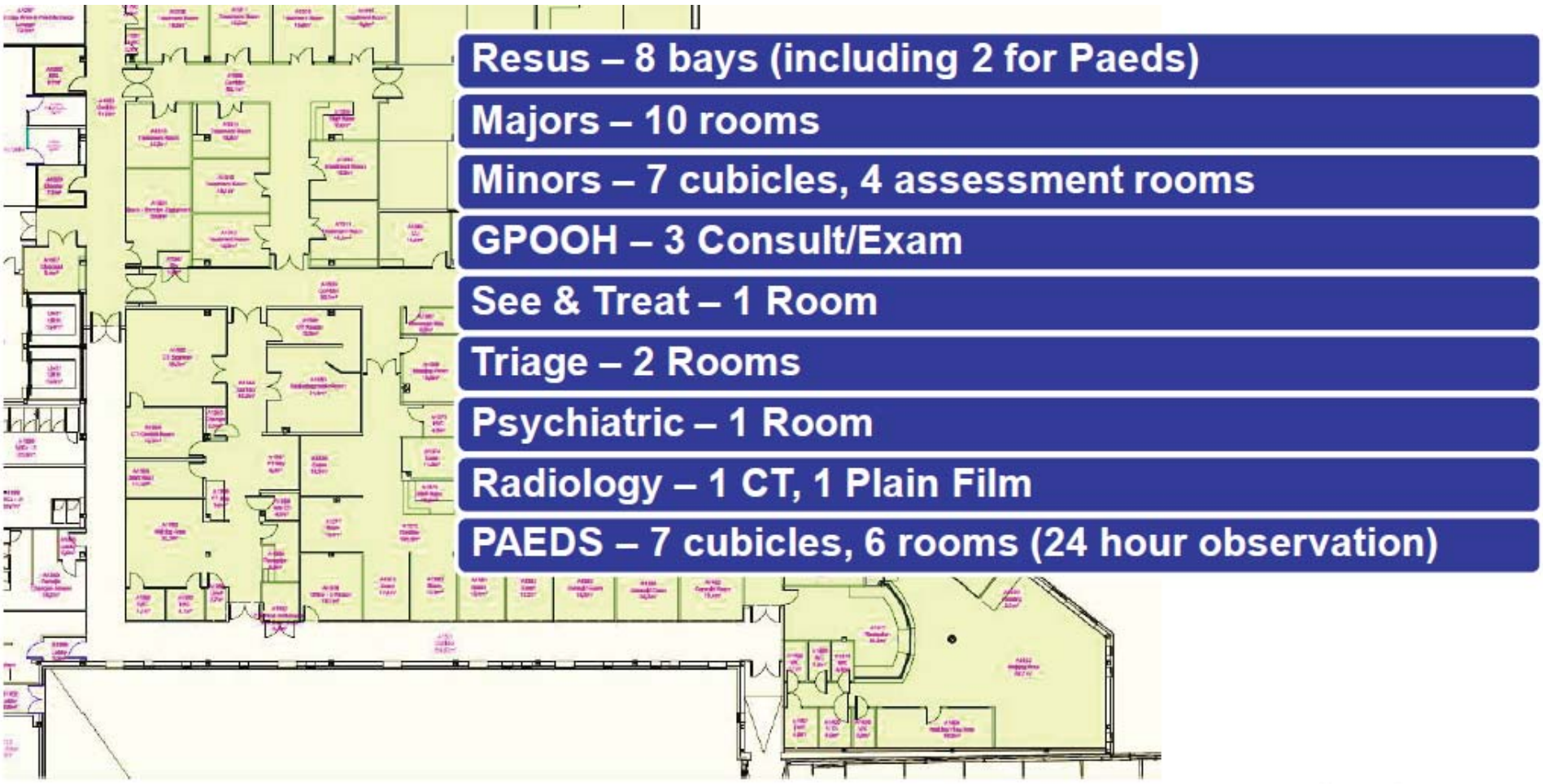
6. CASE STUDIES

Lessons from five design solutions were presented. In addition, live interdiscplinary project teams informally huddled around designs and invited members of the faculty and other delegates to provide constructive critic.

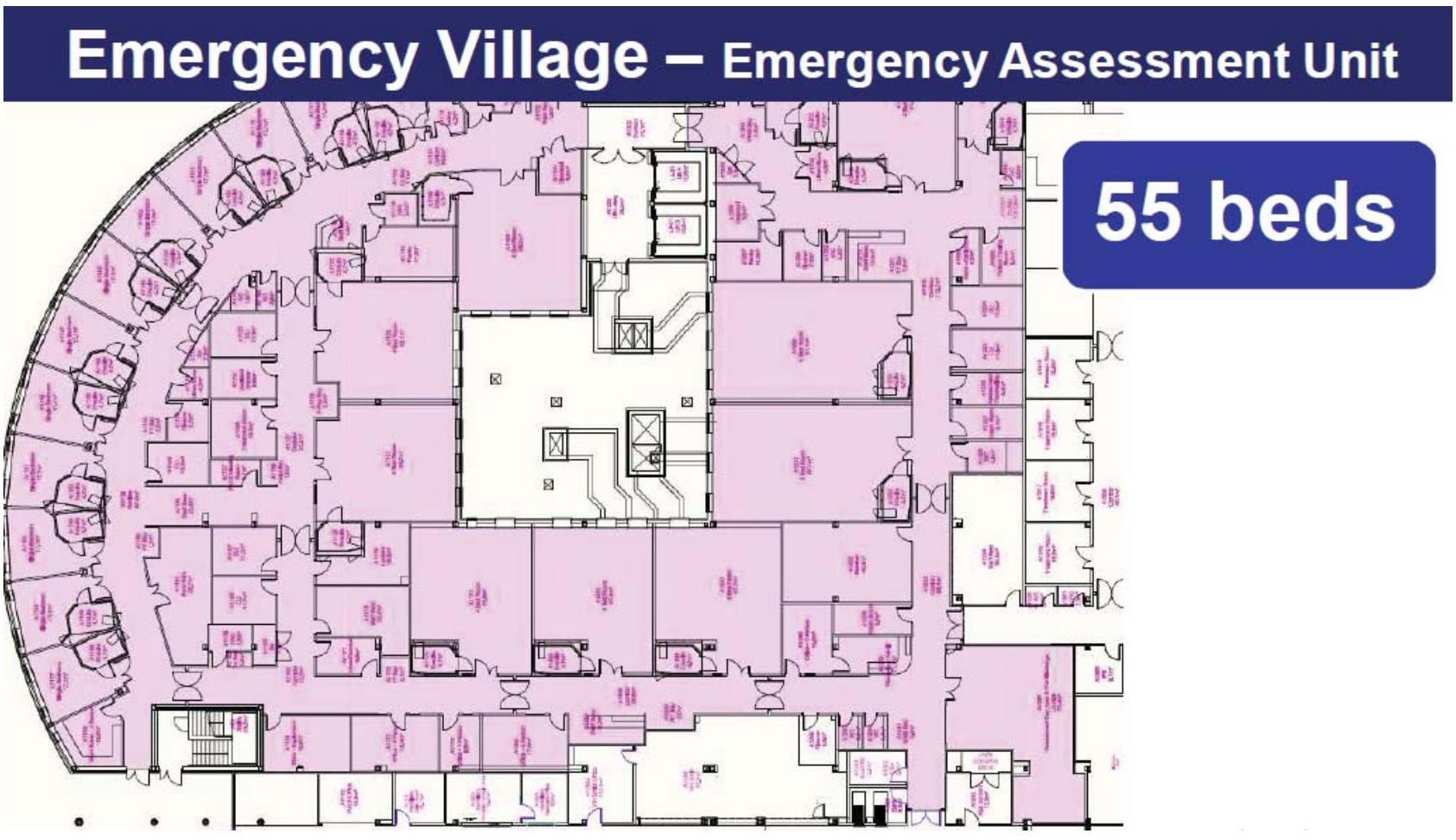
SALFORD ROYAL NHS FOUNDATION TRUST

Lindsay McCluskie and Dr Martin Smith described Salford Royal's experience of the design process and satisfaction with the outcome for a whole site PFI redevelopment for a renal, children, critical care and an emergency village that replaced four old and out-of-date buildings. Salford Royal is an integrated provider of hospital, community and primary care services (including a University teaching trust) which employs circa ~ 6000 staff and has 870 beds. It provides local community services, outpatient, ED and general emergency surgery. It also provides specialist neurosciences, intestinal failure, stroke, trauma, dermatology and renal to Greater Manchester and beyond.

The challenge was to design a flexible footprint for an ED required to cater for circa 90,000 patients (including 17,500 paediatrics). The population has a high incidence of cardiovascular, respiratory, gastro-intestinal and alcohol-related problems. The emergency village included the co-location of resus, majors, minors, paediatric observation and assessment areas, GP Out-of-Hours and Walk-in-Centre, an emergency clinical decision unit and a medical and surgical assessment ward.



This facility has already responded to changes in requirements demonstrating the flexibility of the design. In addition, the geriatric assessment bays, 8 bay resus (with central staff base and no overhead x-ray), CT and radiologist in department, co-location of front-door and backdoor services and mobile phone have delivered benefits.



GATESHEAD HEALTH NHS FOUNDATION TRUST - QUEEN ELIZABETH HOSPITAL

Chris Shaw demonstrated the design of an extension to the core Gateshead hospital and re-location of the emergency department. This was designed to accommodate patients in the following spaces: circa ~ 3000 resuscitation room attendances, 41,000 minors receiving rapid assessment in pods, 7,000 majors in ED pods and 16,000 receiving generic assessment for medical and surgical in pods, in addition 8,000 attendances required a generic short stay in an observation unit.

As shown the ED was relocated next to technical diagnosis and treatment functions on Levels 2 and 3. This went some way towards improving way finding, reducing travel distance and making the main entrance more accessible (which was at level 2).

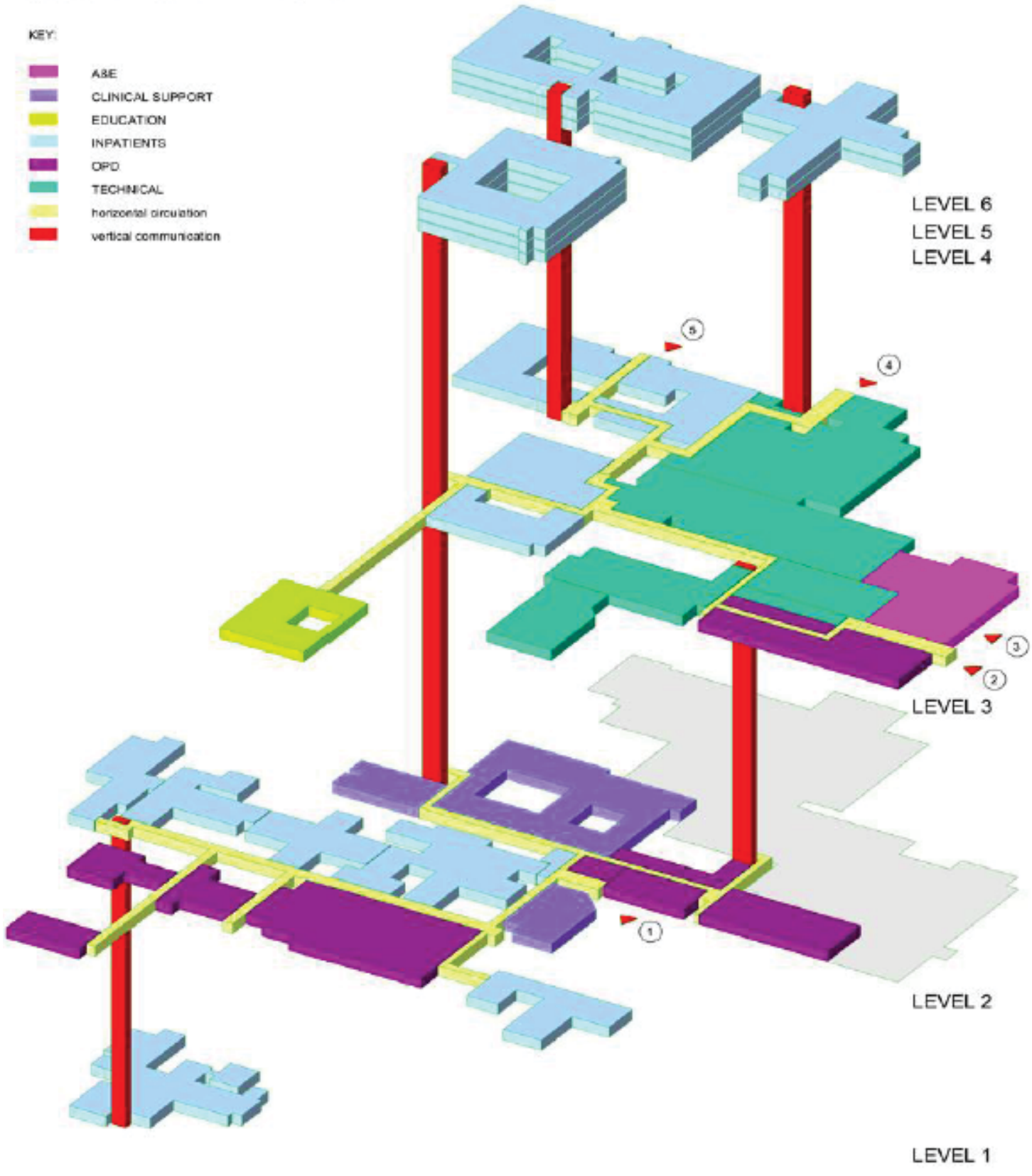
Staffing accounts for 90% of the building cost over its life, while design accounts for just 0.3%. Therefore it was critical to understand gateways and thresholds and to consider flow. ED was treated as one big room.

The various options and benefits of these options were presented. The chosen building scheme was a square form (which is most flexible and provides for multi-reconfiguration-options). This scheme provided improved site access points from level 2, created clinical connectivity between entrance, reception, registration, triage / assessment, diagnosis, support, and treat / transfer / discharge functions, and aggregate inpatient beds on Level 3.

QUEEN ELIZABETH HOSPITAL - WAY FINDING DIAGRAM

KEY:

- A&E
- CLINICAL SUPPORT
- EDUCATION
- INPATIENTS
- OPD
- TECHNICAL
- horizontal circulation
- vertical communication

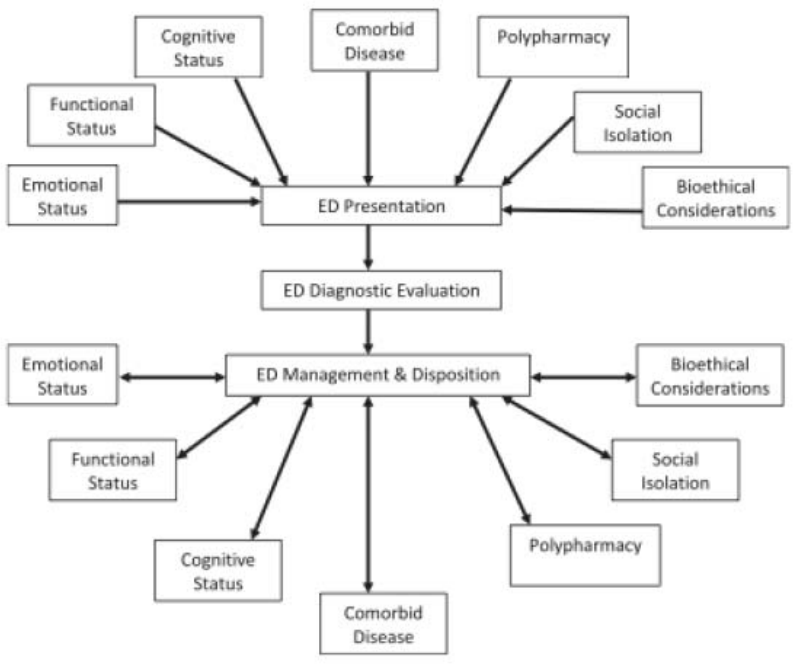


UNIVERSITY HOSPITALS OF LEICESTER NHS TRUST - LEICESTER ROYAL INFIRMARY

Jaydip Banerjee detailed plans for a new integrated ED department in Leicester that was designed around the frailty-friendly front door. Older people comprise 11% of breaches in the 4 hr emergency access target, 15% of medical admissions and occupy 25% of hospital bed days when admitted through the ED. An 18 trolleyed “majors” frequently houses 25 patients, a 7 bedded “Resus” unit that frequently fails to accommodate all those requiring a resuscitation bed, a 16 bedded clinical decisions unit (including 8 geriatric beds) that frequently operates at full capacity and compromises patient privacy & dignity. There are also poor clinical adjacencies and overcrowding.

A new advanced geriatric emergency care model was described that was based on the silver book. Specifically, a left shift from inpatient wards (designed to decrease LOS by increasing ambulatory care and discharge), to acute medical unit (with senior multi-disciplinary decision making in this unit and ED with primary care, ED consultants and geriatricians), emergency department (multidisciplinary input from PT/ OT and community matrons, greater access to intermediate / social care, front-line geriatrician input, information sharing and data management), 999 (improved integration via NHS pathways), community support (operational framework integration with GPs and access to specialist advice) and finally to general practice and GP out of hours.

“If the ED is designed for the most frail and vulnerable ... it will work for the strongest”



"A left shift of activity across the system as a function of time; means that yesterday's urgent cases are today's acute cases are tomorrow's chronic cases"

A specialist review group was assembled to review the design at key stages with discussion related to the development of the 1:200 departmental layouts (e.g. patient flows, location of frailty bays, ratio and arrangement of beds for privacy and dignity, lighting and location / arrangement of WCs and assessment/treatment areas), the discussion of 1:50 room layouts (e.g. specialist furniture, pressure sensitive mattresses and other advanced sensors, bed head services, sanitary requirements and patient entertainment/positive distraction) and the interior finishes scheme (slip, trip and anti-glare/confusion floor finishes, acoustic ceiling finishes, colour/cleanable wall finishes, recognisable and safe door finishes, older people friendly fixtures and fittings such as handrails, artificial lighting and artwork / signage.

CAMBRIDGE UNIVERSITY HOSPITALS TRUST - ADDENBROOKE'S HOSPITAL

Sue Robinson described her experience of the ED refurbishment at Addenbrooke's. This project aimed to address significant capacity constraints in the existing building and to allow the unit to cope with an increased major trauma centre workload, estimated to be 627 trauma patients with an ISS > 9 and a 6% year on year increase in general attendances.

The design process started with the initial principle to 'build a barn', and strong clinical engagement was only partially achieved.

What was achieved was: 7 resuscitation area bays, 7 spaces with 6 chairs (for chair centric delivery), 3 assessment rooms in the ambulance bay and 2 in the walk in entrance, 4 medication areas, a large open plan office for consultants, 2 small meeting rooms and a relocated teaching area.

The sizing of resus spaces was too small to accommodate interdisciplinary trauma teams. In addition, there were issues related to the lack of privacy and the impact on patient experience and dignity through the use of curtains. The medication areas are well liked by the nurses (as it provides quiet space to think and concentrate), which is likely to lead to reduced errors. Greater attention should have been paid to staff facilities as teaching and rest areas were markedly reduced. The refurbishment offered an opportunity to incorporate the Design Council solution to reducing violence and anti-social behaviour, funded by our local hospital charity - ACT.

"It is like building the aeroplane whilst flying it"

"resist just another refurbishment and devote the right amount of time to a gap analysis, business case and project plan. In addition review the care pathway, and pay attention to staff and patient experience and establish measures of success"

"there was a need to carefully consider decant, temporary space occupation and how areas were refurbished. Service continuity and communication throughout all of this is key"

THE WESTERN CAPE REVITALISATION PROGRAMME, SOUTH AFRICA

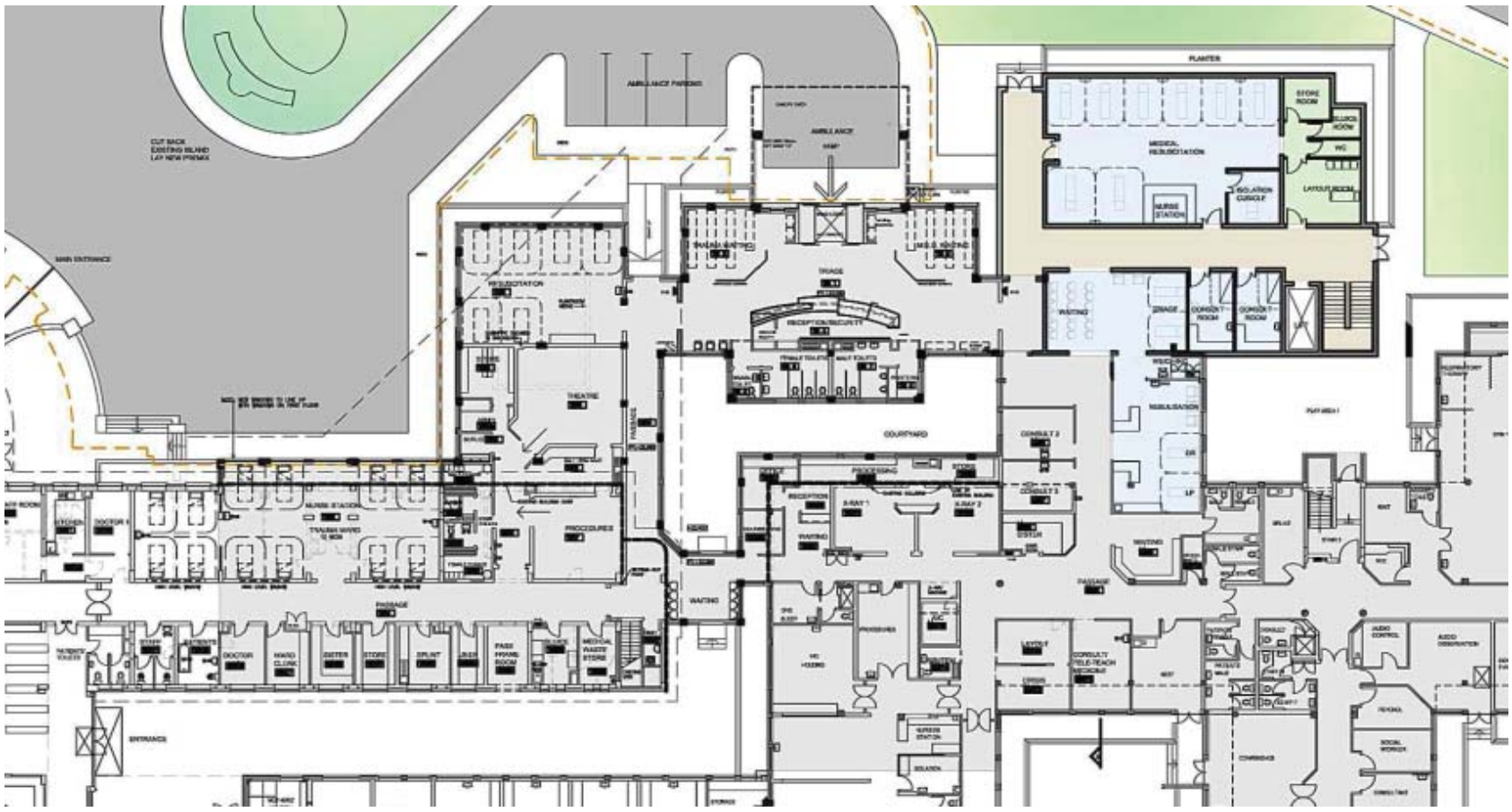
Lee Wallis provided insights from the design of ED's across South Africa to respond to constrained resources and staff shortages (both nurse and clinical). In addition increasing patient numbers and variable demands have increased the pressure on existing outdated spaces.

The Western Cape revitalisation programme, the National Ministry of Health EM review and the Council for Scientific and Industrial Research Infrastructure Unit Support Systems are involved in 41 hospital and 9 Community Health Clinic EDs, serving populations of between 10,000 – 50,000.

The case mix of these facilities includes 25% of a low-moderate acuity (green); 10% at a high acuity (red), 25% paediatrics and over 65 (10%) and 35% trauma. The admission rate is 50-75% and many patients are effected by TB (Multi-drug and extensively drug-resistant). The key was designing space to respond to the environment and the available resources.

The guiding design principles include triage, chair centric and overcrowding planning, Vertical Service Panel, workstation and limited staffing and consultation with other specialties. Some are pictured below.

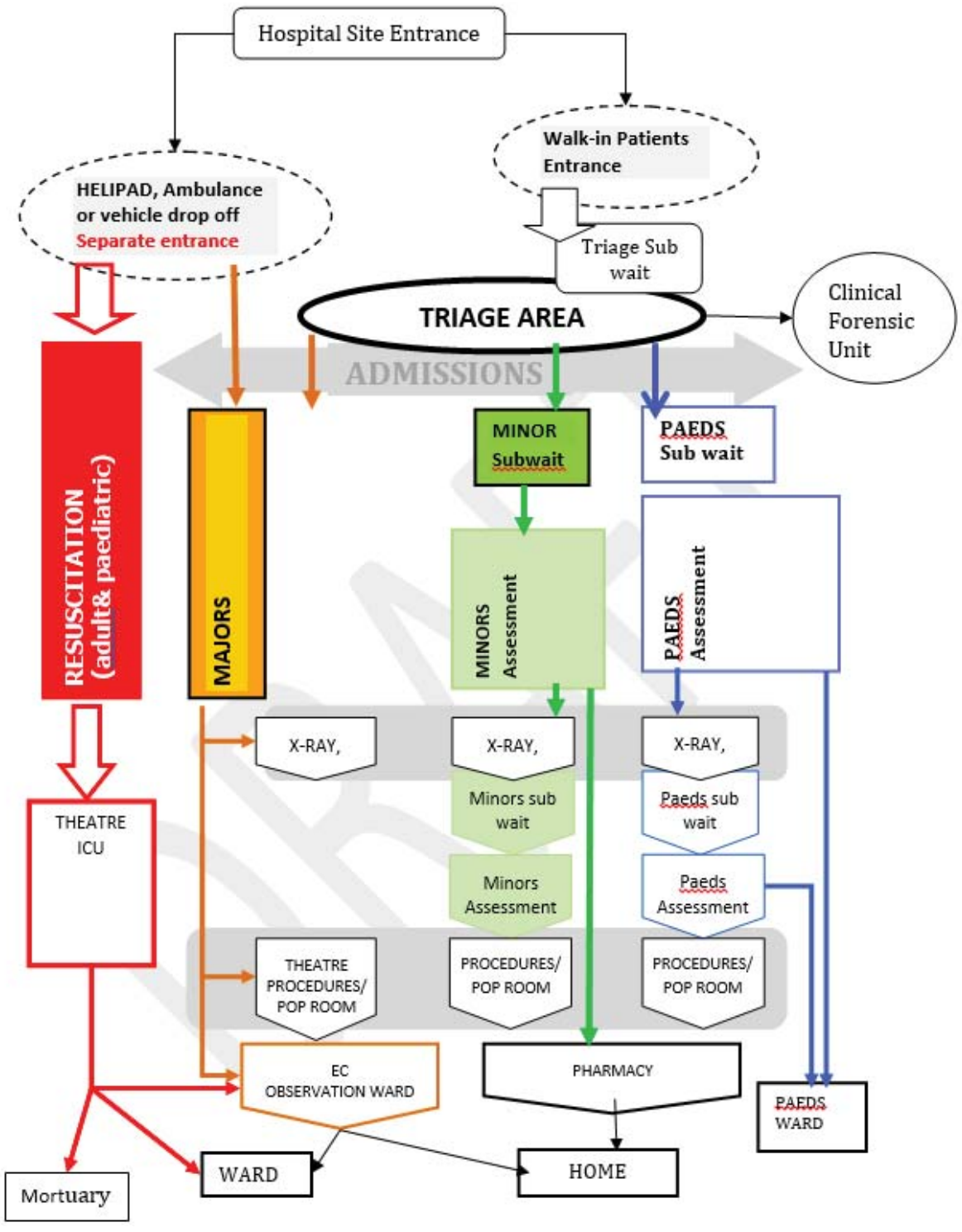
The flow through the facility was also described, this streams patients according to their acuity for walk in through triage or from ambulance and helicopter arrivals.



Before **After**




"The key is designing spaces that respond to the environment and the available resources"

7. CONCLUSIONS & RECOMMENDATIONS

In addition to the integration of three initial conference challenges (people, processes and space), three additional principles emerged. These were:

- The value of “acuity” as a strong concept at the threshold of ED service and spatial design;
- The need for ongoing innovation in process design; and
- Thinking in terms of planning levels and the interface between and separation of systems.

There is a need for interdisciplinary dialogues, advanced process design and spatial configurations that are responsive to service design. The following key principles were identified:

1. Think in terms of regular ongoing and incremental improvements in working processes. The best processes should be the basis for the new ED design and refurbishment; or wholesale transformation;
2. Participate in early decision making, at the very front-end of ED projects and think about “acuity adaptability” as an operational and spatial design principle;
3. Resist just another short-term and not fit for purpose refurbishment and devote the right amount of time to a needs analysis, business case and project plan for an integrated solution;
4. Take a strong clinical leadership position. This may include challenging design adjacencies, rethinking clinical support spaces and defining new medicine management systems for ED;
5. Define patient-streams and waiting spaces with greater functional intent. This could for example include acuity adaptable rooms, or the use of chair centric strategies;
6. Consider how design can support the assessment and management of patients with behavioural problems or other conditions likely to impact on optimal flow.
7. Design for peak activity not the mean. Use scenario planning techniques to investigate what would happen at periods of peak demand (e.g. test when “lean and mean” solutions may go wrong);
8. Understand congestion and use advanced models to understand patient flow;
9. Design multi-functional spaces around split patient acuity flows to increase throughput, responsiveness, segmentation and predictability;
10. Make the critical connection between staffing and ED space design. This involves strategies to cope with demand for the busiest hour, on the busiest day, in the busiest week and year. The most successful organisations are responsive to demand changes and keep a consistent length of stay;
11. Keep abreast of new technologies that are changing the future design of EDs. Spatial designs must be responsive to existing and future technological and service innovation;
12. Commit to research and raise awareness of evidence based design and best practice in human factors in ED design;
13. Carefully consider decant, temporary space occupation and how existing areas are refurbished. Communication between the construction and operations team is key, for service continuity and minimal disruption to patients and staff;
14. Think in terms of levels of planning (e.g. strategic wider commissioning and partnership, site adjacencies and operational zoning and patient flows in the department).

End-Piece – Sue Robinson

The Royal College of Emergency Medicine continues to support the design of the smarter ED. But we must be realistic about what can be achieved within the next 5 years, given the considerable financial constraints and requirements to save money. Some NHS trust EDs will receive large capital funding (approx. £20-30 million), while others will receive relatively small investment (£5-10 million). Unless we make the case for investment in better ED design, we are almost certain to fall short of our target to deliver the smartest ED. It is important to remember that:

> "For most of us, design is invisible, until it fails"[3].

What was achieved with HBN15.01 was to construct a deliberately non-prescriptive and enabling standard that was focused on the process and strategic, site and operational options, rather than a physical design solution. I am proud of HBN15.01, but we are making revisions to supersede section 3. This will be published in 2016. We have also developed an online video to discuss how UK EDs can address an ongoing rise in attendances and admissions [4].

The conference illustrated the need for investment in the following.

1. **Clear funding scenarios** - We must work with policy makers to determine the appropriate levels and sources of investment in ED new build and refurbishment.
2. **Topologies of ED spatial response** - We must articulate more effectively the options and exemplars of ED design. These topologies can then facilitate discussion and be fitted to local budgets. This will help NHS trusts describe the level of capital funding (Large - approx. £20-30 million or small - £5-10 million) that is appropriate.
3. **Dynamic and clinical-led co-created standards** - We must continue to facilitate interdisciplinary networks and national dialogue on what is smart ED design. A standard should not be written and then sit on a shelf. It must advance and challenge existing approaches. The smartest ED conference became one such initiative and I hope this will continue.
4. **Participation in EBD research** - We must be interdisciplinary in our approach to evidence-based ED design. We should not reproduce just what has gone before, but rather innovate and use robust methods to learn what works and what does not. This will support us in our challenge to persuade policy decision-makers.
5. **Values-behaviour rich ED design** - We need to better describe the purpose and function of spaces. This will involve greater interrogation of what defines the services that are offered and how these are experienced by patients.

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3. Mau, Bruce (2004) Massive Change, Phaidon: London.
4. https://www.youtube.com/watch?v=CVatP2Lw7IM

6. **Space and ED clinical cognition** - Research is needed into the flow and relationship between space and cognition (given that the average ED doctor is interrupted 9.7 times an hour).

7. **Clinical support areas within the ED** - There is a need for a wholesale review of current design guidance on clinical support areas within the ED. Reflecting new technology, medical management, patient monitoring and the requirements for clinical, patient and staff storage.

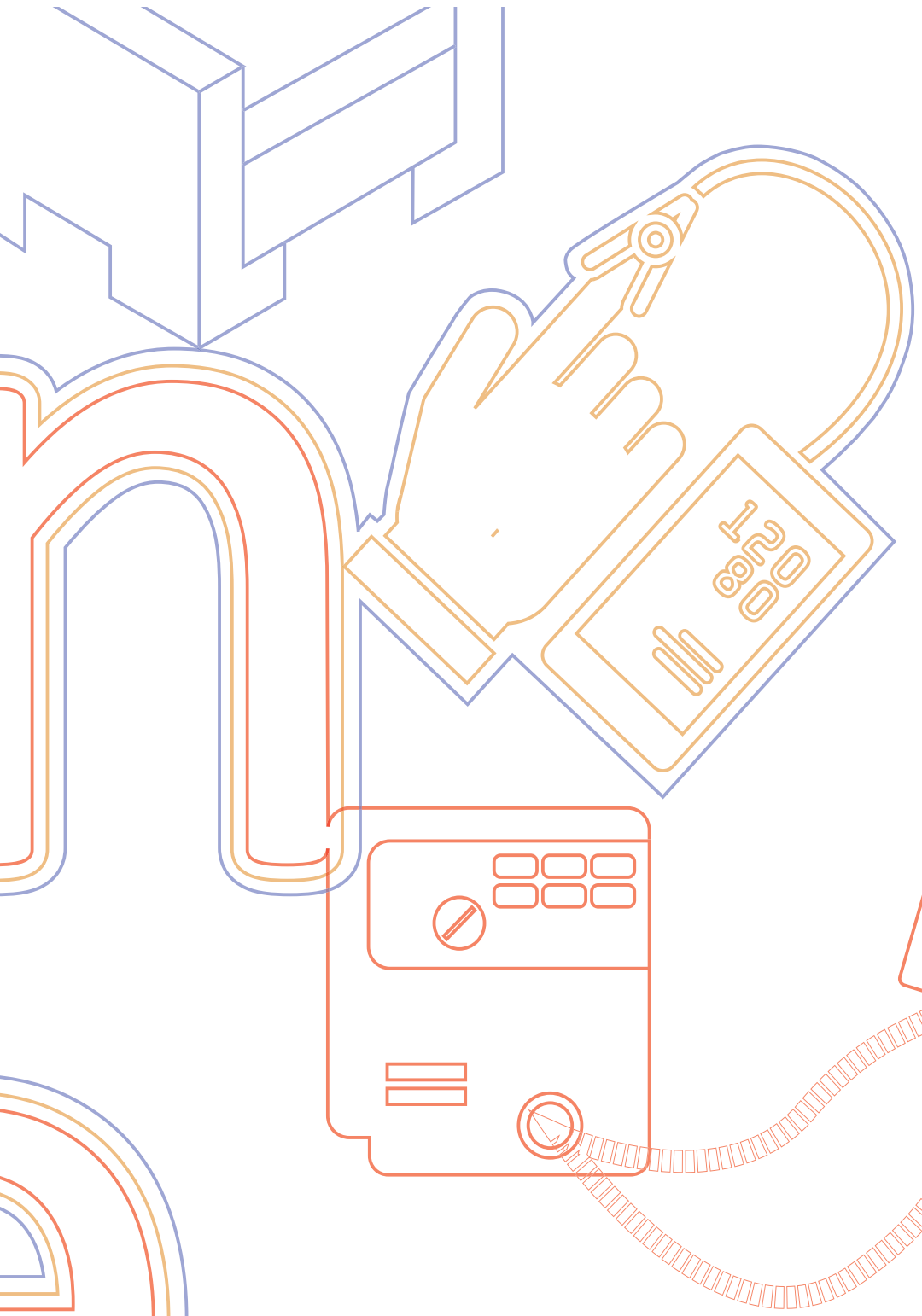
8. **Research into acuity adaptable ED design** - Research is needed into open and adaptable ED design to ensure that the facilities being designed and constructed to accomodate future clinical services and technological advances are effective.

9. **Research into reconfiguration / site masterplanning for ED** - To provide awareness of multi-reconfiguration options for long-term capital investment and to prevent early obsolescence of ED design solutions.

10. **Decant and temporary spaces** - National guidance should be developed on the possible options for temporary space during refurbishment or new build. It should provide advice on what planning is required and how risks can be minimised.

11. **Strong RCEM leadership for ED national design standards** – National guidance for ED design should remain clinically driven. As should national design initiatives to implement standardised design features to achieve capital and operational value for money.

12. **ED environments for the older patient** - Research is needed into the design of ED environments to respond to the increasing number of older people (and other groups of frail and vulnerable patients) attending the ED.



test ED

The Royal College of Emergency Medicine