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Full Paper

# Clinical Adaptability During Capacity Surges

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**Abstract:** The current COVID 19 pandemic has highlighted the need for flexibility in the provision of nursing care of extremely ill patients. A new proposition for a clinical adaptability suite of rooms is presented which can be multi-functional to accommodate surgery, intensive care or isolation.

A literature exploration of medical and nursing practice and requirements and a case study analysis are presented. We explore the physical changes to the built environment which have taken place during the pandemic and undertake an analysis of the environmental and infrastructure requirements of a clinically adaptable room. Finally, we present the initial ideas for an innovative case study which considers how we design, manufacture and assemble advanced, versatile and multifunctional hospital settings.

The resulting proposed clinically adaptable room reflects new models of clinical care. We explore the common denominators which show similar requirements in terms of medical equipment infrastructure, ventilation requirements and sterile conditions. A more sustainable alternative scenario shows the potential for reorganisation and alteration to existing facilities.

**Keywords:** acuity adaptability, intensive care, clinical adaptability, capacity surge, infrastructure

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## 1. Introduction

Historically hospital facilities have provided three types of facilities: dispensaries for medicines, treatment areas for surgery and infirmaries for nursing care (French word for nurse -l'infirmier-e). The plague pandemics of the past would have been treated either by visiting a dispensary or being admitted to an infirmary, however today we have advanced interventional care which has added complexity to the hospital estate.

What was unique in COVID 19 was that some patients needed to be rapidly escalated from low to high acuity WHO (2020). What is more, they become dependent upon sophisticated medical equipment being used in a controlled environment. This made patient and staff safety more challenging, and often created unavoidable cross infection. Infection spread rapidly throughout the world and although many people suffered relatively minor affects such as the common cold and mild influenza it soon became apparent that many others required more intensive nursing care including the use of ventilators and oxygen, continuous positive airway pressure (CPAP).

The rapid spread of COVID 19 took the world by surprise, originating in China, the Chinese quickly began building modular hospitals to accommodate thousands of patients demonstrating the advantages of modern methods of construction as described by Chen et al (2021) and Tan et al (2021). There is a need for scenarios that allow for a more versatile, agile and rapid response to pandemics, unlike the 'nightingale hospitals' which used modular construction large exhibition centre fitouts which could not staff or treat patients at the highest level of acuity.

The aim of this paper is to investigate clinical adaptability a concept where spaces can be used for different clinical functions which require the same level of infrastructure.

## 2. Theories and Methods

### 2.1. Acuity Adaptability

Healthcare is provided within a complex, multi-specialist and multi-acuity setting. As such, patients must flow between a complex of semi-autonomous spaces (Rechel et al.2010, Elkhuizen et al., 2006), which creates duplication in both services and space, unless space can be re-organized. The acuity-adaptable patient room provides an example strategy, where a patient is cared for in the same room "…regardless of the patient level of acuity" (Bonuel and Cesario (2013). However, there are some believe this solution is not viability due to added infrastructure and spatial requirements (Ryan, 2019), while others in contrast have calculated cost benefits (Berry et al. 2004 and Sadler et al. 2011).

There are also differences in implementation setting. Kwan (2011) argue that although some literature demonstrates the projected benefits of the acuity adaptable care delivery model (Brown and Gallant, 2006; Hendrich et al., 2004; Hennon et al., 2011), there are 'flex up, flex down, single stay unit' variations and the need for further evidence of its outcomes. That said, there is evidence that shows that to receive the level of care that matches their variable patterns of acuity, patients are often moved 3 to 6 times during their short stay within a hospital unit (Hendrich et al., 2004). Several papers have been written about issues with transferring critically ill patients within hospitals: operating theatre to ICU and vice versa, emergency departments, examples include Beckmann et al (2004) Agizew et al (2021) and although this refers mainly to the clinical procedures it is critical that the influence of this is understood from the perspective of acuity adaptable buildings, infrastructure and environments.

The reference to these acuity adaptable rooms describes mainly examination rooms in Emergency Departments where the need to upscale patients' treatment can occur quite quickly and in general ward accommodation. The ability to flex from low to high acuity is difficult to achieve in both situations due to the high level of escalation in terms of medical equipment requirements needed to provide high acuity care - HBN 04-02 Critical Care Units (2013). "This Health Building Note provides guidance on critical care units that admit patients whose dependency levels are classified as level 2 or 3 (see 'Comprehensive Critical Care', DH 2000, for definitions of levels of critical care). However, it does not distinguish between the different requirements for level 2 and 3 patients. It excludes facilities for the high-security isolation of patients, dedicated centres for burns patients and areas within the hospital where level 2 or 3 patients are managed on a time-limited basis." Table 1 below indicates how currently HBN 04-02 Critical Care Units currently adopts an acuity adaptable approach for Levels 2 and 3 ICU stating the same requirements for both levels but there is no reference to integrating the Level 1 requirements in HBN 04-01.

Table 1. Current HBN Guidance

| Guidance | | | Nursing Care* |
|---|---|---|---|
| HBN 04-01 (2013) | Adult Inpatient Facilities | Low and Intermediate Care | Levels 0 and 1 |
| HBN 04-01 Supplement 1 (2013) | | | |
| HBN 04-02 (2013) | Critical Care Units | High Dependency | Level 2 |
| | | ICU/ITU | Level 3 |
| - | Isolation Intensive Care | Specialist | Level 4 |
| | *Nursing Care as defined by ICS 2009 | | |

In the case of COVID 19 patients the combination of requiring Level 3 life support facilities and isolation resulting from an infectious disease elevates the requirements to Level 4 Nursing Care. Where patients all require the same level of nursing care the principle of cohort nursing is adopted.

2.2 Patient Acuity and Coping with Surge Variations Throughout the Year

The World Health Authority defines three levels of patient acuity: 1. Low acuity: non-life threatening, 2. Medium acuity: potential for developing life threatening conditions and 3. High acuity: life threatening conditions.

Every year hospitals prepare for seasonal infectious diseases, typically influenza. The majority of clinically at risk are offered a flu vaccination. Few patients develop life threatening conditions requiring intensive nursing care and the number of Intensive Care Beds is usually associated with the number and types of surgical procedures. The rapid escalation of covid patients requiring Level 3 nursing care very quickly overran Intensive Care Units as in Figure 1 resulting in a shortage of facilities which could treat them.

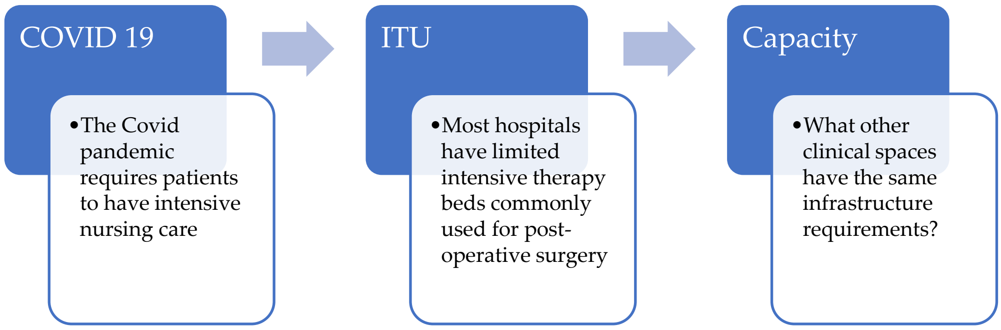


Figure 1 Capacity Surge

This impacted on surgical operations which had to be cancelled due to the lack of ITU facilities and then in the realization that the operating departments themselves contained the necessary infrastructure, operating rooms and recovery areas were adapted to treat patients. In the long term this method of coping with capacity surge was unsustainable. The cancellation of surgical operations led not only to a backlog but in some cases resulted in increased morbidity for patients requiring urgent surgery. The COVID 19 pandemic did not only cause a capacity surge but due to its infectious nature affected departmental access and pathways needing to create dedicated entrance and exit flows.

The provision of infectious diseases units in the UK has largely disappeared. Apart from the High-Level Isolation Unit at the Royal Free Hospital in London and a couple of regional units, the only provision for patient isolation is a single lobbied room as part of a standard ward unit. Neither of these situations has the capacity to cope with a pandemic but it is not sustainable to build and maintain large wards lying empty in anticipation of a new outbreak.

2.3. Adaptability in Design

Open building is a key principle in achieving greater acuity adaptability (Astley et al. 2011). It is a way of challenging territorial use (Habraken 2000), which encourages cross-over and interdisciplinary working and multi-functionally - looking for generics rather than specific room activities and functions. Moving from dedicated and specific to shared and universal or customizable may lead to new approaches to sizing rooms, with activities seemingly less linked to specific spaces (modules, clusters or rooms), it is approach that has a strong foundation. John Weeks (Llewelyn Davies and UCL, 1961-72) for example looked to modernize a more flexible hospital design by focusing on the multi-functional potential.

This article investigates hierarchy, changing enclosures and adapting spaces to be activity and acuity adaptable. Infrastructure and connection to electricity, water and drainage must be further understood, because we must find ways to "…release the…building from the increasingly unmanageable complexity of conduits, cables, and pipes serving every outlet in every room" (Habraken 2000, p. 74). The adaptable futures toolkit from Loughborough University also develops Brand's approach, Schmidt and Austin (2016). They define adaptability as "the capacity for a building to accommodate effectively the evolving demands of its context, thus maximizing through life value" (Schmidt et al. 2009) through various strategies: movability (location, e.g. kit-of-parts); scalability (size e.g. joinable rooms); convertibility (function e.g. multi-functional spaces); refit-ability (performance – e.g. standard shapes and interchangeable components); adjustability (task – e.g. plug and play and non-fixed objects); and versatility (Space – e.g. variety of room sizes or wide corridor widths). Brand (1995) stratified a building into layers that function in a totality but are most adjustable and adaptable to specific uses and technical changes when different layers can be changed independently or with few consequences for the other layers. For Brand (1995) the totality and interdependence between the systems and layers are critical to decision making to create a clear purpose in use. Kendall (2002, 2007) extends this idea to consider the process of procurement and delivery through a three- tier design team system separation which is also presented by the AIA (2017) in their investigation of open rooms.

### 2.4. Infrastructure for Clinically Adaptable Rooms

Mortality rates during COVID 19 were relatively low due to interventional care and oxygen treatment, Alkouh et al (2022) although this equipment requires a high level of engineering services which we have described as 'infrastructure'. Delivery systems which can provide high flow rates of oxygen, continuous positive airway pressure (CPAP), utilise ventilators, monitor and provide life support machines. This type of infrastructure is common in operating theatre suites and in emergency department resuscitation rooms and in Level 3 Intensive Care Units.

In most hospitals there may only be a few rooms of each type, they may not be collocated and due to the infectious nature of the pandemic creating separate clinical pathways to prevent the spread of infection can be difficult. Adapting these highly serviced infrastructure areas to cope with pandemic patients can take time to set up, possibly longer to convert back to their original purpose (decontamination and cleaning) and still not provide the best possible treatment for patients (cohort nursing may compromise hospital acquired infections). It also affects the staff and the level of PPE they require if the patients are not all in single rooms with the potential for isolation. Russotto et al (2015) highlights problems with bacterial contamination pre-covid emphasising the complex infection control issues related to the built environment.

Wunsch et al (2008), Wunsch et al (2011) and Nurok and Kahn (2020) show sufficiency and sustainability of bed number. It raises the medical issue associated with transferring critically ill patients – long distances by train (Beardsley, 2020) and within hospitals (Agizew et al 2021 and Beckmann et al 2004).

Combined clinical and architectural studies (Barach and Rostenburg, 2015), such as those focused on operating rooms (Joseph et al 2018, Ibrahim et al 2017, Ulrich et al 2008 and Taffe et al 2021). For example Krupka and Sondberg (2006) describe the design of the operating room and its impact on the room economics highlighting the expensive infrastructure requirements something which is also common to an Intensive Care Room.

Intensive Care as a separate medical pathway is relatively recent, the first unit at St. Thomas' dates from 1966 with the first new build departments dating from the 1980's. The Faculty of Intensive Care Medicine was not founded until 2010. The majority of academic papers written in relation to intensive care and covid patients are by medical practitioners describing the issues of adaptability in relation to nursing practices and treatment pathways. Although this does not directly relate to healthcare planning and design in terms of healthcare architecture, it does emphasise the need for architects and designers to understand user requirements. Oakley et al (2020) outlines how one of the UK's largest ICU units coped with the Covid pandemic and makes an interesting comparison with a pre-COVID 19 study by Clay-Williams (2018). Chawla et al (2021) gives a detailed breakdown of how 38 operating rooms were converted into 112 ICU beds in the space of 2-7 days. It describes the process of changing an OR into an OR-ICU. It sets out a six-point plan:

1. Identify if it can be done in your hospital
2. Identify where it can be done
3. Measure how many patients each operating room can accommodate
4. Procure the additional equipment needed to provide ICU level care
5. Develop a care team model for the new OR-ICUs
6. Consider patient admission

Whitearkiekter (2021) describe how architects-led a conversion of an operating suite into an ICU in a newly completed hospital which was undergoing its commissioning.

### 2.5. The Methodology of this Study

This study looks for the common denominators which exist amongst rooms which require high engineering services infrastructure and medical equipment to allow them to be used flexibly according to demand, not only in the case of pandemics but for services changes within hospitals and decant facilities for upgrading and refurbishment. Separating core fixed equipment from mobile equipment and designing engineering controls would allow rooms to be repurposed and returned to their designated use very quickly enabling a quick response to a capacity surge.

The initial methodology was to investigate the common denominators required to create such a room or cluster of rooms. This was carried out through analysing the individual room data sheets for each type of room from the Activity Database (ADB) together with the findings from a previous literature review of operating theatre suites for Health Facilities Scotland, Symons et al (2018) and then compare this with a literature related to intensive care facilities and outcomes from the ongoing pandemic. This literature review identified several papers relating the physical environment to surgical procedures

A literature search in parallel with the setting up of a prototype design for an 'Interventional Therapy Suite' based upon personal findings and experience of healthcare design and construction is completed. It relates to the need for intensive care facilities and level of isolation requirements, how operating theatres were adapted to care for Covid 19 patients, current design requirements for both operating theatres and ICUs together with architectural design theory related to open building concept and designing for acuity adaptability.

The prototype design and proposed construction of this interventional therapy suite also follows a recent research project Mills et al (2020) Transforming Construction 'Challenging Spaces Frontiers' which looked at operating theatre design in terms of modular and off-site construction and how lessons could be learnt from the Space Industry. The interventional therapy room is designed as part of a suite. Although normally only operating rooms are part of a suite of rooms, there is precedence of incorporating support rooms in isolation for the treatment of burns patients. It is designed as a single patient treatment area to minimise cross infection and allow flexibility. The design developed for this interventional therapy suite is adapted from operating theatre suite layouts contained in HBN 26 with the exception of an Anaesthetic Room.

**3. Results**

Initially four different spaces were identified as in Table 2 which potentially have the same infrastructure requirements which could be developed into a standard cluster of rooms. The table below sets out the common denominators amongst these four rooms. All the rooms require a minimum ceiling height of 2700mm with preferably 3000mm in operating rooms. All the room proportions tend be square.

Table 2 Comparison of Four Room Types

| Clinical Facility | Room Area (m2) | Medical Equipment Ceiling Delivery | Piped Oxygen | Specialist Ventilation | Gowning /Isolation | Adjacent Clean Supplies | Adjacent Dirty Disposal |
|---|---|---|---|---|---|---|---|
| ITU Bed | 26 | Essential | Essential | Essential | Desirable | Close Proximity | Close Proximity |
| Isolation | 26 | Potentially | Essential | Essential | Essential | Desirable | Desirable |
| Resus Bay | 26 | Essential | Essential | Desirable | Potentially | Desirable | Close Proximity |
| Operating Room | 35-55 | Essential | Essential | Essential | Essential | Essential | Essential |

The table shows a high number of common elements. The potential size of the operating theatre can vary according to the type of operation, but at the lower end of the scale the area is comparable with the others, especially given that over the years intensive nursing care rooms have been increasing in size.

Opinion is divided in relation to the provision of an anaesthetic room, and it is predominately a UK requirement. Due to the type of surgery being proposed, the anaesthetic room has been omitted. The Clean Preparation Room will provide drugs and disposable items as required by an anaesthetist. Figure 2 below sets out the relationship of the Interventional Therapy Room with its adjoining support areas.

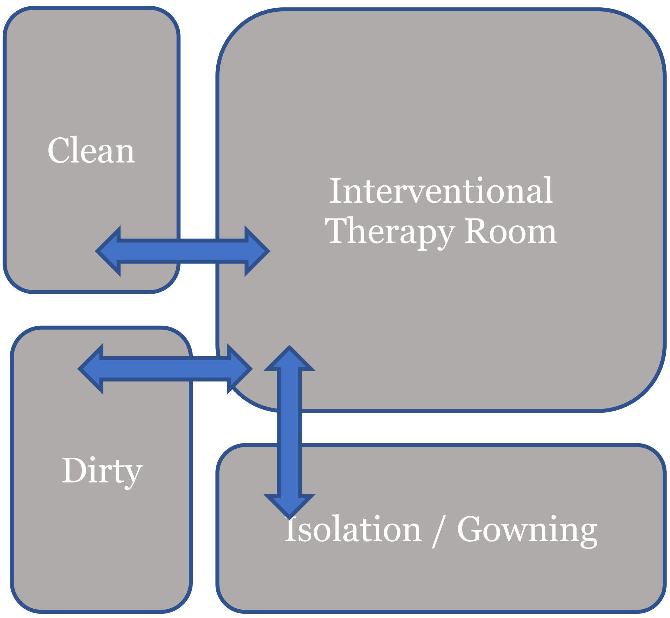

Figure 1: Proposed Interventional Therapy Suite

The rooms are designed to reflect common infrastructures as in Table 3.

Table 3: Interventional Therapy Room Comparison to Other Room Types

| **Requirements / HBN** | **Operating Room** (HBN 10-01 (2007) and HBN 26 (2004)) | **Surgical Procedures** (HBN) | **CCU Level 3** (HBN 04-02 2013) | **ICU Isolation** (HBN 04-01 Supple. 1/ HBN 04-02 (2013)) | **ITU Level 4 Isolation** (Does not Exist) | **Interventional Therapy Room** |
|---|---|---|---|---|---|---|
| **HTM References** | HTM03-01 | | | | | |
| **ADB Data Sheet Reference** | N0107 | N0111 | B1610 | B0308A | - | |
| **Temperature and Ventilation** | | | | | | |
| Permissible Space Temperature Range (dry bulb) (degC) | 18-25 | 18-25 | 18-25 | 18-28 | 18-28 | 18-25 |
| Heating Design Temperature (DegC) | 22 | 22 | 22 | 22 | 22 | 22 |
| Minium Air Changes (AC/hr) | 25 | 10 | 10 | 10 | 10 | 25 |
| Ventilation Type | Supply | Supply | Supply | Cascade | Cascade | Supply/ cascade |
| Pressure Relative to Adjoining Space | 25 pascals | Positive | Positive | - | - | 25 pascals |
| Suppy Air: Final Filter Class | F7 | F7 | F7 | G4 | G4 | F7 |
| Permissible Relative Humidity Range (%) | - | - | Un-controlled | Un-controlled | Un-controlled | - |
| **Lighting** | | | | | | |
| Type of Control | S/V | S/V | S/N | S/N | S/N | S/V |
| Daytime General Service Illuminance (Lux) | 1000 | 1000 | 100 | 100 | 1000 | 1000 |
| Daytime Specific Service Illuminance (Lux) | 500 | 500 | 400 | 300 | 500 | 500 |
| Nighttime General Service Illuminance (Lux) | - | - | 10-20 | 5 | 5 | - |
| Nighttime Specific Service Illuminance (Lux) | - | - | 10-20 | 0.5 | 0.5 | - |
| Local Task Illuminance (Lux) | 10000 to 100000 | 30000-60000 | 1000 | 300 | 300 | 10000 to 100000 |
| Colour Rendering Required | Y | Y | Y | Y | Y | Y |
| Colour Rendering Required Characteristics (Ra) | 90 | 90 | 90 | 80 | 90 | 90 |
| Unified Glare Rating Limit (URGL) | 19 | 19 | 19 | 19 | 19 | 19 |
| Emergency Escape Rout Lighting Required | Y | Y | Y | Y | Y | Y |
| Standby Lighting Grade - General Lighting | A | A | A | A | A | A |
| Standby Lighting Grade - Local Lighting | A | A | A | A | A | A |
| **Risk** | | | | | | |
| Clinical Risk Catergory | - | - | - | - | - | - |
| Non-clinical Business Continuity Risk Category | - | - | - | - | - | - |
| **Noise** | | | | | | |
| Noise Intrusion (dB) 1 hr day | 40 | 40 | 45 | 40 | 40 | 40 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Noise Intrusion (dB) 1 hr night | 40 | 40 | 35 | 35 | 35 | 40 |
| Noise Intrusion (dB) f night | 50 | 50 | 45 | 45 | 45 | 50 |
| Maximum Internal Noise from M&E Services (NR) | 40 | 40 | 30 | 30 | 30 | 40 |
| Room Sound-insulation Parameters - Privacy | Private | Private | Moderate | Confidential | Confidential | Private |
| Room Sound-insulation Parameters - Noise Generation | Typical | Typical | Typical | Typical | Typical | Typical |
| Noise Sensitivity | Sensitive | Sensitive | Medium | Medium | Medium | Sensitive |
| Sound-insulation Rating (dB D nT,w) | - | | | | | - |
| **Safety** | | | | | | |
| Maximum Surface Temperature (DegC) | 43 | 43 | 43 | 43 | 43 | 43 |
| Domestic Hot Water Discharge Temperature (DegC) | 43 | 43 | 41 | 41 | 41 | 43 |
| Maximum Cold Water Discharge Temperature (DegC) | <20 | <20 | <20 | <20 | <20 | <20 |
| **Fire** | - | - | - | - | - | - |
| Type of Automatic Fire Detection | Smoke | Smoke | Smoke | Smoke | Smoke | Smoke |
| Location | Duct mounted on Supply | Duct mounted on Supply | | | | Duct mounted on Supply |

New Room Requirements Sheets were developed for each room type to reflect core or fixed requirements based upon the fixed core components of spatial/building requirements, environmental and engineering requirements and fixed equipment. Figure 3 sets out how the Interventional Therapy Room can be reconfigured for change of use and Figure 4 indicates the process.

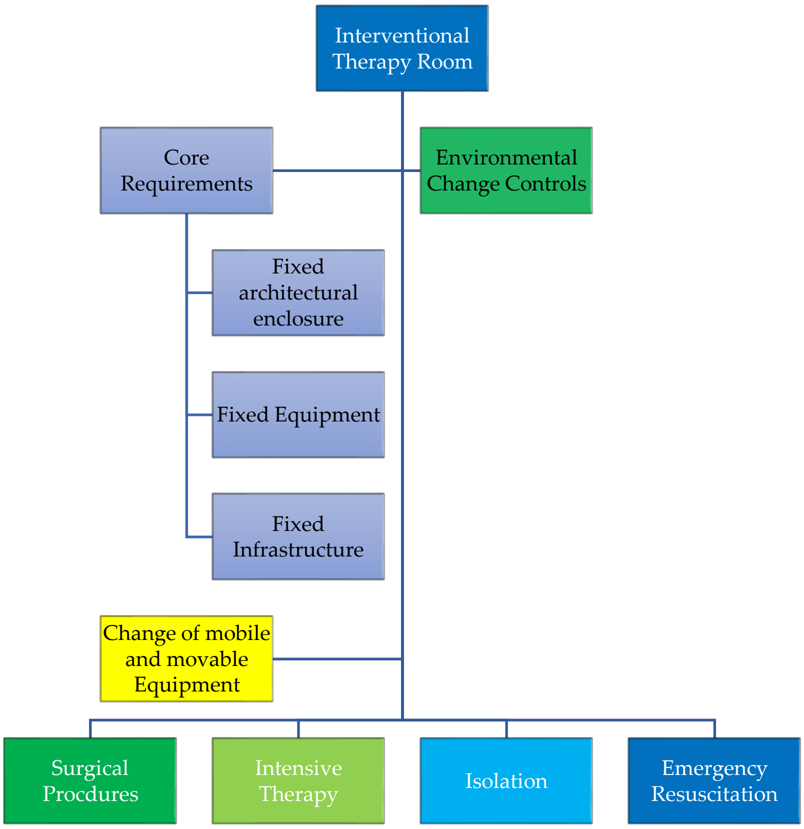


Figure 3: Adaptability of Interventional Therapy Room

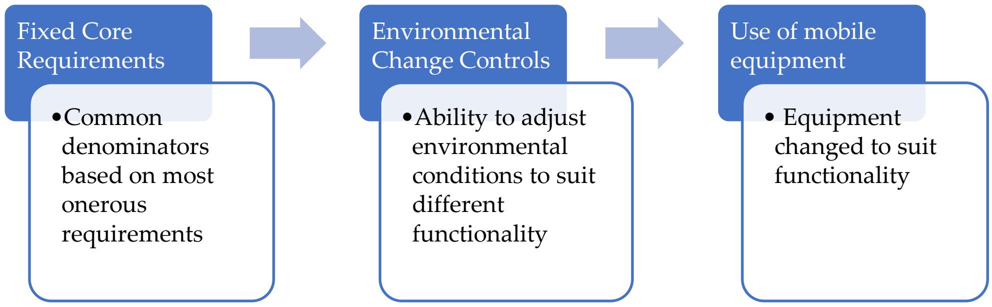


Figure 2 Room Adaptability Process

The Interventional Therapy Room requires two items of fixed equipment a Ceiling Mounted Delivery Systems: Twin Arm Pendants which are a common feature and where accessories can be interchanged and Surgeon's Panel or Theatre Control Panel built into one of the partitions. In addition to this room, which can adapt to different clinical conditions, there are three support rooms which provide:

- Gowning/Scrub up/Isolation facilities with interlocking doors providing entry from the corridor. The common feature in this case is a scrub sink
- Clean Utility/ Preparation Area has no fixed equipment (the Omnicell which is requirement is movable rather than fixed)
- Dirty Utility common name in both operating suites and inpatient wards would require the addition of a small macerator to the fixed equipment of a theatre dirty utility

Mobile storage with worktops and trolleys enables the rooms to flex to suit the clinical requirements and controls incorporated within the theatre control panel can enable the environmental conditions to be altered to suit. In this case the design flexibility approach is horizontal where the room occupancy changes to suit patient needs – surgery, intensive care or isolation rather than the vertical approach of an acuity adaptable room accommodating different levels of environmental and infrastructure requirements.

## 4. Discussion

The notion that spatial forms should precisely accommodate a single function, in a tightly engineered way, has proliferated in healthcare infrastructure design through the use of standard and standardised quality assurance guidance and tools, such as Health Building Notes (HBNs) and Activity Database (ADB) in the UK. But, given new drivers to reduce backlog (both patient and building) and to reduce the carbon footprint of the NHS estate it is critical that clinicians work more closely with building delivery partners. For example the clinical-leadership shown by Chawla et al (2021) provides guidance for clinical adaptability.

In terms of hospital planning and design the concept of this clinical adaptable suite of rooms predates the covid pandemic in an attempt to introduce adaptability within areas of high technical requirements. The Layers Approach (Netherlands Board for Healthcare Institutions, 2007) separates hospitals into different layers including a 'hot floor' for clinical activity. This study takes the 'hot floor' and further separates it according to its infrastructure requirements. The creation of a 'universal' room is also part of an industry drive for standardisation and modular construction. In a separate literature investigation into the transfer of critically ill patients there is evidence indicating that patient morbidity increases during transfer and thus the ability to carry-out certain surgical procedures on patients within ICU could be beneficial.

The covid pandemic highlighted a rapid response to capacity surge for ICU accommodation and many academic papers have been written detailing how the medical profession has responded. Chawla et al (2021) details how to reconfigure an OR into a CCU and demonstrates a synergy with the concept of an interventional therapy suite. The physical properties may be different, and the authors recognize the limitations with not having individual patient rooms, issues with potential cross infection which would support the case for developing the concept of an interventional therapy suite. Three of their steps relate to:

- Procure the additional equipment needed to provide ICU level care
- Develop a care team model for the new OR-ICUs
- Consider patient admission

The first of these is incorporated within the suite design as apart from the fixed ceiling delivery systems all equipment is mobile. Chalwa et al (2021) also state that anesthetic machines can also be used as ventilators. The second step is an interesting concept of developing integration within the clinical/ nursing teams and in terms of patient admissions this looks at patient pathways. Brambilla et al (2020) and (2021) utilise tools for measuring sustainability, space and facilities management such as the Optimised Flexibility Assessment Tool which they have developed from the Open Building Assessment Tool (OBAT) to determine flexibility and which could be adopted for testing a prototype.

## 5. Conclusions

The findings from this study indicate that it is the beginning of a much larger area of research involving a different approach to healthcare design. Over the years the level of engineering services has increased to nearly 50% of the capital building cost and advances in medical equipment technology have changed conceptions relating to reconfiguration and what constitutes a flexible space. In order to achieve flexibility, the building requires to have the necessary infrastructure. Due to this high cost it is not economically viable to install it in all areas and traditional departments or functional units need to be reviewed. Many patients have multi-morbidity conditions (highlighted through the COVID-19 pandemic) which may lead to different care pathways. The standard adult inpatient wards as in HBN 04-01 now include specialist rooms: an accessible room, a bariatric room and an isolation room. Designing standard facilities becomes difficult but adopting an infrastructure approach could not only increase bed management efficiency but increase flexibility. The move towards 100% single rooms is important for controlling infection and gives the opportunity for flexing between Level 1 and Level 2 Nursing Care and single rooms with en-suites can be designed to be fully accessible as was demonstrated at Salford Royal. There is the potential for using bariatric rooms as ICU rooms as the increased area of these rooms (with a similar shape) can be used for medical ICU patients.

The design of Intensive Care Units needs to be developed and particularly following the recent pandemic to understand the difference between ICU following surgery or ICU following the escalation of disease acuity relating to medical conditions such as pneumonia and sepsis. In terms of colocation this Interventional Therapy Suite can situated between the operating department and the ICU where it can provide routine facilities as required by an individual hospital, decant facilities for theatre/ ICU refurbishments or be used in the case of surge capacity due to pandemics or to major trauma incidents.

Creating a separate bariatric facility where in the case of multi-morbidity, the patient's bariatric condition determines the infrastructure requirements, this type of accommodation could also cater for medical pandemic situations. Table 4 below sets out how the suite can be flexed to different situations. The main challenge is ensuring that that the infrastructure can accommodate all requirements.

Table 4: Types of Clinical Adaptability

| Clinical Activities | Potential Use |
|---|---|
| Interventional ITU Bed | Opportunity to carryout surgical procedures on post-operative patients without transferring back to theatre |
| Isolation | Can be used for patients with various infectious diseases and burns patients |
| Resus Room | In the event of surge capacity in ED can accommodate more serious trauma patients |
| Operating Suite | Can be used to address backlog surgery for conditions which do not require large theatres |

The study highlights the need for a new approach to briefing healthcare projects. Current UK guidance dates back to 2013 with Activity DataBase (ADB) although reissued in 2021 not reflecting current equipment or procurement status.

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