E2: Rethinking healthcare: physical environments that reduce harm, improve staff retention, lower costs and improve public health

International Forum on
QUALITY & SAFETY
in HEALTHCARE
COPENHAGEN

Adapting to a changing world: equity, sustainability and wellbeing for all

@QualityForum #Quality2023

Institute for Healthcare Improvement

BMJ

Rethinking healthcare: Physical Environments that Reduce harm, Improve Staff Retention, Lower Costs and Improve Population Health

PAUL BARACH, DOMINIQUE ALLWOOD

NIGEL EDWARDS, JAMES BARLOW

COPENHAGEN

MAY 17, 2023

Who we are

Paul Barach, Sigmund Freud University, Vienna; Thomas Jefferson University, USA; J Bara Innovation

Dominique Allwood, Chief Medical Officer & Chief Medical Officer & Director of Population HealthAcademic Health Science Network (AHSN) Deputy UCLPartners, London, UK

Nigel Edwards, Chief Executive, Nuffield Trust, London UK

James Barlow, Imperial College, London, UK

Timetable

Introduction and ice breaker	1:15-1:20
Fish Panel— Thought Experiment exercise	1:20-1:40
Debrief	1:40-1:50
Lessons from the Pandemic	1:50-2:00
Lessons from Nightingale	2:00-2:10
Salutogenic environments	2:10-2:20
Wrap Up	2:20-2:30

What was your…….

1. First role
2. Worst role
3. Current role
4. Dream role

Lessons from the pandemic

Polling Question: What were the lessons from COVID about how our buildings and services work

What was you experience of the buildings and environment during covid – what learning do we need to capture?

Go to menti.com meeting id 1729 4104

Result

Thought experiments

Mental explorations of hypothetical questions through imaginary scenarios to reveal new insights and possibilities


What if we
could change
the course of
history?

THE QUESTION

If we had the power to go back in time and add just one resource to what was available on March 11, 2020 to respond to the COVID-19 pandemic, so that we could change its course for the better, which would we choose?

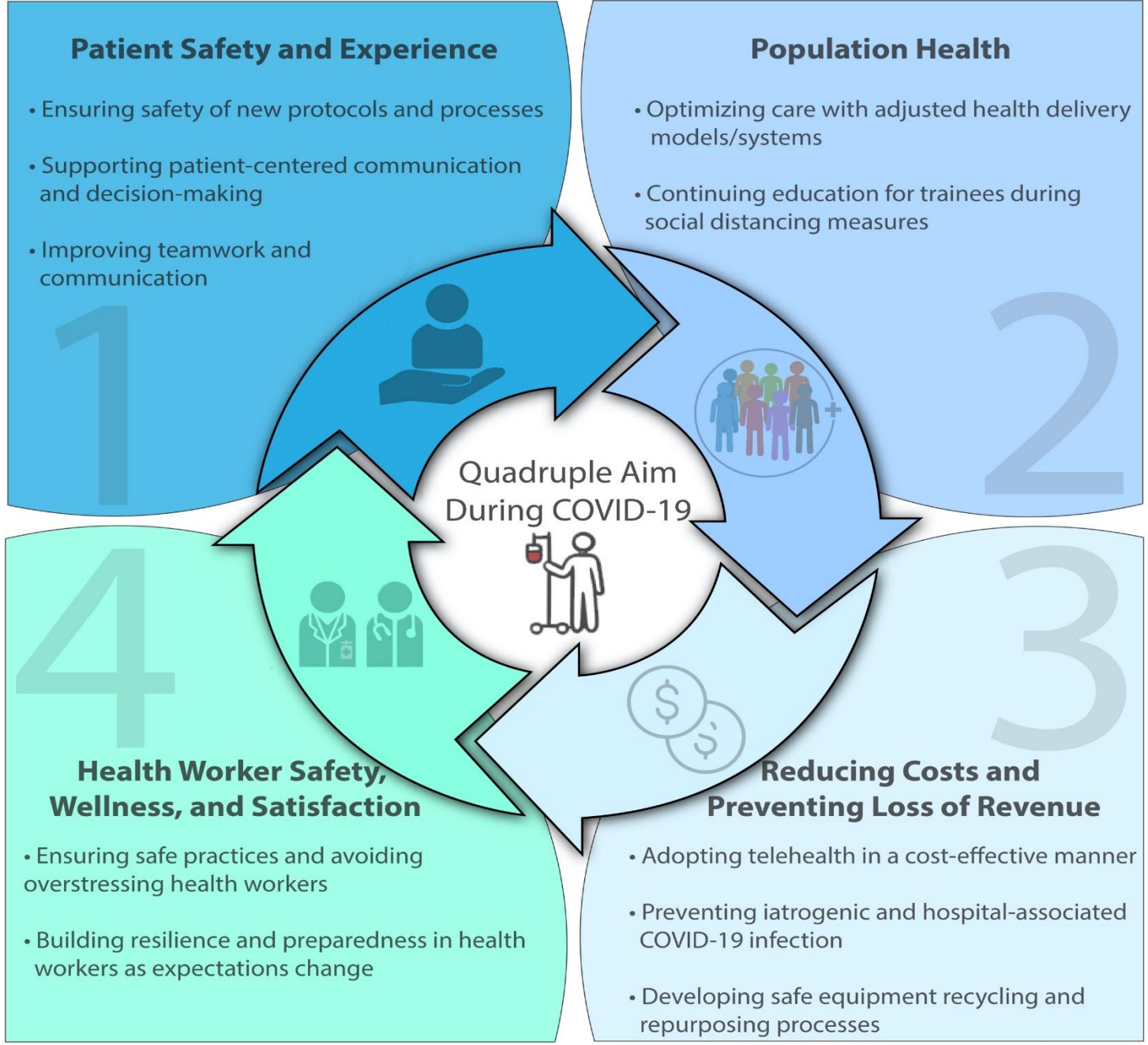
Fish-bowl Thought Experiment

* Bob Klaber, Consultant General Paediatrician & Director of Strategy, Research & Innovation, Imperial College Healthcare NHS Trust.

** Dianne Murray, RN, NHS Education for Scotland

*** Sandra Jayacodi, Chair Imperial BRC Public Advisory Panel, UK

Debrief


Patient Safety and Experience
• Ensuring safety of new protocols and processes
• Supporting patient-centered communication and decision-making
• Improving teamwork and communication
1
Population Health
• Optimizing care with adjusted health delivery models/systems
• Continuing education for trainees during social distancing measures
2
Quadruple Aim During COVID-19
4
Health Worker Safety, Wellness, and Satisfaction
• Ensuring safe practices and avoiding overstressing health workers
• Building resilience and preparedness in health workers as expectations change
3
Reducing Costs and Preventing Loss of Revenue
• Adopting telehealth in a cost-effective manner
• Preventing iatrogenic and hospital-associated COVID-19 infection
• Developing safe equipment recycling and repurposing processes

Acta Biomed 2020; Vol. 91, Supplement 9: 50-60 DOI: 10.23750/abm.v91i9-S.10117

Original article

COVID-19 and Healthcare Facilities: a Decalogue of Design Strategies for Resilient Hospitals

Stefano Capolongo[1], Marco Gola[1], Andrea Brambilla[1], Alessandro Morganti[1], Erica Isa Mosca[1], Paul Barach [2,3,4]

[1]Politecnico di Milano, Department of Architecture, Built environment and Construction engineering (DABC), Design and Health LAB, Italy; [2]Department of Pediatrics, Wayne State University School of Medicine, Detroit, MI, United States of America; [3]Jefferson College of Population Health, Philadelphia, PA, United States of America; [4]Interdisciplinary Research Institute for Health Law and Science, Sigmund Freud University, Wien, Austria

Abstract. *Background and aim:* The COVID-19 pandemic has upended the global healthcare systems. The surge in infections and sick critically ill patients has tested the resilience of healthcare infrastructures and facilities forcing organizations to quickly adapt and embrace emergency solutions. The paper proposes a decalogue of design strategies applicable both to new hospitals and to the refurbishment of existing hospitals. *Methods:* The authors conducted observations at hospitals, during public health webinars and through experts working groups from March to May 2020. *Results:* In this commentary, the authors present a list of strategies for creating critical care surge capacity and exploring design strategies for healthcare design for resilient hospital facilities. The strategies are organized into two tiers: I) design and II) operations. The (I) Design phase strategies are: 1) Strategic Site Location; 2) Typology Configuration; 3) Flexibility; 4) Functional program; 5) User-centerdness. The (II) Operation phase strategies are: 6) Healthcare network on the territory; 7) Patient safety; 8) HVAC and indoor air quality; 9) Innovative finishing materials and furniture; 10) Healthcare digital innovation. *Conclusions:* Hospitals, health care systems, and institutions urgently need to assess their resources, identify potential bottlenecks, and create strategies for increasing critical care surge capacity. The COVID-19 pandemic disrupted healthcare operations and accelerated the processes of innovation and transformation. The design and operational strategies can enable the achievement of resilient hospital facilities. Further multidisciplinary researches is needed to validate the strategies empirically. (www.actabiomedica.it)

Key words: COVID19; Hospital; Healthcare facilities; Built Environment; flexibility; resilience; evidence based design; user centerdness; digital innovation; patient safety

COVID-19 impact on healthcare systems

The coronavirus disease 2019 (COVID-19) virus is creating unprecedented stresses on healthcare facilities and critical care systems. The rate of infections and critically ill hospitalized patients reached unprecedented levels. Hospitals play a crucial role within the health system in providing essential medical care to the community, particularly during a crisis. They are complex and vulnerable institutions, dependent on critical external support and supply lines which operate with limited margin of error, at a very high rate and capacity. Even a modest rise in admission volume can overwhelm a hospital beyond its functional reserve. The COVID-19 pandemic has stressed critical support services and interrupted supply chains along with staff shortages and communications have also been challenging topics (1). Hospitals struggled to adequately respond to an unprecedented and sudden demand for emergency care and Intensive Care Unit (ICU) beds for infectious

Lessons from the pandemic

* Poor flow and layout
  - ED
  - ICU
  - Wards
* Single / isolation rooms
  - Not enough
  - Insufficient storage
* Other
  - Oxygen - poorly designed / low capacity supply
  - Workstations on wheels are a hazard
  - Natural light really
* Storage - not in the corridor
*Staff facilities
  - Work stations put staff in close proximity and key source of infections and illness
  - Small staff rooms with no natural light
  - No showers / lockers – removed to save money or make space for other functions
* Remote working
  - Outpatient care – how does a shift to teleconsultation affect the remaining work?
  - We can reduce office space but what do we lose?

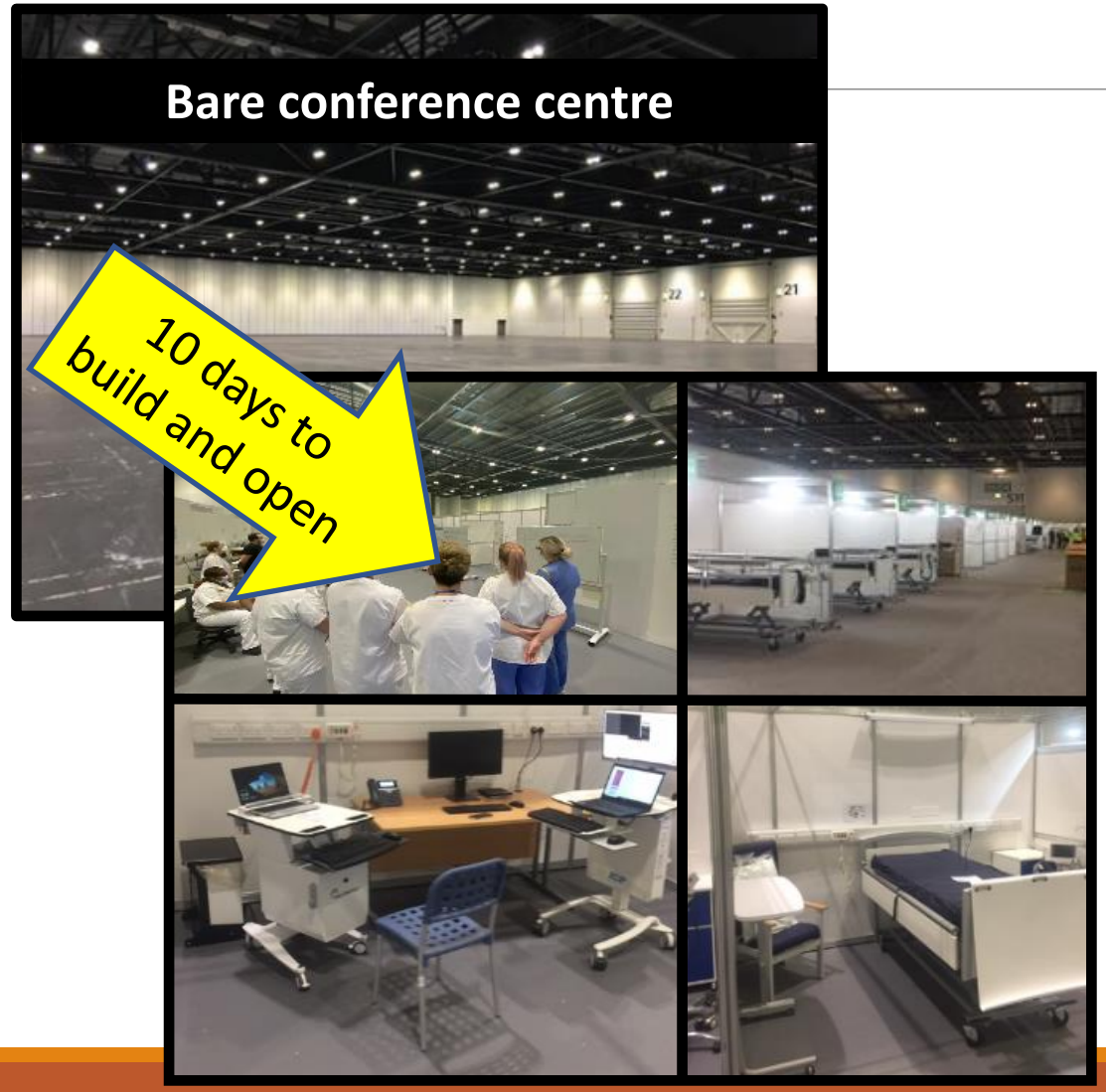
Lessons from COVID and beyond

DOMINIQUE ALLWOOD


SALA ATTESA
S2

NHS Nightingale London
Turning a conference centre into a hospital

- Designing the layout & infrastrure
- Creating the ‘care’ environment
- Improving workflow
- Driving learning and innovation



Clinical Model …build the aircraft in flight

Military planning tools TEPIDCOIL

- Training
- Equipment
- Personnel (Workforce)
- Information
- Clinical
- Organisation
- Infrastructure
- Logistics

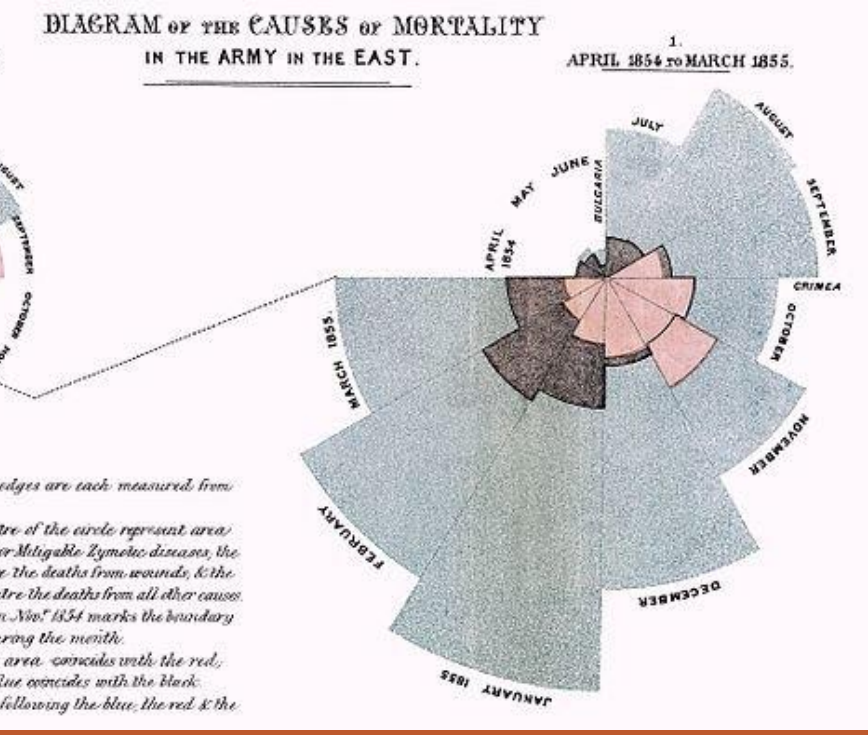
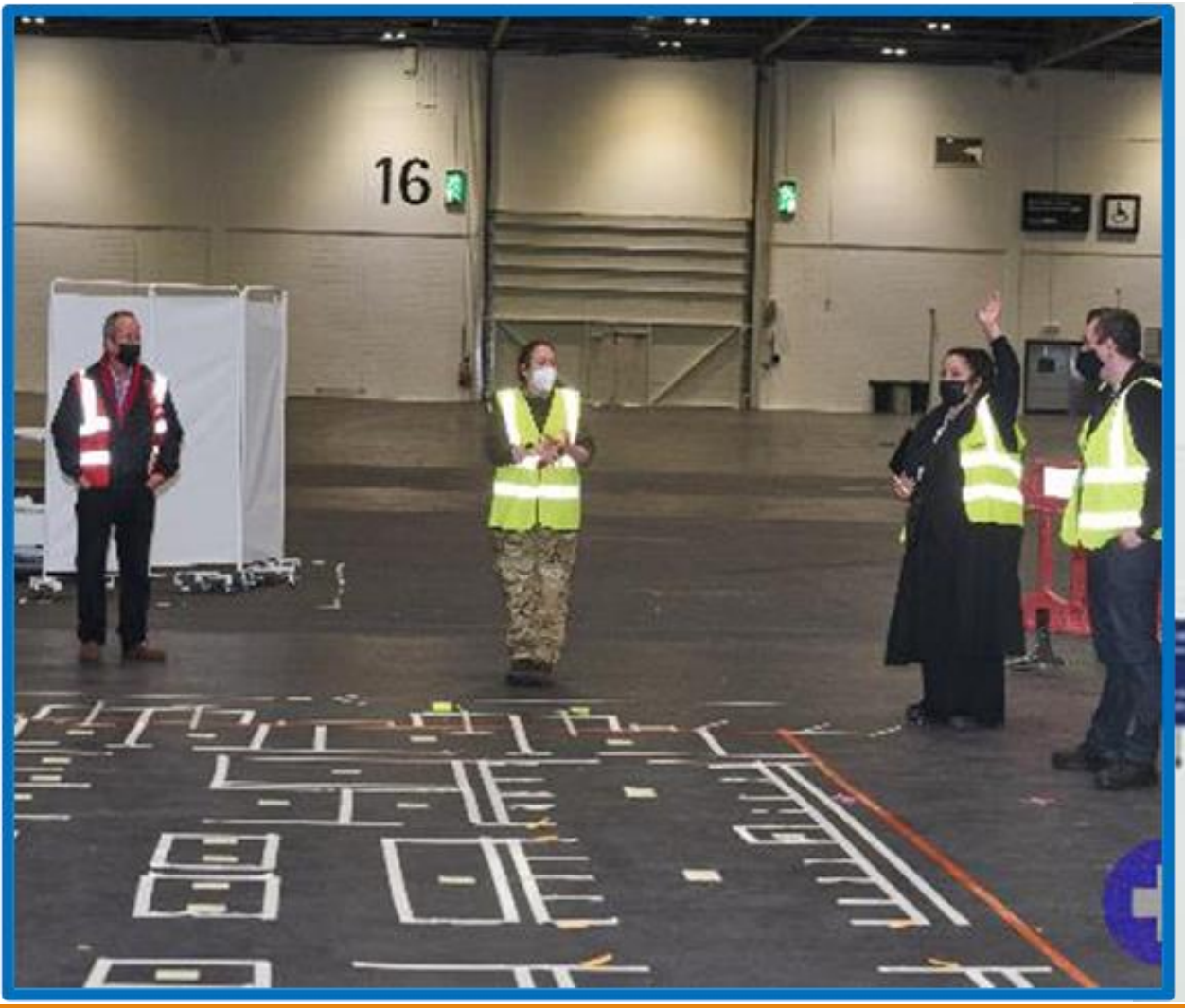
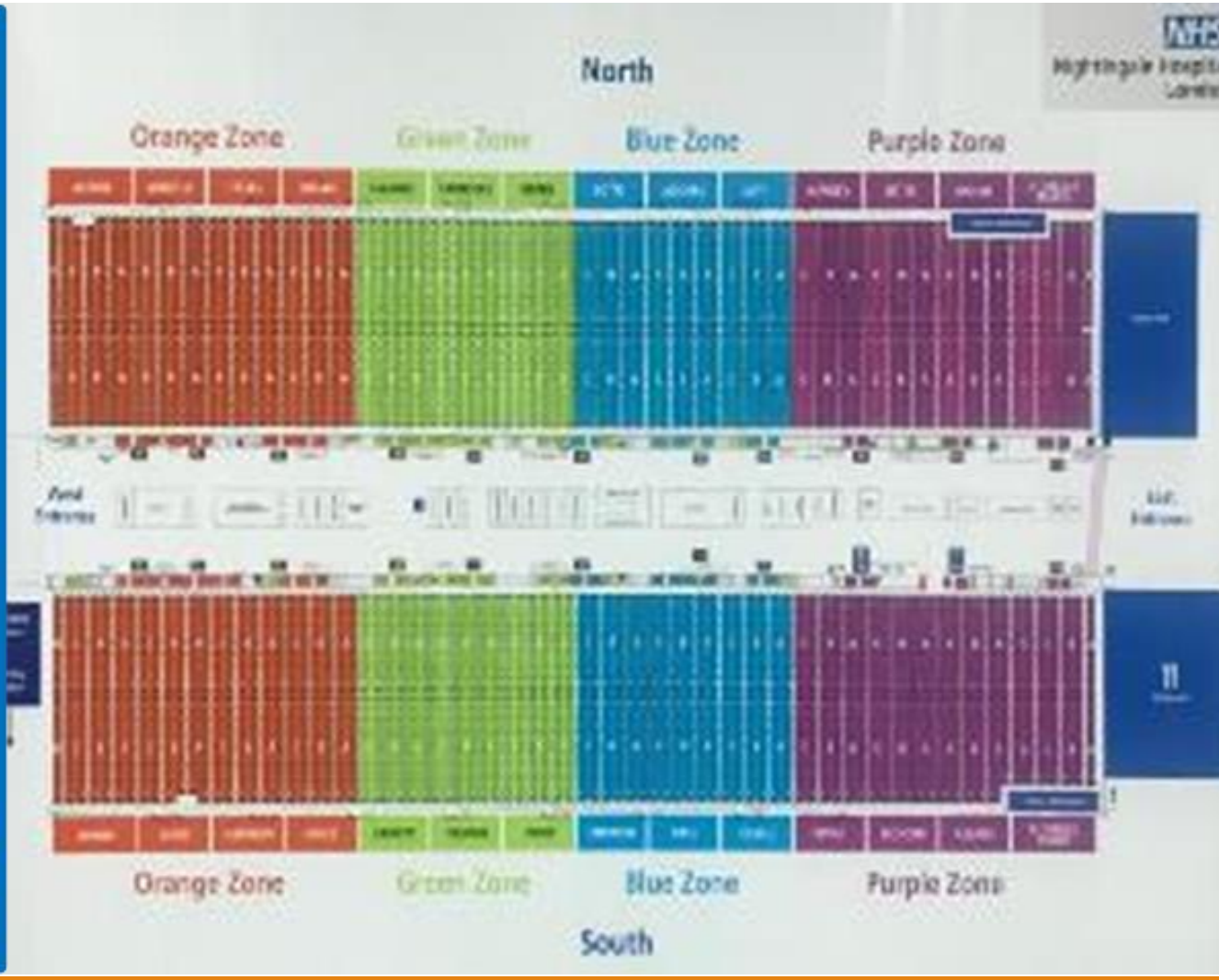


DIAGRAM OF THE CAUSES OF MORTALITY
IN THE ARMY IN THE EAST.
2.
APRIL 1855 TO MARCH 1856.
1.
APRIL 1854 TO MARCH 1855.
JUNE
MAY
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY 1856
FEBRUARY
MARCH
APRIL 1854
BULGARIA
CRIMEA
The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.
The blue wedges measured from the centre of the circle represent, area for area, the deaths from Preventible or Mitigable Zymotic diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes.
The black line across the red triangle in Nov.r 1854 marks the boundary of the deaths from all other causes during the month.
In October 1854, & April 1855, the black area coincides with the red, in January & February 1856, the blue coincides with the black.
The entire areas may be compared by following the blue, the red & the black lines enclosing them.


16

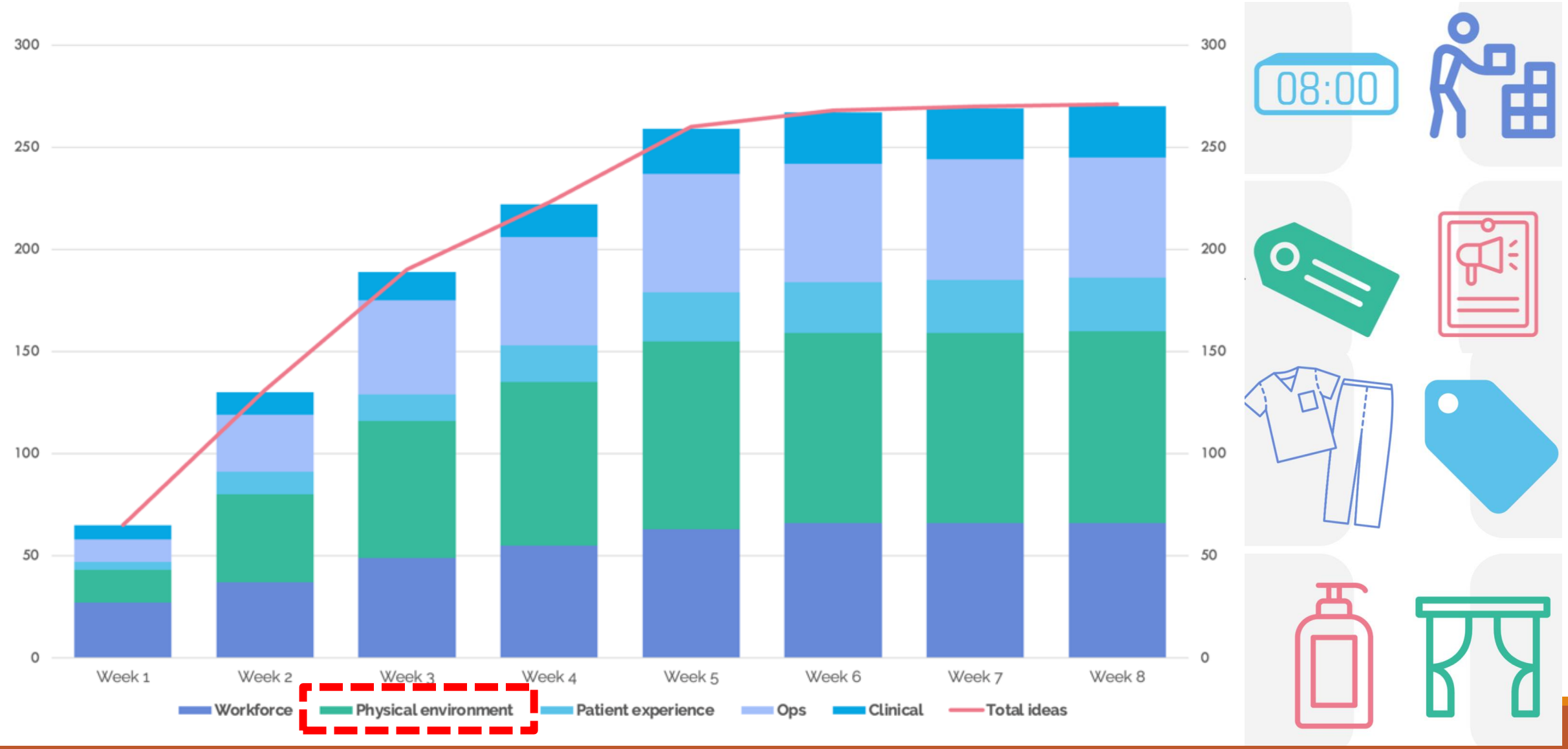

North
Orange Zone
Green Zone
Blue Zone
Purple Zone
Orange Zone
Green Zone
Blue Zone
Purple Zone
South

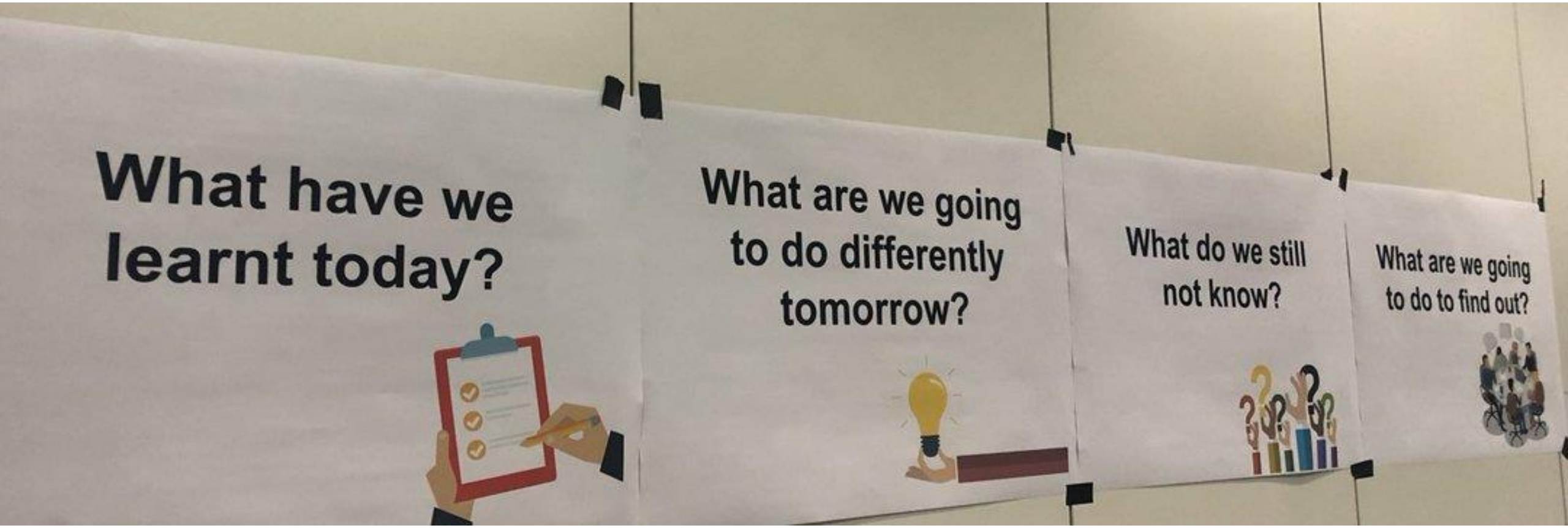

41

"A crisis isn't a reason to pause improvement work… Rather, it's to put learning where it should be – a mainstream activity for everyone involved in health and care"

ImproveWell.

NHS
Nightingale Hospital London



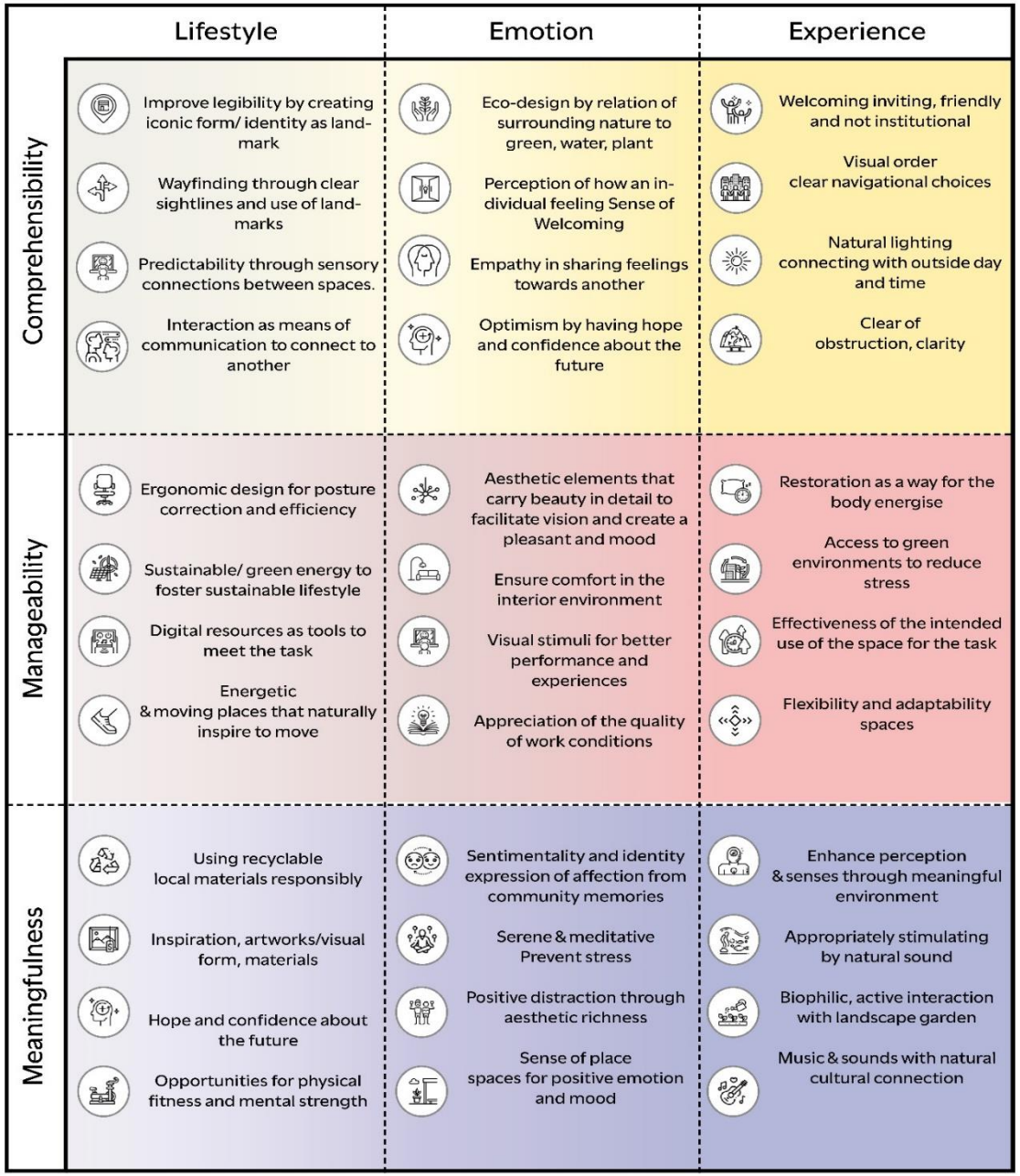

What have we learnt today?
What are we going to do differently tomorrow?
What do we still not know?
What are we going to do to find out?


IMPROVEMENT AREA
MEASUREMENT
OUR IDEAS
*FALLS RISK ASSESSMENT
• APPROPRIATE FOOTWEAR
• MOBILITY BOARDS
• MEDICATION REVIEW
*PRACTICE/UPSKILLING
• TIMELY PATIENT ASSESSMENT
• FALLS MATS
• RECOGNISING WHO IS AT RIS
• ENVIRONMENTAL SAFETY
NHS
Thank you
to our amazing NHS staff
#thankyouNHS


NHS
Nightingale Hospital
London
NHS
NHS

Salutogenic environments

paul



How do we need to change our thinking about design and delivery?

Getting the design of the buildings right we need to go right back to the design ideas about:

- How patients and visitors interact with services
- How staff are treated and deployed
- How the services are designed
- How we think about hospitals in the wider system

Future Healthcare Journal 2023 Vol 10, No 1: 1–4

INFRASTRUCTURE

The Wolfson Prize: designing the hospital of the future

Author: Nigel Edwards,[A] Stephen Dunn,[B] Paul Barach[C] and Louella Vaughan[D]

ABSTRACT

Background

The 2021 Wolfson Economics Prize asked how new hospitals should be designed to radically improve patient experiences, clinical outcomes, staff wellbeing and integration with wider health and social care. With a major programme to rebuild and renew hospitals in England underway, the Prize offered an opportunity to understand current thinking about hospitals and their future place.

Methods

The 41 submissions that were identified as 'most promising' were reviewed and subjected to framework analysis. Emerging themes were identified and discussed iteratively.

Results

Five dominant themes were identified: a calming environment; systems of care; distribution of services; use of technology; and going green. Several tensions and trade-offs were evident across the submissions and a number of gaps were identified in the knowledge base that need to be remedied to ensure that new hospitals are safe and efficient.

Conclusion

The previous approach to building new hospitals, with its over-riding drive to reduce costs, has not served the UK well. New ways of thinking about hospital building and design are urgently needed, especially the funding of research and the creation of a national repository devoted to design solutions and post-build evaluations of new hospitals.

KEYWORDS: architecture and design, awards and prizes, hospitals, knowledge bases

DOI: 10.7861/fhj.2022-0105

Rumours of the death of the hospital have been greatly exaggerated or at least that would appear to be one of the core conclusions from the submissions to the £250,000 2021 Wolfson Economics Prize.[1] The Prize is funded by the Wolfson Foundation, which is an independent grant-making charity aiming to improve the civic health of society through education and research. The judges were independent and drawn from a variety of backgrounds in healthcare, architecture and design, charities and business. The Prize brief asked the question 'How would you design and plan new hospitals to radically improve patient experiences, clinical outcomes, staff wellbeing, and integration with wider health and social care?'

In many ways, the Prize could not be more timely. The Conservative manifesto of 2019 included a pledge to review and renew hospital infrastructure. Although the promise to build 40 new hospitals has been questioned, around 50 hospitals are either currently planning or engaged in some kind of major building project, with more still in the planning stages.[2] The UK Government is also undertaking a review of the standards that underpin hospital design, as part of its Health Infrastructure Plan (HIP).[3]

Thus, the Prize provides an opportunity to understand how clinicians, architects, engineers, planners and designers are thinking about hospitals and their future place and the ideas that they consider important. This report first examines the main ideas in the submissions and then discusses the issues that emerge from this analysis. It then suggests areas for reflection, action and the development of future research and policy.

Methods

One reviewer (SD) read and analysed all the submissions that were identified as 'most promising' by Policy Exchange, the think tank that ran the competition. Submissions were summarised and interesting ideas were identified using a framework approach. Emerging themes were mapped by one researcher (SD); these were reviewed by the three other reviewers (PB, NE and LV) and then discussed iteratively, with refinement of the analysis. Discrepancies were discussed and settled by consensus.

Main themes

The nature of the 41 entries ranged widely. Some focused narrowly on details of internal processes and practical aspects of engineering, whereas others took a conceptual approach, attempting to reimagine the hospital and its surrounding campus and their interface with local communities. Regardless of the scope, five broad themes emerged.

Creating a caring and calming environment

Many of the proposals placed a strong emphasis on salutogenic design quality, natural light and a 'biophilic design' incorporating

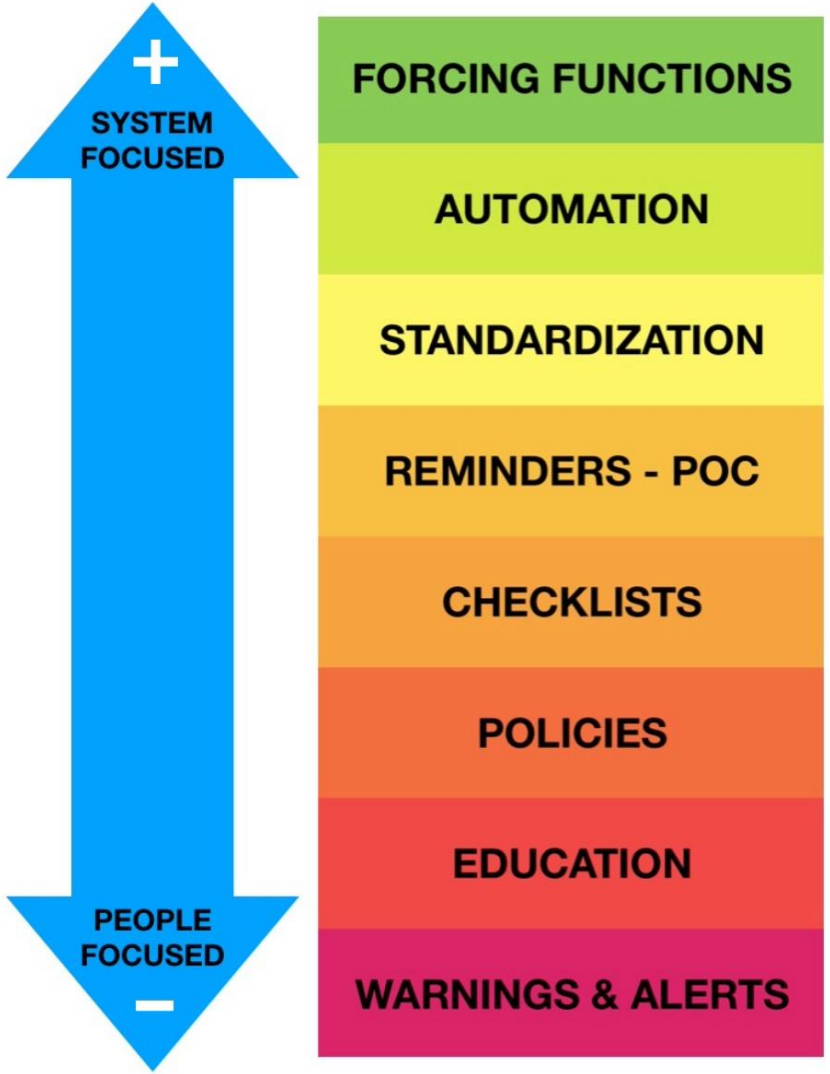
Author: [A]chief executive, Nuffield Trust, London, UK; [B]visiting senior fellow, Nuffield Trust, London, UK; [C]lecturer, College of Population Health, Thomas Jefferson University, Philadelphia, USA and Sigmund Freud University, Vienna, Austria; [D]senior clinical research fellow, Nuffield Trust, London, UK

Patients and visitors

Here are some examples – what would you add, emphasise or challenge?

Current practice	Change principle
The patient's time is treated as free – travel and waiting have no costs associated with them	Travel and waiting times are minimised One-stop services are created
Patients are passive recipients of care that is often impersonal	Patients are active participants in their care and need access to resources to support this. Digitisation allows personalisation.
Anonymous and institutional reception space and airport style common areas	Open and inviting, breaking down barriers, smaller more personal spaces
Patients have limited access to information	The patient's record is at their bedside or on their devices
Outcomes are defined in terms of narrow biomedical indicators rather than the goals of the patient	Outcomes incorporate patient experience and personalised needs
Patients interact with the system on a face-to-face basis	Patients can choose a variety of ways, including phone and video, to meet their needs
Patients share rooms	Patients have single rooms
Patients are moved to suit clinical management arrangements or when they deteriorate	Once admitted to hospital, care is brought to the patient (critical care may be an exception to this but outreach and early intervention can reduce this)
There is little design consideration for visitors and carers	Visitors and carers have space to meet with patients and professionals

Hierarchy of Intervention Effectiveness



PALOMAR MEDICAL CENTER WEST: PATIENT ROOM SUMMARY

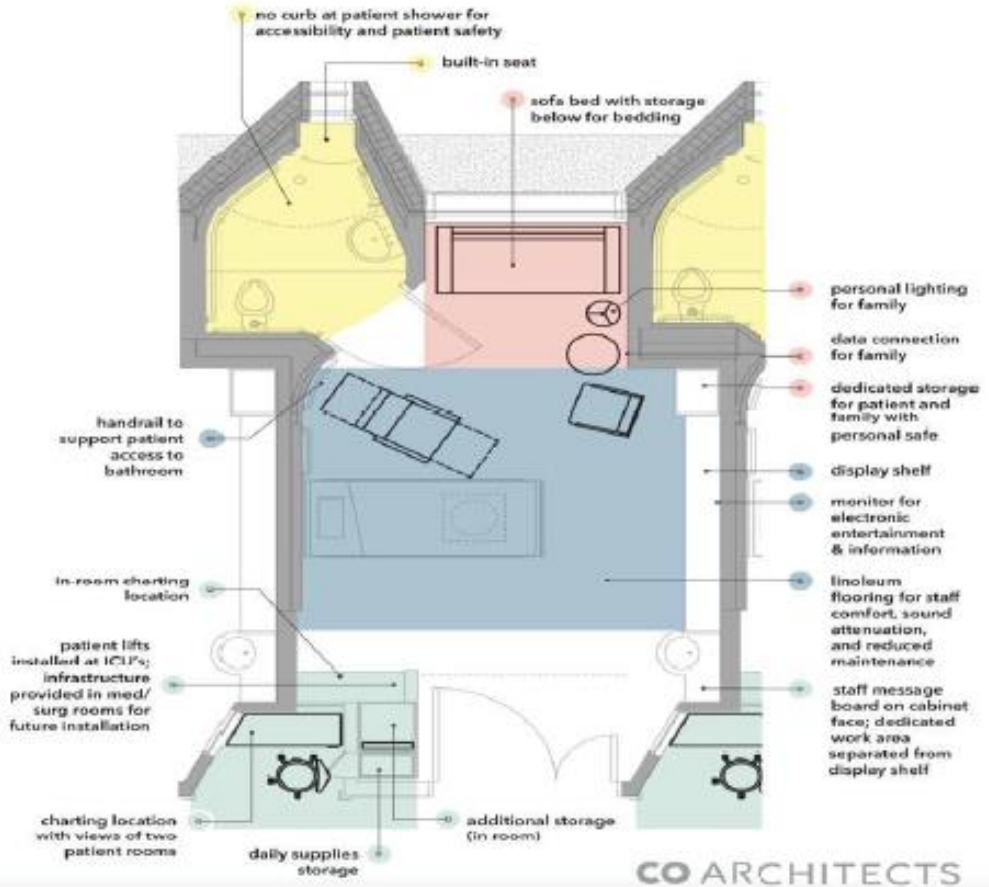
HYGIENE ZONE
- Patient bathroom located on the headwall with continuous handrail from bed to door
- Roll-in shower at all bathrooms for accessibility
- Wide door to accomodate patient & helper

FAMILY ZONE
- Dedicated family area with sleeper sofa to promote integrated care in all rooms
- Electrical and data ports for personal computer and other devices
- Individualized lighting
- Cubicle curtain for privacy
- Guest seating for 3-4

PATIENT ZONE
- Patient chair
- Patient wardrobe includes personal safe
- Footwall includes display shelf and electronic entertainment & information
- Maximum daylight and views to exterior
- Control of window shade from bed
- Control of lighting from bed

STAFF ZONE
INSIDE ROOM
- In-room hand washing sink close to door encourages good hygiene practices by all who enter
- Work counter provides dedicated space for clinician use
- Cabinet hides motorized lift from view
- Soap and towels at sink are hidden from view but easily accessible
- Additional storage provided for lesser used items
- Individualized lighting

OUTSIDE ROOM
- Decentralized nurse station provides quiet area for concentrated work
- Work counter is height adjustable
- Daily meds & supplies located at distributed storage reduces nurse time away from patient
- Windows visual access to two patient rooms from one location
- Work chair has lumbar support for comfort during longer sitting tasks
- Individualized lighting



Barach P Parker D. 2022

Staff

What would you add, emphasise or challenge?

Current practice	Change principle
Casual and social interaction between staff is of low value	Opportunities are created for opportunistic interaction to support socialisation, promote peer-to-peer learning, increase innovation and manage patients better
Offices for busy staff can be a long distance from clinical areas	Teams work together and close to the clinical areas
Staff movement and internal travel are a cost of doing business	Activities are clustered around patient needs and key adjacencies
Expert support is limited to who is available on call or on site	Telemedicine provides the opportunity to spread expertise across distances
Staff facilities can be limited – for example, staff have to change at home and when on night shift they need to feed themselves	There are dedicated staff changing facilities, lockers and support areas; the infrastructure is created to help staff to flourish – hot food at night, mess rooms and so on are provided
Staff may work in areas with limited or no natural light	Stress is reduced by enabling access to light, biophilic design and green space
Staff may deal with multiple room layouts, different storage arrangements and idiosyncratic approaches	Standard room and ward/department layouts reduce frustrations and improve safety
Staff spend a lot of time looking for equipment	Key equipment is tracked wirelessly and stored in standard ways and locations
Staff cope with multiple alarms	Intelligent systems integrate alarms to minimise noise and alarm fatigue
Staff undertake work that can be automated	Work is automated where possible, releasing time for high touch patient contact

Services

What would you add, emphasise or challenge?

Current practice	Change principle
Running at very high occupancy rates is efficient	Systems work at a steady pace, with spare capacity to support infection control and the ability/capacity to deal with variation
Design is for average workflows	Design is able to flex capacity and service configuration
Queuing, waiting and batch processing are efficient mechanisms for programming work	The aim is for flow and 'pull' models designed around the clinical microsystem that supports patient-centred, humane and personalised care
Care is based on face-to-face encounters in the hospital	Telemedicine means clinicians are no longer bound to the hospital in which they work
Care is organised around medical specialties	Care is organised around clusters of specialist multidisciplinary care that reflects the growth of patient complexity
Emergency and planned care workflows can be mixed.	Processes are separately streamed to improve flow of patients and to optimise equipment use
There is a reliance on rules and individual effort to ensure safety	Predictive and proactive high-reliability systems are created- see Appendix 1
Approaches to care delivery are highly variable within the organisation	There are highly reliable standardised approaches that can adapt, scale and flex as necessary
Patients who are medically fit remain in hospital for extended periods due to the complexity of their (often non-medical) needs	Patients are transferred to appropriate alternative modalities of care as soon as they are ready
There is a secondary–primary care split, with hospitals delivering episodic care	Hospitals work closely with local places to support population health management
Referral is the route to expertise	There are multiple other routes to expertise, for example: advice and guidance services, specialist support to primary care and multidisciplinary clinics
General hospitals have a supplicant relationship to tertiary centres	Hospitals are part of networks with balanced reciprocal relationships supported by integrated control centres

Hospitals as part of the wider system

How do hospitals need to adapt, change, redesigned?

Current practice	Change principle
Hospitals are standalone institutions and private spaces	Hospitals are integrated with the community and other resources – either within the hospital site or by taking the hospital to the high street Hospitals are important symbols and important components of civic society
Limited health promotion is undertaken	The hospital is an active health promoter, both internally for patients, visitors and staff and also in its participation in its wider community, including schools and leisure facilities
Wellness and leisure happen elsewhere	Hospital ambulatory, rehab and wellness work use leisure facilities and other public space
Centralised procurement saves money	Local procurement saves food miles and puts money into the local economy
Travel, food miles and carbon are externalities	Carbon and other environmental costs are treated as real Hospitals contribute to the social, economic and environmental sustainability of the wider system

‘Traditional’ facilities (open-plan Nightingale-style wards) to 100% single room accommodation in a newly built hospital

Overall aim was to identify the impact on:

- care delivery and working practices
- staff experience
- patient experience
- safety outcomes (including fall and infection rates)
- capital and operational costs.

Three workstreams conducted before and after the move:

1. mixed-methods study to inform a pre-/post-‘move’ evaluation; 2. quasi-experimental before-and-after study using two control hospitals; 3. analysis of comparative costs associated with single rooms.

‘Before’ data in 2010-11 in four case study wards in the old accommodation, ‘post’ data collected 12–15 months after the move (2012-13).

Funded by NIHR/SDO

Summary at DOI: 10.3310/hsdr03030, full report at DOI 10.3310/hsdr03030

Tunbridge Wells Hospital at Pembury

- £225 million new build (2008-2011 construction work)
- 512 single beds
- 8+2 obstetric theatres
- 37 outpatient rooms
- Approx. 65,000 sq.m.
- 1st NHS Hospital with 100% single rooms in England




Cost impact of a single room hospital design

Construction costs no higher as a result of all single room design, as no additional ward space required.

Any increase in **energy, maintenance and periodic refurbishment costs** over hospital lifetime outweighed by total life-cycle costs:

- 1:1:12 ratio between **capital expenditure** (including major life-cycle work) vs estates-related **operating costs** (building running costs, equipment upgrades) vs **medical costs**

Negligible difference in lifetime costs (net present value) between the **all-single room design and a 50% single-room design** (full life-cycle costs of all single-room hospital would have reduced by only 0.7% over a 60 year period).

Hard to identify any clear cost effect associated with single rooms, apart from **increased cleaning costs** (53% higher in all-single room design) but these represent a very small share of total lifetime operating costs.

49% increase in cost of preparing and serving meals, due to change from a central kitchen to ward-based kitchen model (not related to single rooms design).

Staffing implications

Some impact on operational costs arising from **overall increase in nursing staff and change in the skills mix** after the move:

In all case study wards there was an **increase in the cost of nursing/midwifery staff,** with the exception of the surgery unit.

Changes in **ratio of FTE nursing staff per bed**:

- 1.16 to 1.47 (elderly ward)
- 3.35 to 4.74 (maternity)
- 1.21 to 1.38 (surgery unit)
- 1.74 to 1.60 (acute assessment unit)

Clinical implications

Loss of staff effectiveness and efficiency due to challenges in surveillance and additional walking, but not possible to determine impact on clinical outcomes

No clear evidence of cost impact of single rooms in terms of falls

No clear evidence of impact on length of stay and hospital-acquired infections

Data collected 12-15 months after the move - longer term study needed to generate evidence on care-related outcomes

Poling question: What are your ideas about new design principles

Result

Conclusions

Post occupancy evaluation to include:

- User Feedback: Gathering feedback from hospital staff, patients, and visitors regarding their experiences and satisfaction with the building's design, functionality, and overall usability.
- Functional Evaluation: Assessing whether the hospital's spaces and layouts effectively support the intended functions and workflows, such as patient flow, staff efficiency, and coordination between different departments.
- Technical Performance: Evaluating the performance of building systems, including heating, ventilation, and air conditioning (HVAC), lighting, acoustics, and technology infrastructure to ensure they meet the required standards and provide a comfortable and functional environment.
- Safety and Security: Reviewing the effectiveness of safety measures, such as fire safety systems, emergency exits, security protocols, and compliance with relevant codes and regulations to ensure the building provides a secure environment for patients, staff, and visitors.
- Energy Efficiency and Sustainability: Assessing the hospital's energy consumption, water usage, waste management practices, and overall environmental sustainability to identify opportunities for improvement and reduce the building's ecological footprint.
- Adaptability and Flexibility: Examining the building's ability to accommodate future changes and expansions, such as the addition of new technologies, advancements in medical equipment, or shifts in healthcare delivery models.
- Cost and Operational Efficiency: Evaluating the building's operational costs, maintenance requirements, and life cycle analysis to identify potential areas for cost savings and improvements in the long-term operation and maintenance of the facility.
- Compliance with Design Intent: Comparing the actual performance and functionality of the hospital with the original design intent, architectural drawings, and specifications to ensure that the building was constructed according to the planned vision.

Figure 5: The Leap Upstream, by Tye Farrow, 2015 in Chua G. The ultimate test for architecture and design: do our buildings and spaces cause health? (46)

Safety Management System-
A Framework for Measuring and Monitoring safety*

Prompts

- Identify the different types of harm that can exist in your setting
- Use a range of safety measures, while understanding their strengths and limitations
- Ensure the measures are valid, reliable and specific

Prompts

- Specify the level of reliability you would expect in areas of standardised practice
- Use local and national audits and initiatives to monitor reliability
- Understand what contributes to poor reliability

Prompts

- Select an appropriate mix of formal and informal safety monitoring mechanisms
- Use this information to take timely action to avert safety issues
- Reflect on whether current structures and committees enable timely action to be taken

Prompts

- Don't wait for things to go wrong before trying to improve safety
- Explore new opportunities to develop systematic ways to anticipate future risks
- Use a variety of tools and techniques to build an understanding of the factors that give rise to safety issues

Prompts

- Use the analysis of incidents as a starting point to reveal the wider issues in the system
- Place more emphasis on learning, feedback and action than simply on data collection
- Integrate and tailor information to make it meaningful from the ward to the board

* Health Foundation

Learning Health System

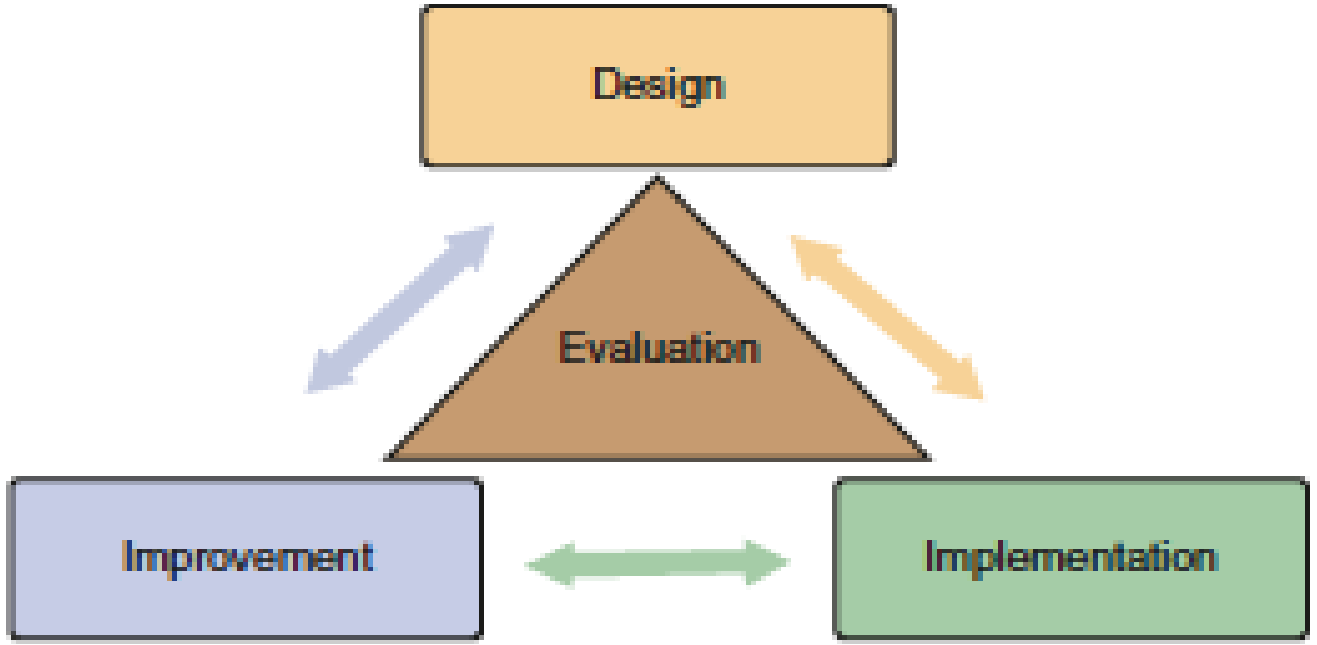


Fig. 39.2 Design Focused Implementation Framework (DFIF)