

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


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COPENHAGEN

MAY 17, 2023



# Who we are


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# 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 |

The background of the slide features a close-up, slightly blurred photograph of a wooden surface. Scattered across the surface are several small, light-colored wooden blocks, some of which have letters (A, S, E, R, B, N) and numbers (8, 3) printed on them. A long, thin, light-colored wooden strip is also visible, partially obscuring the blocks. The overall lighting is warm and soft.

**What was your.....**

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



# Lessons from the pandemic

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

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

Go to [menti.com](https://menti.com) meeting id 1729 4104

SEE RESULTS OF MENTI QUESTIONS AT PAGE 60-66

[Result](#)



# Thought experiments

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

A close-up, low-angle shot of a wooden chair, likely a dining chair, with a yellow background. The chair's legs and seat are visible, and the wood has a warm, natural finish. The lighting is soft, creating a warm and inviting atmosphere.

**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

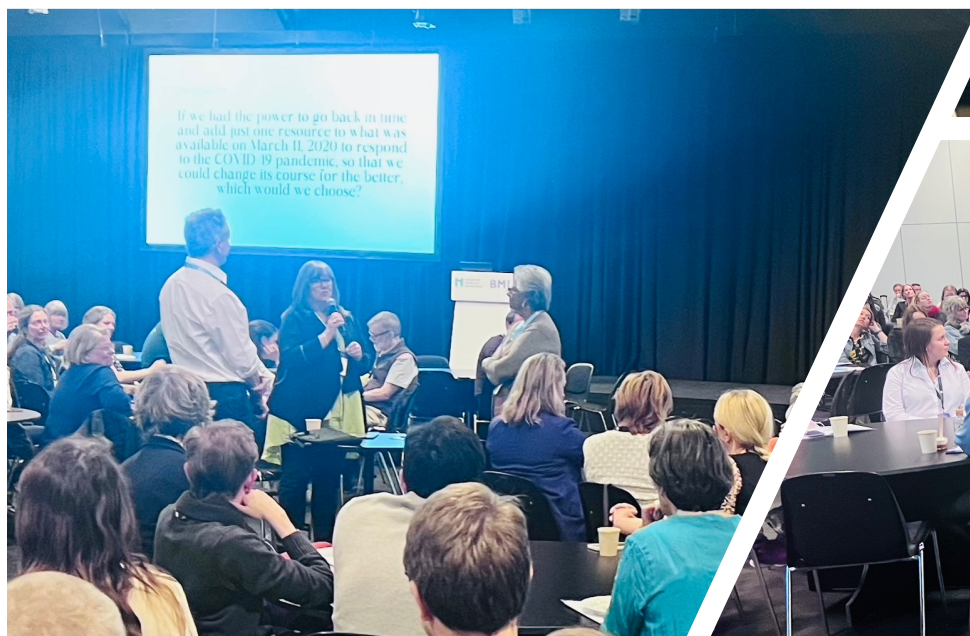
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\* Bob Klaber, Consultant General Paediatrician & Director of Strategy, Research & Innovation, Imperial College Healthcare NHS Trust.

\*\* Dianne Murray, RN, NHS Education for Scotland

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







# The Quadruple Aim

Article

AMERICAN COLLEGE OF  
Medical Quality

## Supporting the Quadruple Aim Using Simulation and Human Factors During COVID-19 Care

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### Abstract

The health care sector has made radical changes to hospital operations and care delivery in response to the coronavirus disease (COVID-19) pandemic. This article examines pragmatic applications of simulation and human factors to support the Quadruple Aim of health system performance during the COVID-19 era. First, patient safety is enhanced through development and testing of new technologies, equipment, and protocols using laboratory-based and in situ simulation. Second, population health is strengthened through virtual platforms that deliver telehealth and remote simulation that ensure readiness for personnel to deploy to new clinical units. Third, prevention of lost revenue occurs through usability testing of equipment and computer-based simulations to predict system performance and resilience. Finally, simulation supports health worker wellness and satisfaction by identifying optimal work conditions that maximize productivity while protecting staff through preparedness training. Leveraging simulation and human factors will support a resilient and sustainable response to the pandemic in a transformed health care landscape.

### Keywords

health care simulation, patient safety, Quadruple Aim, COVID-19, system preparedness

### Introduction

Coronavirus disease 2019 (COVID-19) has uniquely stressed health care systems, policy makers, and

health care workers throughout the world as they face the worst health and economic crises of our lifetimes. Administrators are rapidly navigating their institutions through uncertain times, providing leadership and strategic plans to manage numerous evolving systems threats. Many of these plans run counter to the accepted mantra in modern times, including intentional cancellations of profitable elective procedures and layoffs or furloughs of dedicated medical staff during the pandemic.<sup>1</sup>

The Triple Aim of health system reform addresses ongoing and future challenges faced by the health care sector<sup>2</sup> with recent calls for expansion to a Quadruple Aim<sup>3</sup> to include considerations and protection for staff. These 4 interdependent goals consist of (1) enhancing patient experience and safety, (2) improving population health, (3) reducing costs and preventing loss of revenue, and (4) improving wellness and satisfaction of health care workers. The fourth Aim incorporates the increasing understanding that excellent health care is not possible without a physically and psychologically safe and healthy workforce. COVID-19 has created unique threats and unanswered challenges to each element of the Quadruple Aim (Table 1).

Human factors<sup>4</sup> is a scientific discipline that addresses the complex interwoven variables that affect health care workers' ability to deliver safe,



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# Lessons from the pandemic

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- \* 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?



## German doctors pose naked in protest at PPE shortages



Guardian, April 27, 2020

## **Risk of hospital admission with coronavirus disease 2019 in healthcare workers and their households: nationwide linkage cohort study**

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Healthcare workers and their households **contributed a sixth** of covid-19 cases admitted to hospital.

Patient facing healthcare workers had **threefold increased** risks of admission with covid-19.

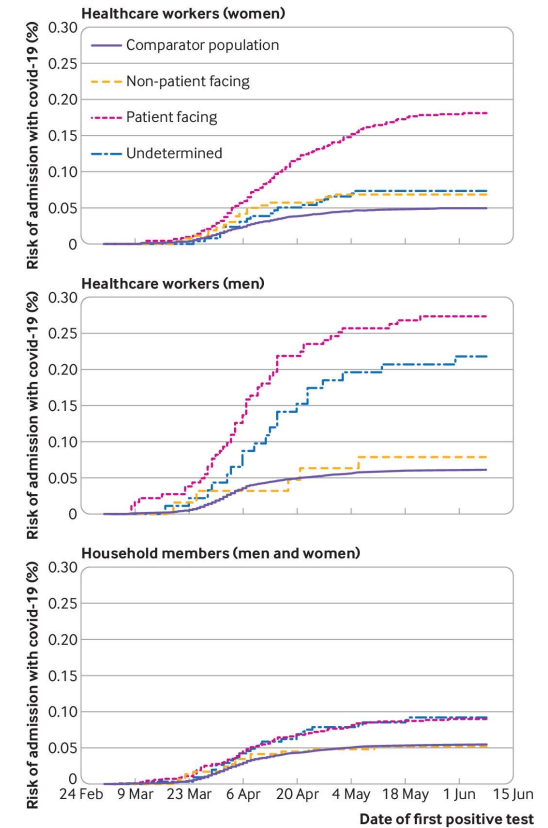
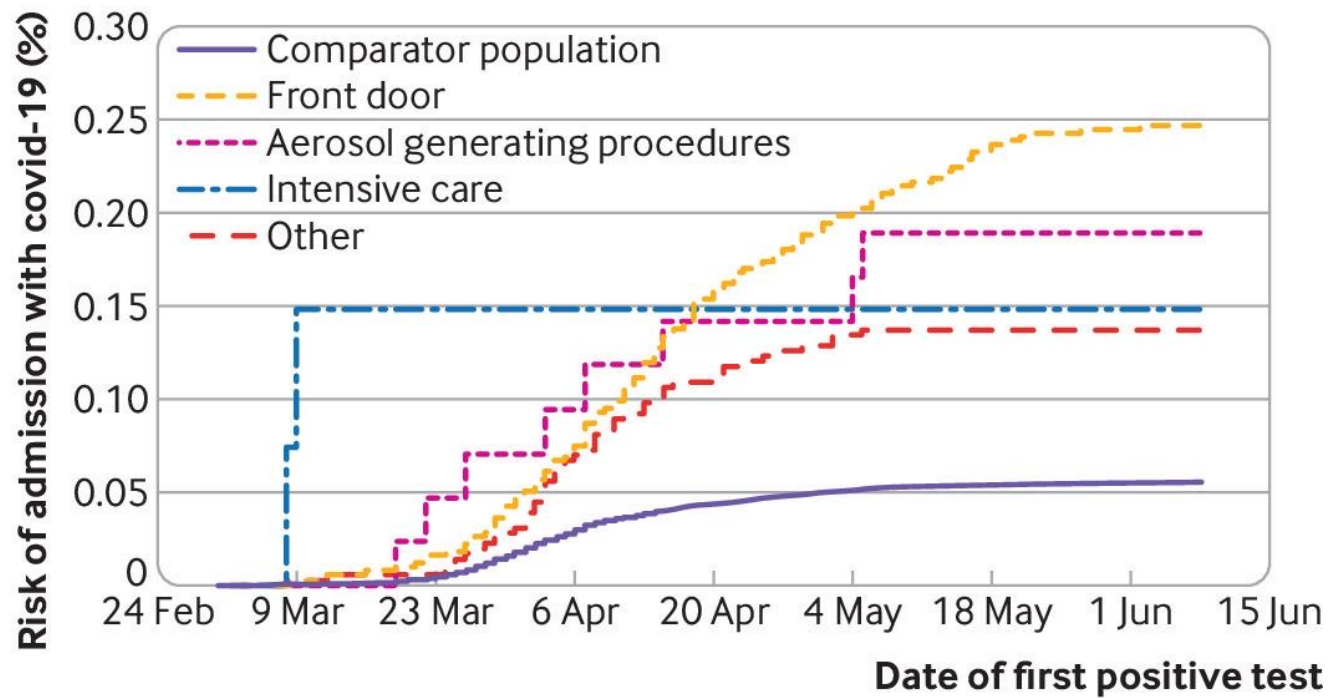
HCW household members **twofold increased** risks of admission with covid-19.

*BMJ* 2020; 371 doi: <https://doi.org/10.1136/bmj.m3582>

Mutambudzi M, Niedwiedz C, Macdonald EB, *et al* Occupation and risk of severe COVID-19: prospective cohort study of 120 075 UK Biobank participants *Occupational and Environmental Medicine* Published Online First: 09 December 2020. doi:10.1136/oemed-2020-106731



## Cumulative incidence (risk) of admission to hospital with covid-19 in healthcare workers, household members of healthcare workers, and the general working age population



# Lessons from COVID and beyond

DOMINIQUE ALLWOOD

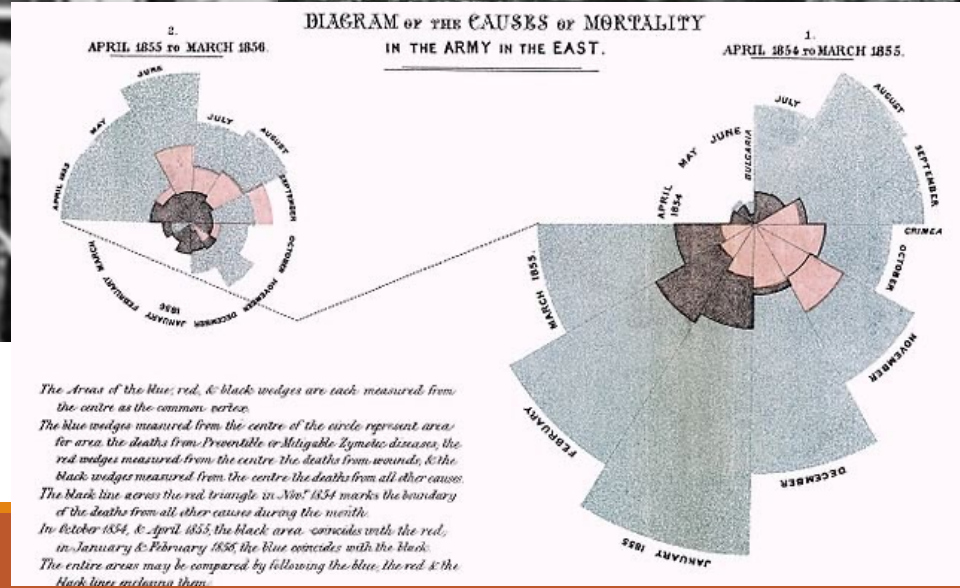
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# Florence Nightingale





# NHS Nightingale London Turning a conference centre into a hospital

**Designing the layout & infrastrure**

**Creating the 'care' environment**

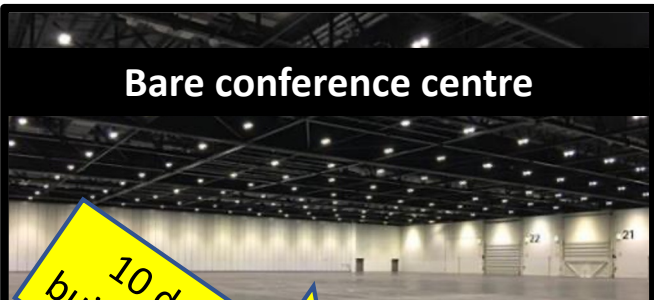
**Improving workflow**

**Driving learning and innovation**



Clinical Model  
...build the aircraft in  
flight

Bare conference centre

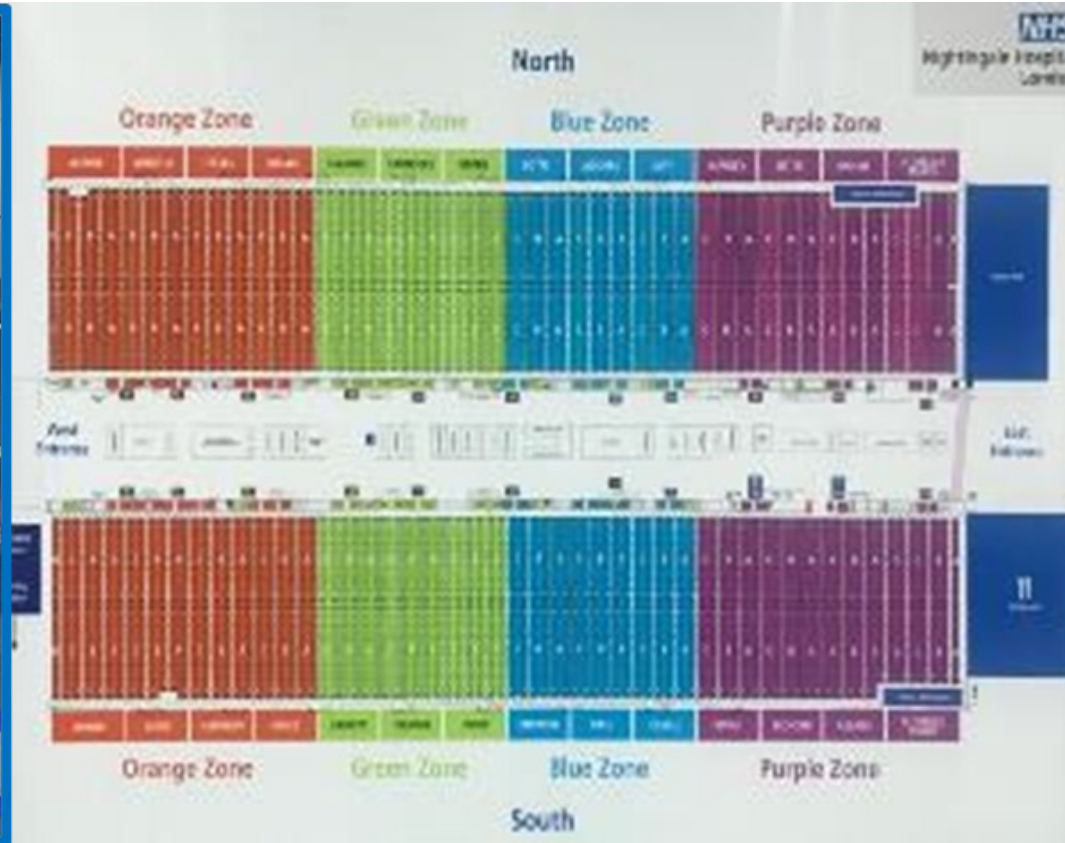
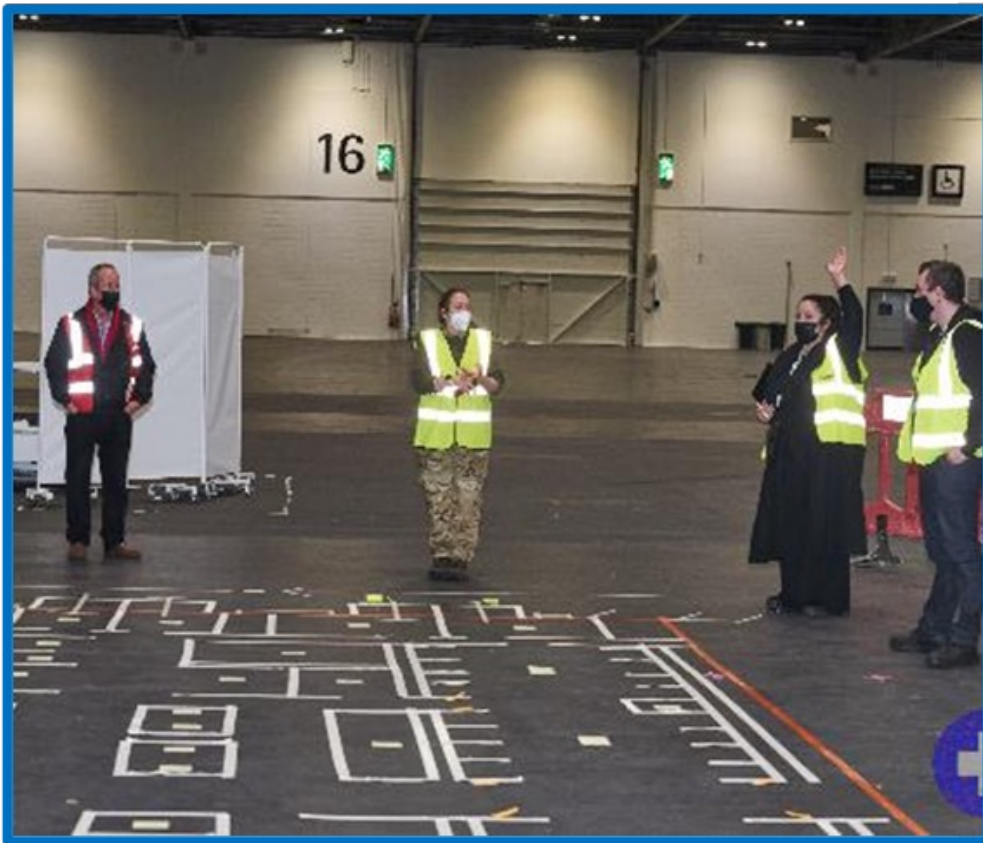


10 days to  
build and open



Military planning tools TEPIDCOIL

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







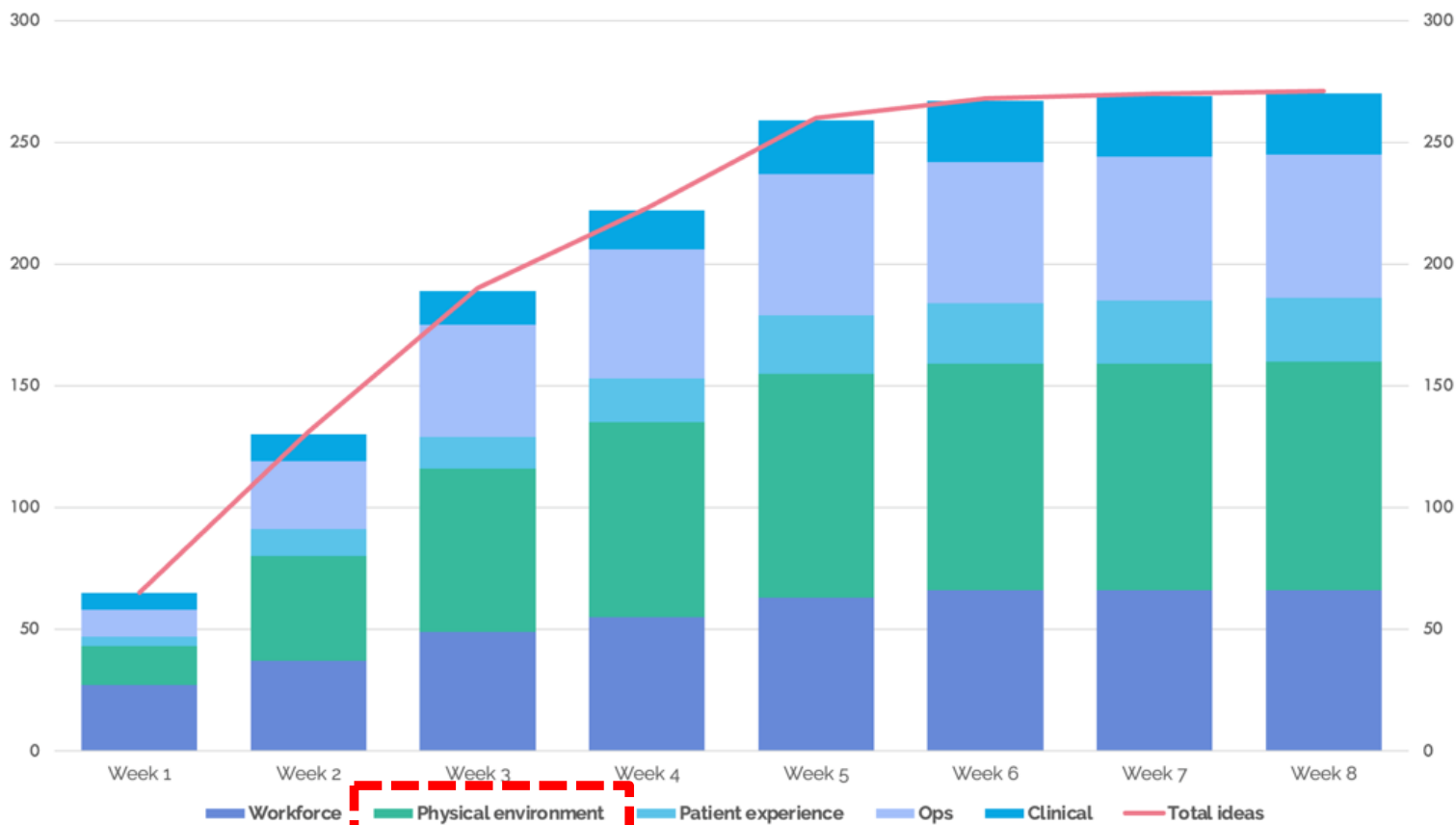


“A crisis isn’t a reason to pause improvement work... Rather, it’s to put learning where it should be – a mainstream activity for everyone involved in health and care”

# ImproveWell.



Nightingale Hospital  
London



**What have we  
learnt today?**



**What are we going  
to do differently  
tomorrow?**



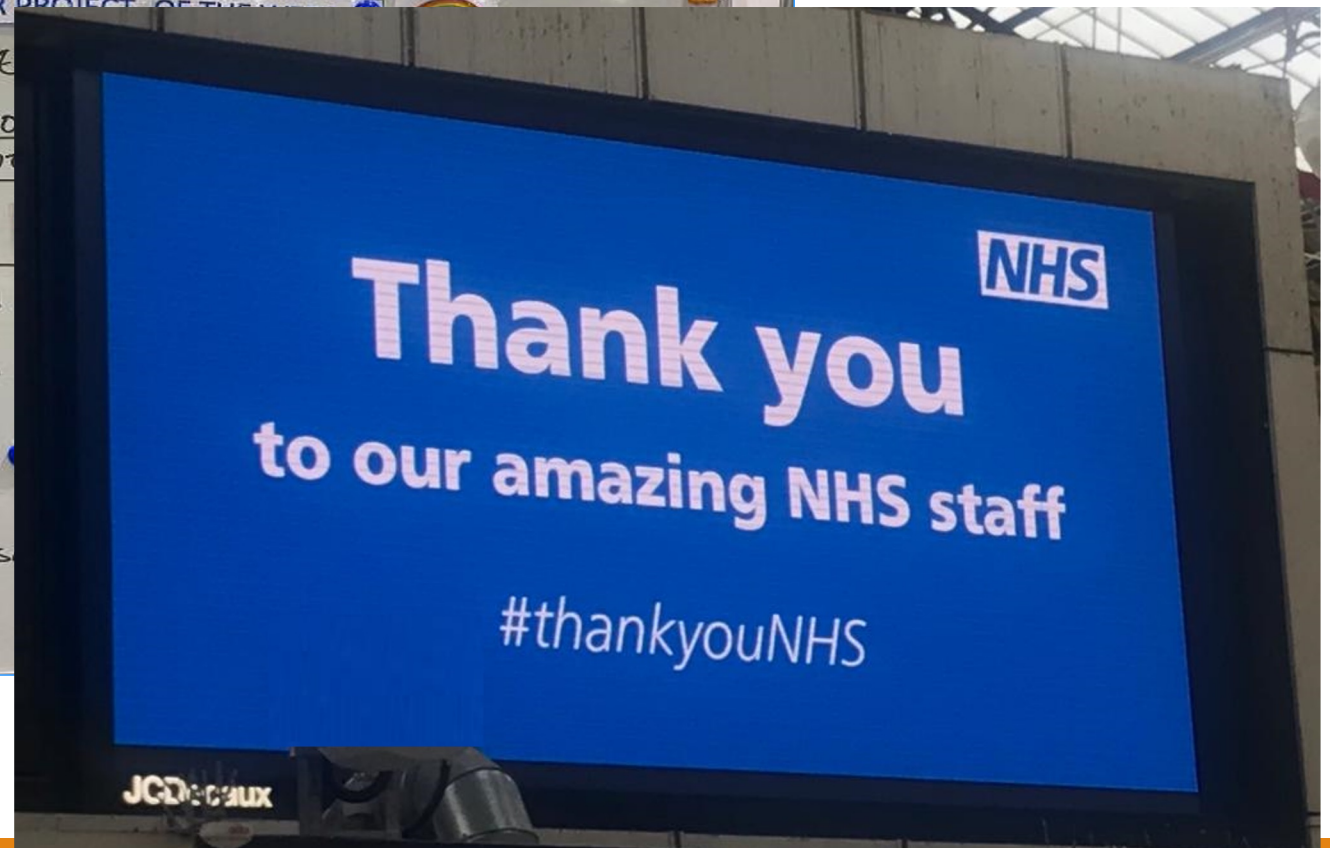
**What do we still  
not know?**



**What are we going  
to do to find out?**









The image shows the entrance to Nightingale Hospital in London. The building features a large, modern glass facade with a prominent white cross-shaped sign in the center. The sign displays the NHS logo and the hospital's name. Below the sign is a set of glass doors leading into the building. The entrance is flanked by blue walls with the NHS logo. The overall design is contemporary and professional.

**NHS**

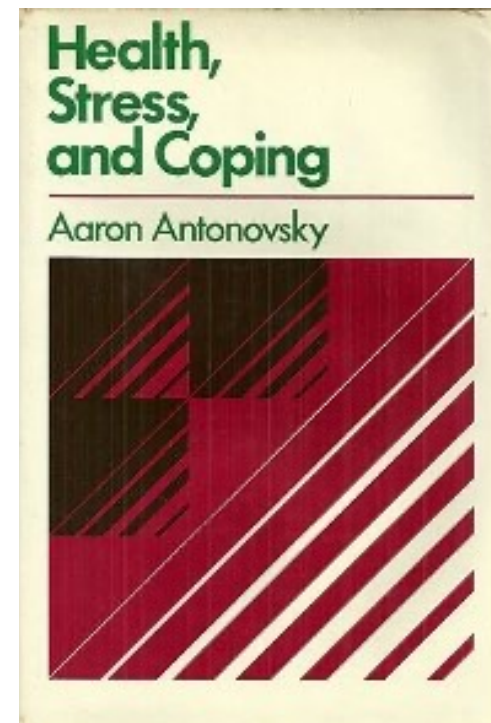
**Nightingale Hospital  
London**

**NHS**

**NHS**



## *Theory of Health and Salutogenesis*



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

400 submissions to the Wolfson Hospital of the Future Award Competition

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 2021 Vol 16 No 1 1-4 ORIGINAL RESEARCH

**INFRASTRUCTURE** The Wolfson Prize: designing the hospital of the future

Author: Nigel Edwards,<sup>a</sup> Stephen Dunn,<sup>b</sup> Paul Barach<sup>c</sup> and Louella Vaughan<sup>d</sup>

**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.

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

**Results**  
Four 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 one-sided 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 base.

DOI: 10.7861/fhj.2022-0105

Barriers to 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. The Prize is funded by the Wolfson Foundation,

which is an independent grant-making charity aiming to improve the care, 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 itself 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. The UK Government is also undertaking a review of the standards that underpin hospital design, as part of its Health Infrastructure Plan (HIP).<sup>1</sup>

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 (GD) 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 (GD) those were reviewed by the three other reviewers (PE, NB and LV) and then discussed iteratively, with refinement of the analysis. Disagreements 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, the broad themes emerged:

Creating a caring and calming environment  
Many of the proposals placed a strong emphasis on adopting design quality: natural light and a 'biophilic design' incorporating

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1

# Translating Salutogenic Theory into Environmental Design Factors that Promote Health and Prevent Stress!

|                   | Lifestyle   | Emotion   | Experience  |
|-------------------|---|---|---|
| Comprehensibility |  Improve legibility by creating iconic form/identity as landmark<br> Wayfinding through clear sightlines and use of landmarks<br> Predictability through sensory connections between spaces<br> Interaction as means of communication to connect to another |  Eco-design by relation of surrounding nature to green, water, plant<br> Perception of how an individual feeling Sense of Welcoming<br> Empathy in sharing feelings towards another<br> Optimism by having hope and confidence about the future                 |  Welcoming inviting, friendly and not institutional<br> Visual order clear navigational choices<br> Natural lighting connecting with outside day and time<br> Clear of obstruction, clarity                                   |
| Manageability     |  Ergonomic design for posture correction and efficiency<br> Sustainable/ green energy to foster sustainable lifestyle<br> Digital resources as tools to meet the task<br> Energetic & moving places that naturally inspire to move                          |  Aesthetic elements that carry beauty in detail to facilitate vision and create a pleasant and mood<br> Ensure comfort in the interior environment<br> Visual stimuli for better performance and experiences<br> Appreciation of the quality of work conditions |  Restoration as a way for the body energise<br> Access to green environments to reduce stress<br> Effectiveness of the intended use of the space for the task<br> Flexibility and adaptability spaces                         |
| Meaningfulness    |  Using recyclable local materials responsibly<br> Inspiration, artworks/visual form, materials<br> Hope and confidence about the future<br> Opportunities for physical fitness and mental strength   |  Sentimentality and identity expression of affection from community memories<br> Serene & meditative Prevent stress<br> Positive distraction through aesthetic richness<br> Sense of place spaces for positive emotion and mood                          |  Enhance perception & senses through meaningful environment<br> Appropriately stimulating by natural sound<br> Biophilic, active interaction with landscape garden<br> Music & sounds with natural cultural connection |

Edwards N, Barach P, Dilani, Farrow T. 2022

## Patients and visitors

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

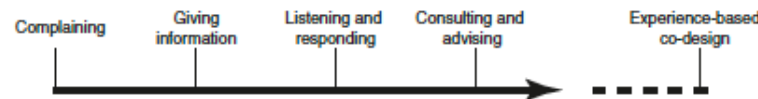
| Current practice   | Change principle   |
|--|--|
| The patient's time is treated as free – travel and waiting have no costs associated with them      | Travel and waiting times are minimised   |
| Patients are passive recipients of care that is often impersonal                                   | One-stop services are created<br>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   |

# Co-Production of Improved Outcomes

- In co-production, professional and patient activities, as well as available resources must be coordinated and controlled in an integrated manner.
- Requires rethinking the organizational architecture of healthcare systems.
- Requires organizational architectures that can enable fluid organizing across various temporarily connected “actors” -- entities capable of acting intentionally, such as individuals, groups, or organizations.



**Fig. 39.3** The continuum of co-design roles of the patient. (Reprinted with permission from Bate and Robert [23])

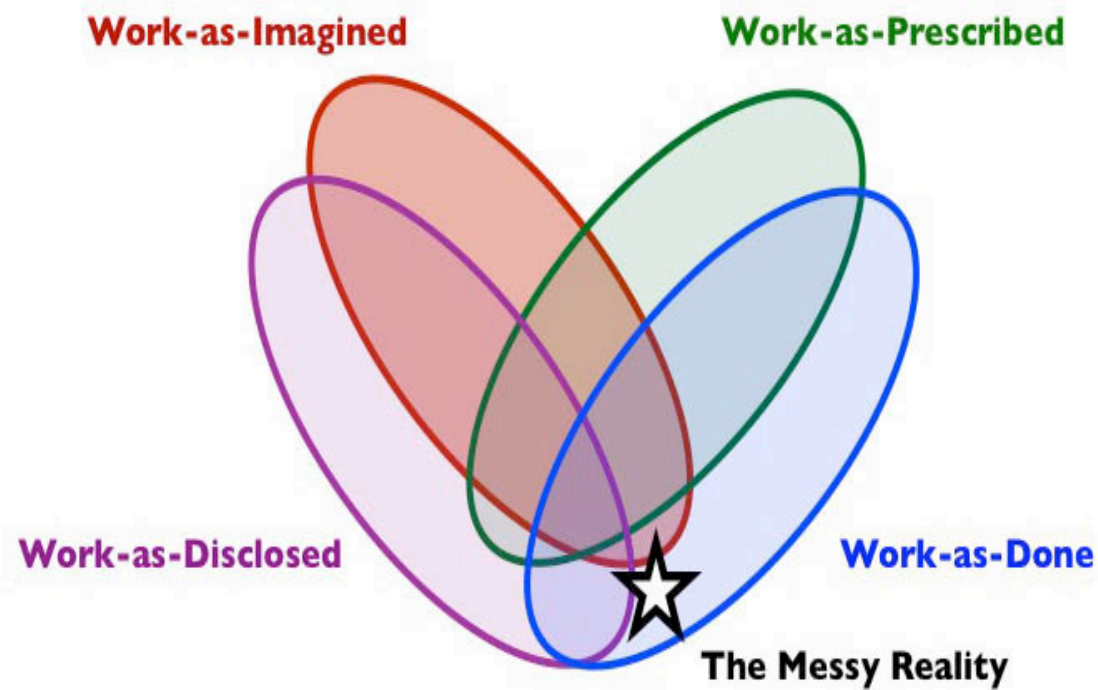


## Staff

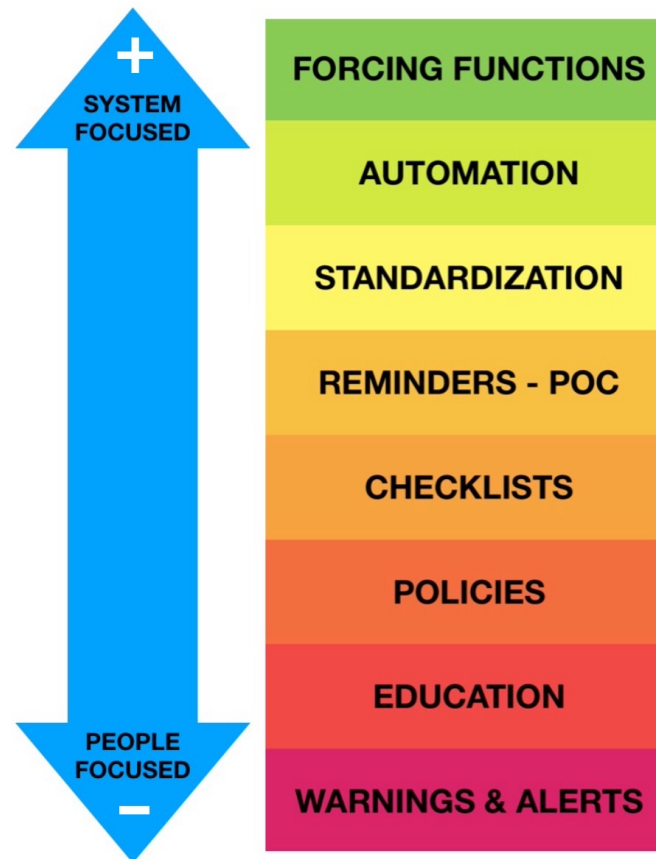
What would you add, emphasise or challenge?

| 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 <a href="#">enabling access to light, biophilic design</a> 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  |

## Workflow Redesign: Staff Work as Done vs Work as Imagined



# 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 accommodate 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

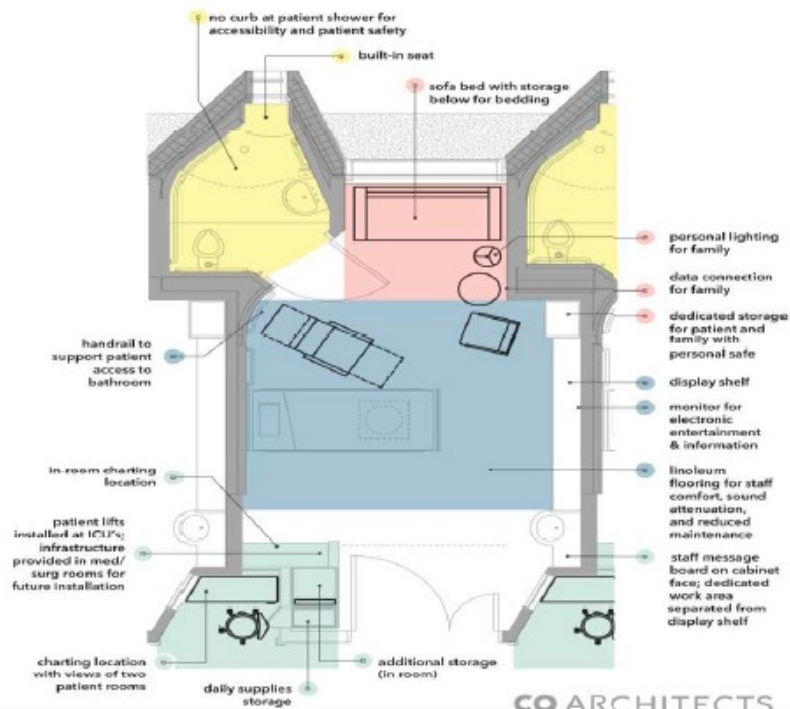
### STAFF ZONE

#### 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

## Brief Report

### Reuse of Personal Protective Equipment: Results of a Human Factors Study Using Fluorescence to Identify Self-Contamination During Donning and Doffing

Devin Doos, MD,<sup>a</sup> Paul Barach, B.Med.Sci., MD, MPH,<sup>b,c</sup> Elisa Samiento, MSPH-EPAF,<sup>a</sup> and Rami Ahmed, DO, MHPE<sup>d</sup>

<sup>a</sup>Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, Indiana; <sup>b</sup>Jefferson College of Population Health, Thomas Jefferson University, Philadelphia, Pennsylvania; and <sup>c</sup>University of Queensland, Brisbane, Queensland, Australia  
Reprint Address: Devin Doos, MD, Department of Emergency Medicine, Indiana University School of Medicine, 720 Eskenazi Avenue, FT 3, Indianapolis, IN 46202.

**Abstract—Background:** At least 115,000 health and care workers (HCWs) are estimated to have lost their lives to COVID-19, according to the chief of the World Health Organization (WHO). Personal protective equipment (PPE) is the first line of defense for HCWs against infectious diseases. At the height of the pandemic, PPE supplies became scarce, necessitating reuse, which increased the occupational COVID-19 risks to HCWs. Currently, there are few robust studies addressing PPE reuse and practice variability, leaving HCWs vulnerable to accidental contamination and harm. **Objective:** The objective of this study was to assess potential HCW contamination during PPE donning, doffing, and reuse. **Methods:** The study included 28 active acute care physicians, nurses, and nurse practitioners that evaluated 5 simulated patients with COVID-like symptoms while donning and doffing PPE between each patient encounter. An N95 mask was contaminated with a transparent fluorescent gel applied to the outside of the N95 mask to simulate contamination that might occur during reuse. Participants were evaluated after PPE doffing for each encounter using a black light to assess for face and body contamination. **Results:** All participants had multiple sites of contamination, predominantly on their head and neck. None of the participants were able to don and doff PPE without contaminating themselves during five consecutive simulation cycles. **Conclusions:** The current Centers for Disease Control and Prevention (CDC) guidelines for donning and doffing fall short in protecting HCWs. They do not adequately protect HCWs from contamination.

There is an urgent need for PPE and workflow redesign. © 2021 Published by Elsevier Inc.

**Keywords—personal protective equipment; PPE; donning; doffing; PPE reuse; occupational risks**

#### Introduction

COVID-19 has shone a bright light on the physical and emotional safety burdens that frontline health care workers (HCWs) around the world face. Unsafe working conditions and a lack of personal protective equipment (PPE) remain major challenges for HCWs throughout the recurrent waves of the pandemic and reflect on our society's failings.

PPE offers a critical barrier for preventing disease transmission in health care settings, but its widespread use during the COVID-19 pandemic has changed the experience of care delivery. In the United States, an estimated 3600 HCWs perished from COVID-19, which was most likely contracted during work (1). Centers for Disease Control and Prevention (CDC) guidelines and PPE availability were unable to keep HCWs safe from harm. HCWs in low-income countries have been particularly affected due to limited protective equipment and delayed vaccinations (2). Globally, the Director-General of the World Health Organization has a documented

## The dangers of reused personal protective equipment: healthcare workers and workstation contamination

D. Doos<sup>a,\*</sup>, P. Barach<sup>b,c</sup>, N.J. Alves<sup>a</sup>, L. Falvo<sup>a</sup>, A. Bona<sup>a</sup>, M. Moore<sup>a</sup>, D.D. Cooper<sup>a</sup>, R. Lefort<sup>a</sup>, R. Ahmed<sup>d</sup>

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Human factors  
Contamination  
Worker safety  
Occupational hazards



#### SUMMARY

**Background:** Personal protective equipment (PPE) is essential to protect healthcare workers (HCWs). The practice of reusing PPE poses high levels of risk for accidental contamination by HCWs. Scarce medical literature compares practical means or methods for safe reuse of PPE while actively caring for patients.

**Methods:** In this study, observations were made of 28 experienced clinical participants performing five donning and doffing encounters while performing simulated full evaluations of patients with coronavirus disease 2019. Participants' N95 respirators were coated with a fluorescent dye to evaluate any accidental fomite transfer that occurred during PPE donning and doffing. Participants were evaluated using blacklight after each doffing encounter to evaluate new contamination sites, and were assessed for the cumulative surface area that occurred due to PPE doffing. Additionally, participants' workstations were evaluated for contamination.

**Results:** All participants experienced some contamination on their upper extremities, neck and face. The highest cumulative area of fomite transfer risk was associated with the hook and paper bag storage methods, and the least contamination occurred with the tabletop storage method. Storing a reused N95 respirator on a tabletop was found to be a safer alternative than the current recommendation of the US Centers for Disease Control and Prevention to use a paper bag for storage. All participants donning and doffing PPE were contaminated.

**Conclusion:** PPE reuse practices pose an unacceptably high level of risk of accidental cross-infection contamination to healthcare workers. The current design of PPE requires complete redesign with improved engineering and usability to protect healthcare workers.

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#### Introduction

Continued mutation the severe acute respiratory syndrome coronavirus-2 means that coronavirus disease 2019 (COVID-19) continues to be a cause of significant illness globally. Recommended protective measures for healthcare workers (HCWs) remain variable and sometimes ambiguous. HCWs have relied on personal protective equipment (PPE) to protect themselves,

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E-mail address: [devindoos@gmail.com](mailto:devindoos@gmail.com) (D. Doos).

<https://doi.org/10.1016/j.jhin.2022.05.016>  
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#### Original Research

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**Keywords:**  
infection control; emergency medical services; occupational health; sanitary engineering; personal protective equipment; human factors; COVID-19

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## How Can Personal Protective Equipment Be Best Used and Reused? A Closer Look at Donning and Doffing Procedures

Ashley M. Hughes PhD, MS<sup>1,2</sup>, Devin Doos MD<sup>3</sup>, Rami A. Ahmed DO MHPE<sup>1</sup>, Trang N.D. Pham MD, MS<sup>1,4</sup> and Paul Barach B.Med. Sci, MD, MPH, Maj (ret.)<sup>1,4</sup>

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#### Abstract

**Objective:** The aim of this study was to examine safety-related contamination threats and risks to health-care workers (HCWs) due to the reuse of personal protective equipment (PPE) among emergency department (ED) personnel.

**Methods:** We used a Participatory Design (PD) approach to conduct task analysis (TA) of PPE use and reuse. TA identified the steps, risks, and protective behaviors involved in PPE reuse. We used the Centers for Disease Control and Prevention (CDC) guidance for PPE donning and doffing specifying the recommended task order. Then, we convened subject matter experts (SMEs) with relevant backgrounds in Patient Safety, Human Factors and Emergency Medicine to iteratively identify and map the tasks, risks, and protective behaviors involved in the PPE use and reuse.

**Results:** Two emerging threats were associated with behaviors in donning, doffing, and re-using PPE: (i) direct exposure to contaminant, and (ii) transmission/spread of contaminant. Protective behaviors included: hand hygiene, not touching the patient-facing surface of PPE, and ensuring a proper fit and closure of all PPE ties and materials.

**Conclusions:** TA was helpful revealed that the procedure for donning and doffing of re-used PPE does not protect ED personnel from contaminant spread and risk of exposure, even with protective behaviors present (e.g., hand hygiene, respirator use, etc.). Future work should make more apparent the underlying risks associated with PPE use and reuse.

"I'm putting on my PPE. So, I must be safe."

Adapted from Etzion et al.<sup>1</sup>

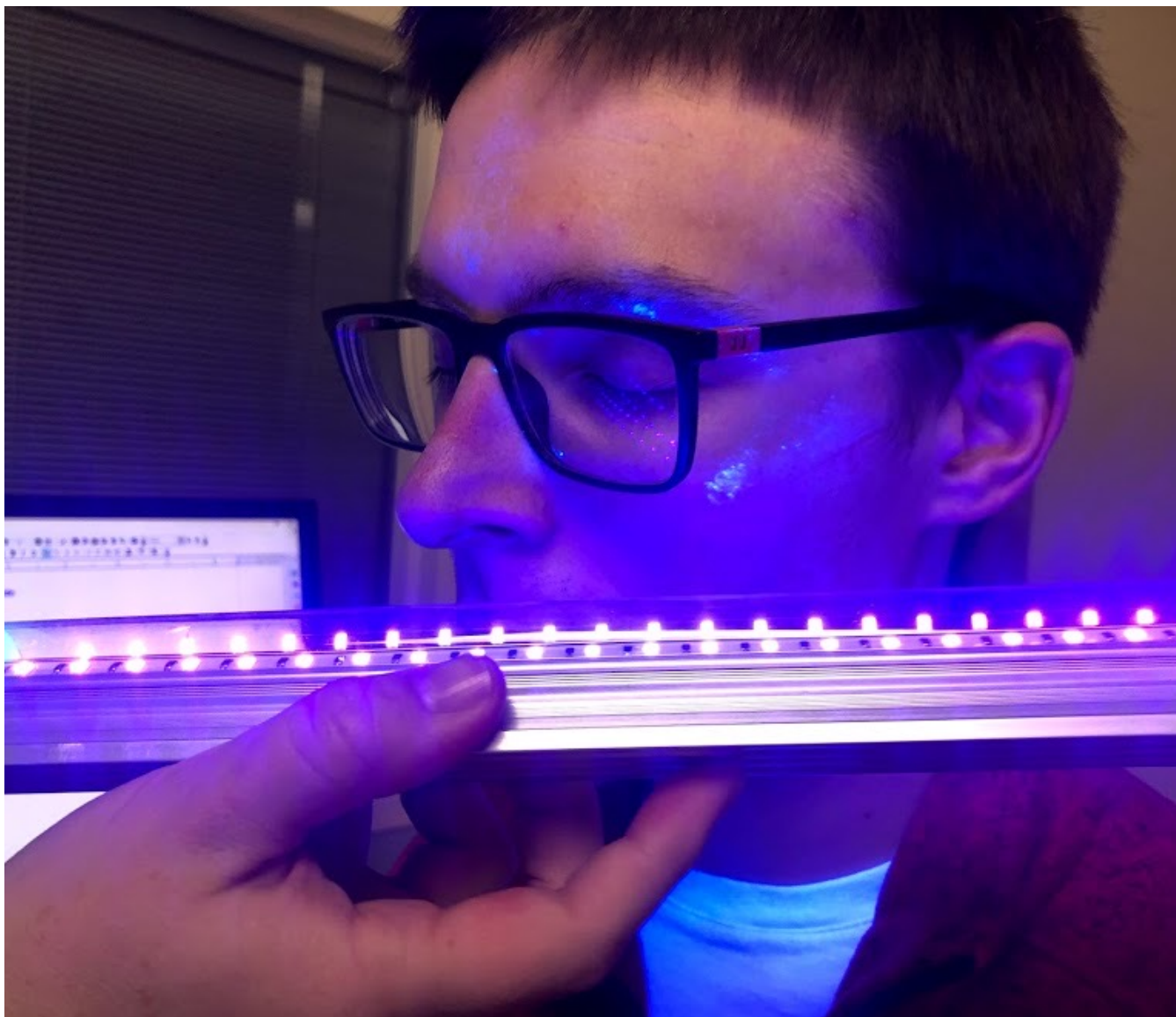
The coronavirus disease 2019 (COVID-19) pandemic is an ongoing existential threat to patients and healthcare workers (HCWs) worldwide. According to the World Health Organization (WHO), in May 2021, approximately 115,000 HCWs, including more than 3,600 United States (US) HCWs, had died from COVID-19 and millions of HCW have been infected while caring for patients.<sup>1,2</sup> By the end of June 2020, US HCWs filed 4,100 safety complaints surrounding safety concerns due to personal protective equipment (PPE) shortages to the Occupational Safety and Health Administration (OSHA), the US Labor Department's workplace safety agency.<sup>3–6,10</sup> The Centers for Disease Control and Prevention (CDC) officially recognized "crisis" and "contingency" plans to guide staff protection amidst PPE shortages.<sup>7</sup> "Crisis" periods of reuse admittedly do not adhere to standards of care; however, periods of "crisis" demand reuse of key pieces of PPE (e.g., N95 respirator) as facilities were unable to meet the standard PPE safety utilization rates.<sup>8</sup>

Protocols for donning and doffing of PPE remain ambiguous, lacking an evidence base, and often differ by PPE product, manufacturer and clinical location, resulting in wide deviations in practice.<sup>9</sup> PPE donning and doffing protocol deviations commonly result in self-contamination, but, have not been addressed at the source.<sup>10–12</sup> Removal of PPE, for instance, is a deceptively complex procedure, associated with high rates of doffing errors and likely contamination even with basic PPE.<sup>13</sup> Emerging data suggest that most HCWs were contaminated during doffing PPE during single use periods, revealing an urgent need to examine the root causes of self-contamination risks,<sup>14,15</sup> and, particularly, when considering crisis periods for when PPE shortages required routine reuse.

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**SDMPH**  
SOCIETY FOR DISASTER MEDICINE & PUBLIC HEALTH

<https://doi.org/10.1017/dmp.2022.291> Published online by Cambridge University Press





## Common Areas of Contamination



Neck

Fingers

Wrist

Face

## Common Areas of Contamination



Neck

Fingers

Wrist

Face

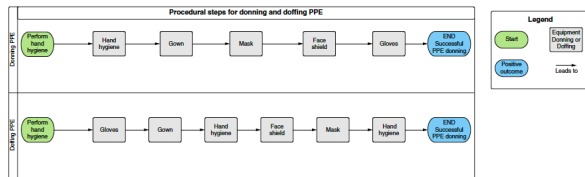


Figure 1. CDC donning and doffing PPE procedural steps.

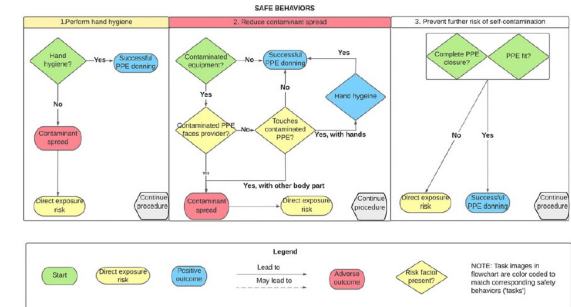
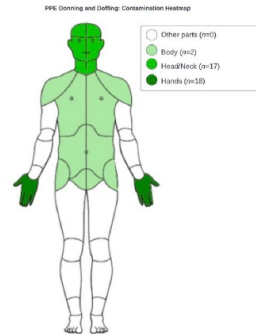


Figure 2. PPE donning and doffing taskflows and safety behaviors.

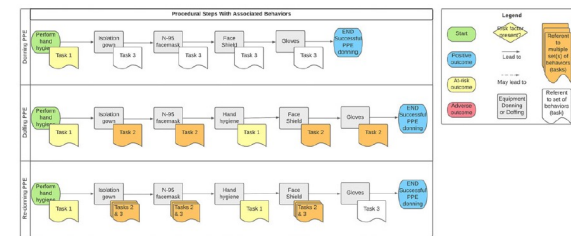


Figure 3. PPE donning and doffing procedural steps with associated risks and safety behaviors.

Table 1. Human centered recommendations for protecting health care workers

| Targeted risk  | Recommendation   | Recommendation components  |
|--|--|--|
| Prevent further risk of self-contamination;<br>Reduce contaminant spread | Improve training and competency enhancement techniques | Real-time feedback; Guided practice through spotters or technologies (eg, Glo Germ™) <sup>23,48,50,59,64</sup> |
| Prevent further risk of self-contamination                               | Implement stewardship for PPE                          | Spotters and infection control involvement <sup>50</sup>   |
| Reduce contaminant spread  | Re-design environment for infection control            | Standardized protocols and guidelines <sup>37</sup>  |
|  |  | Scanner/light to detect or disinfect <sup>73</sup>   |
|  | Enhance PPE design to promote risk awareness           | Physical re-design of doffing area(s) <sup>76</sup>  |
|  |  | Color-coded PPE gown <sup>74</sup>   |
|  |  | Just-in-time screen-based guidance <sup>37,77</sup>  |



## Services

What would you add, emphasise or challenge?

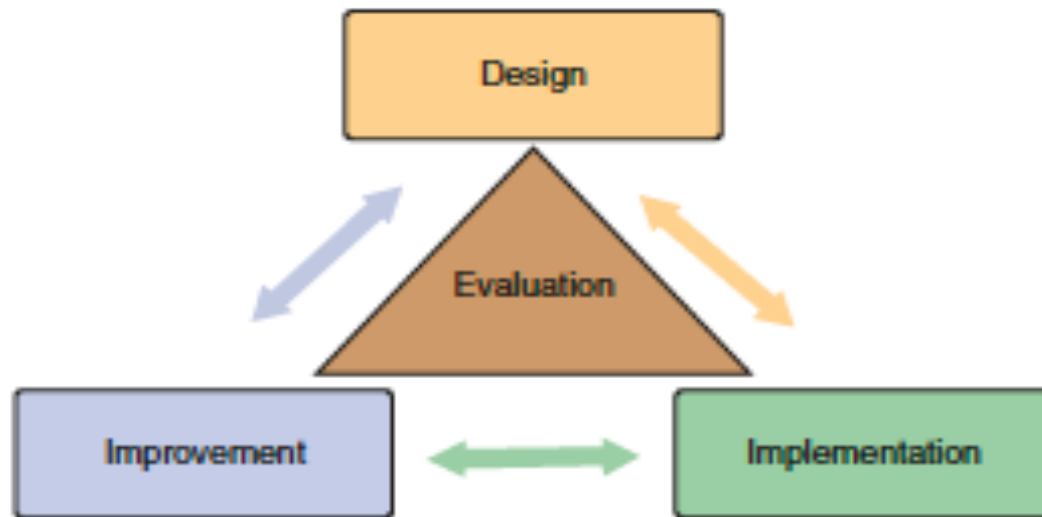
| Current practice  | Change principle   |
|---|--|
| Running at very high occupancy rates is efficient   | Systems work at a steady pace, with spare capacity to support infection control and the ability/capacity to deal with variation  |
| Design is for average workflows   | Design is able to flex capacity 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 <a href="#">multiple other routes to expertise</a> , 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  |



*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)*

# Learning Health System

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**Fig. 39.2** Design Focused Implementation Framework (DFIF)

Ramaswamy R, Barach P, 2022

# 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<br><br>Hospitals are important symbols and important components of civic society |
| Limited health promotion is undertaken                   | The hospital is an <a href="#">active health promoter</a> , 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<br><br>Hospitals contribute to the social, economic and environmental sustainability of the wider system   |



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

Stefano Capolongo<sup>1</sup>, Marco Gola<sup>2</sup>, Andrea Brambilla<sup>3</sup>, Alessandro Morganti<sup>1</sup>, Erica Isa Mosca<sup>4</sup>, Paul Barach<sup>2,3,4</sup>

<sup>1</sup>Politecnico di Milano, Department of Architecture, Built environment and Construction engineering (DABC), Design and Health LAB, Italy; <sup>2</sup>Department of Pediatrics, Wayne State University School of Medicine, Detroit, MI, United States of America; <sup>3</sup>Jefferson College of Population Health, Philadelphia, PA, United States of America; <sup>4</sup>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-centeredness. 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](http://www.actabiomedica.it))

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

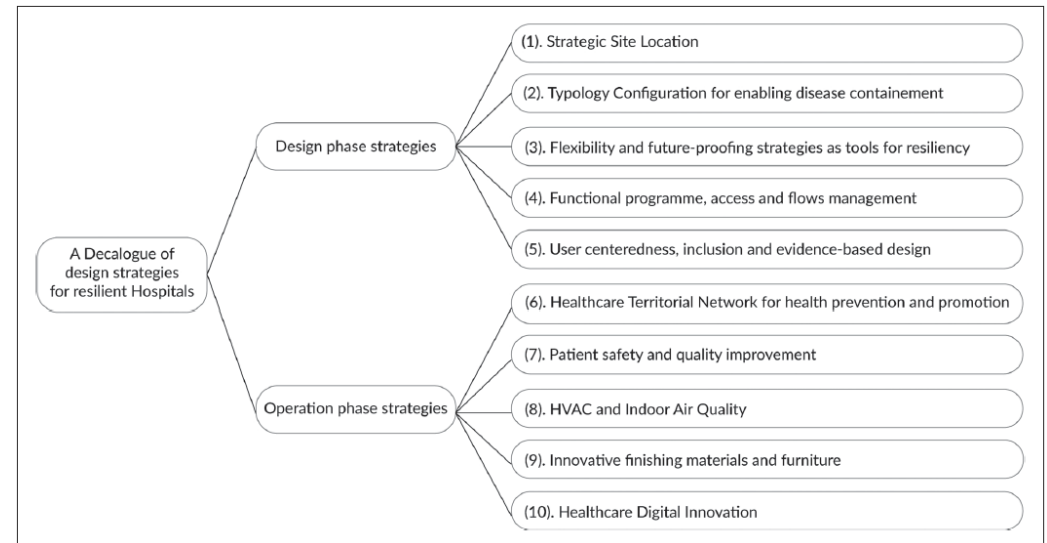


Figure 1. Flowchart of the decalogue of design strategies for resilient hospitals

### 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

# ‘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](https://doi.org/10.3310/hsdr03030), full report at DOI [10.3310/hsdr03030](https://doi.org/10.3310/hsdr03030)



# Tunbridge Wells Hospital at Pembury

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- £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

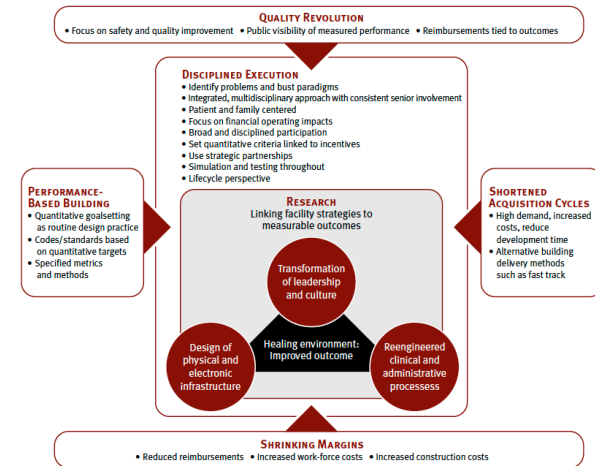
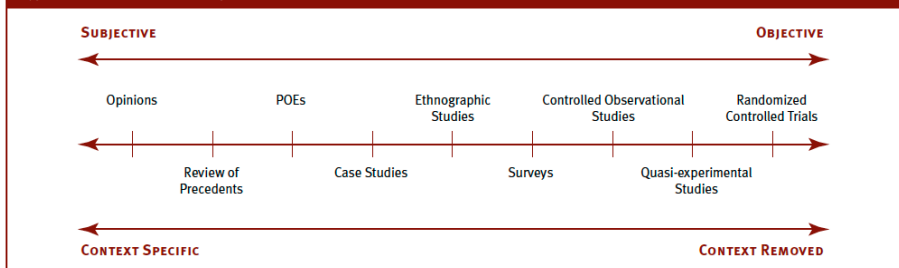
Data collected 12-15 months after the move - longer term study needed to generate evidence on care-related outcomes

# Post Occupancy Evaluation

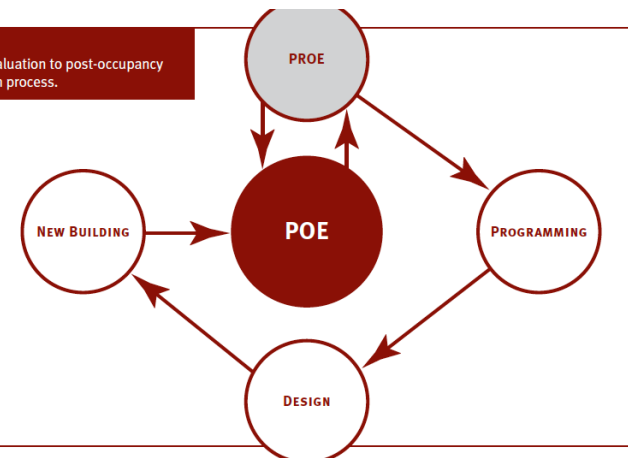
- **User Feedback:** Gathering feedback from hospital staff, patients, and visitors regarding their experiences and satisfaction with the building's design, functionality, and overall usability.
- **Functional Evaluation:** Assessing whether the hospital's spaces and layouts effectively support the intended 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.

# A PRACTITIONER'S GUIDE TO EVIDENCE-BASED DESIGN

**FIGURE 1.**  
Types of research studies that provide evidence for design decision making.



**Figure 4.**  
Relationship of pre-occupancy evaluation to post-occupancy evaluation and steps in the design process.



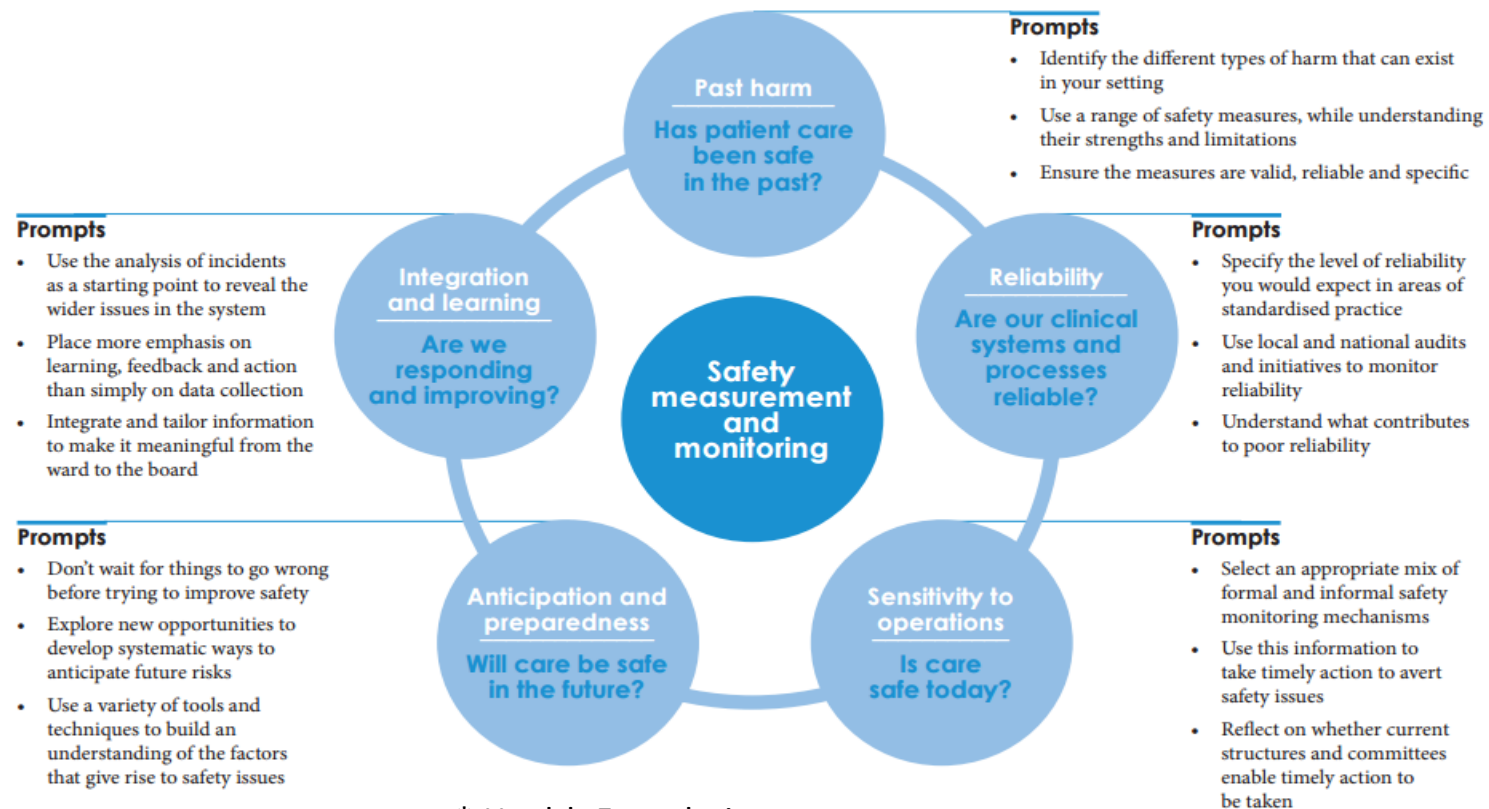


# Conclusions

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# Safety Management System-

## A Framework for Measuring and Monitoring staff and patient safety\*



\* Health Foundation

# Consolidated Framework for Implementation Research

- 1. Intervention Characteristics:** The features of the healthcare intervention, including its evidence base, complexity, and adaptability, can influence implementation outcomes.
- 2. Outer Setting:** The external context in which the healthcare intervention is implemented, such as the social, economic, and political factors, as well as the culture and climate of the organization or community, can affect implementation.
- 3. Inner Setting:** The internal organizational factors, such as leadership, culture, resources, and infrastructure, influence the implementation process.
- 4. Individuals:** The characteristics, attitudes, and beliefs of individuals involved in the implementation, including healthcare providers, patients, and other stakeholders, play a role in implementation success.
- 5. Implementation Process:** The strategies and activities used to implement the healthcare intervention, such as planning, engagement, and evaluation, are important for successful implementation.

Damschroder et al. *Implementation Science* (2022) 17:75  
<https://doi.org/10.1186/s13012-022-01245-0>

Implementation Science

RESEARCH Open Access

## The updated Consolidated Framework for Implementation Research based on user feedback

Laura J. Damschroder, Caitlin M. Reardon<sup>\*</sup>, Marilla A. Opra Widerquist and Julie Lowery

### Abstract

**Background:** Many implementation efforts fail, even with highly developed plans for execution, because contextual factors can be powerful forces working against implementation in the real world. The Consolidated Framework for Implementation Research (CFIR) is one of the most commonly used determinant frameworks to assess these contextual factors; however, it has been over 10 years since publication and there is a need for updates. The purpose of this project was to elicit feedback from experienced CFIR users to inform updates to the framework.

**Methods:** User feedback was obtained from two sources: (1) a literature review with a systematic search; and (2) a survey of authors who used the CFIR in a published study. Data were combined across both sources and reviewed to identify themes; a consensus approach was used to finalize all CFIR updates. The VA Ann Arbor Healthcare System IRB declared this study exempt from the requirements of 38 CFR 16 based on category 2.

**Results:** The systematic search yielded 376 articles that contained the CFIR in the title and/or abstract and 334 unique authors with contact information; 59 articles included feedback on the CFIR. Forty percent ( $n = 14$ ) of 344 of authors completed the survey. The CFIR received positive ratings on most framework sensibility items (e.g., applicability, usability), but respondents also provided recommendations for changes. Overall, updates to the CFIR include revisions to existing domains and constructs as well as the addition, removal, or relocation of constructs. These changes address important critiques of the CFIR, including better centering innovation recipients and adding determinants to equity in implementation.

**Conclusion:** The updates in the CFIR reflect feedback from a growing community of CFIR users. Although there are many updates, constructs can be mapped back to the original CFIR to ensure longitudinal consistency. We encourage users to continue critiquing the CFIR, facilitating the evolution of the framework as implementation science advances.

**Keywords:** Implementation science, Implementation framework, Implementation determinants, Implementation outcomes, Implementation evaluation, Consolidated Framework for Implementation Research, CFIR, Theory

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

International Forum on Quality and Safety in Healthcare

**Wednesday 17 May | 13:15-14:30**

[Paul Barach](#), Sigmund Freud University, Austria; Jefferson College of Population Health, USA; Imperial College London, England; pbarach@gmail.com

[Dominique Allwood](#), UCL Partners; Imperial College NHS Trust; dominique.allwood@uclpartners.com

[Nigel Edwards](#), Nuffield Trust, England, nigel.edwards@nuffieldtrust.org.uk>

[James Barlow](#), Imperial College London, England; j.barlow@imperial.ac.uk>

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# MENTI Audience Responses

What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|                       |   |                  |
|-----------------------|---|------------------|
| Work from home        | Healthcare truly isn't equipped for adverse events  | No clear routing |
| One person rooms work | Poor ventilation.   | Not enough place |
| Work from home        | So so so many shared spaces made it impossible for staff and patients to stay physically separated as recommended | They don't work  |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|                                 |                               |   |
|---------------------------------|-------------------------------|---|
| Well                            | Working in medicine is great! | Flexibility in decision making                                  |
| Don't forget the family         | Focus on work as done         | Changed to seperate flows of patients to the GP practice.       |
| Lot of space not used efficient | Not prepered                  | Don't have flexibility to rapid adjustments of patient circuits |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |                          |   |
|--|--------------------------|---|
| Re-structuring was suddenly possible within a short period of time | Masks work               | Virtual medicine                              |
| donot shake hands  | Human centred design     | Insufficient staff rest areas                 |
| Teamwork   | Shared rooms do not work | Better choices about what is really necessary |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |                                       |   |
|--|---------------------------------------|---|
| Lack of depot  | Crowd control difficulties            | We have very limited places in hospital if new requirements are introduced ie isolation |
| Space not suitableNo space for equipmentSpace not flexibleDifficult to change fixtures or fittings | Be better for our planet              | Smaller units   |
| Not suitable for many patients in isolation  | Kaotic due to lack of normal routines | Not ready to scale up   |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |  |                                       |
|--|--|---------------------------------------|
| Poor ventilation in current buildings                | Buildings dont work  | Spaces too cramped.                   |
| Availability   | Services not set up or ready to cope with a pandemic             | The need for specific count of supply |
| Access to PPE that we would've used anyways improved | ED environment difficult for mental health delivery during covid | Wording without rigid rules lovely    |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |  |   |
|--|--|---|
| Instructions                           | Telehealth is goodIT systems need to be betterAirflow and ventilation issues | Separation of emergency and elective patient flow |
| Togetherness                           | Building and servicesblacked flexibility                                     | Teamwork, stand together                          |
| Lack of storageLack of flexible spaces | We completely rebuild the way ofcworkibgcwothin one month                    | Lack of sufficient space, leadership and tools.   |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|   |  |   |
|---|--|---|
| We have to work together.   | There are very few ways into the building so that made it easy to require masks and screening at entry | No backup surgical services in case of pandemic. Workflow did not exist, hence large backlog of patients left behind, which we now have to deal with. |
| Universal designed wards work better than specials                              | Healthcare workers are courageous and resilient  | Teamwork and ambitions - very important.  |
| The strat was rend ti workshop together<br>Buildings SAS not good for isolation | We CAN get caught by surprise  | Rooms unadaptable to flow   |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|   |                            |                               |
|---|----------------------------|-------------------------------|
| Easier to arrange meetings as people don't have to meet up for them   | Virtual care               | Not prepared for 1 meter rule |
| Face to face appointments were impacted for a number of weeks.. PPE impacted on interactions with derive users. | You need separed flows     | Good ventilation is important |
| The hallways are too narrow to pass   | It doesn't really supportt | Unappropriate rooms           |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |   |   |
|--|---|---|
| Mindfulness  | More operational, More collaboration with other organizations                                     | Maximise every space for clinical space   |
| God with Manu single rooms   | Telecommunications work beautifully but thermal sensors judge febrile people poorly               | Buildings in Mental Health for patients were poorly designed to support Infection control due to risks. |
| Isolation from single rooms. Difficulty with visibility of healthcare staff. | Spaces were too close together so there wasn't enough space to work autonomously or innovatively. | Ingress and egress proved to be pinch points. People in a crowd act as a fluid and these created dams   |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |   |                                    |
|--|---|------------------------------------|
| Not enough single rooms and plain basic rooms  | We needed outdoor tent for triage at the ER | The ability of working in distance |
| Work jome  | Don't act too quickly                       | Lack of isolation rooms            |
| We have open areas in the dept to allow few staff to look after lots of patients. This does not work for infectious disease. | Work From Home                              | Big waiting rooms                  |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |   |   |
|--|---|---|
| Team work is dream work We are lucky to have an NHS We can adapt to change | Importance of team work and collaborative working | Don't work. Difficult ti isolate patients                     |
| Open workplace is not optimal  | Planning  | Work from home  |
| Importance of team working and sharing the work load                       | Work from home                                    | Too many people squashed into offices not big enough for them |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |   |   |
|--|---|---|
| We had much too much paper based. Old building with many small rooms were actually very good during the pandemic | Need more telemedicine                              | A lot communications is necessary                                     |
| Less hieraki   | Entrance and exits not set up for social distancing | A lot of life has close contact with others.                          |
| Depots sete lacking.   | Reduce amounts of protocolsTeamworkEfficiency       | Lockouts had a major impact on workforce, aircon was a major weakness |



What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |  |   |
|--|--|---|
| Clinical spaces not adaptable, insufficient rest spaces and showers etc for staff, | Too few isolationrooms                           | Work from home  |
| No routine   | A lot can be do from home, if Zoom works         | 6 bedded rooms made isolation very difficult. Moving of patients disrupted continuity of care |
| Quick change is possible   | Open work spaces dont work with digital meetings | People tent to think about them selves if pressured   |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |  |  |
|--|--|--|
| Isolated sides were difficult to organize.   | Limited family participationInfection preventionWorking from home  | How important it is to have health system and government partnership in bring agile change to system improvement and change management y |
| Sometimes you need to break te rules in order to help your patients or your colleges | - isolation equipment was key !!!  | Isolation  |
| Benefits of working from home  | The lack of flexibility of our infrastructure to adapt to a pandemic of this proportion. New infrastructure is being thought in a more modular way | Passionate   |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |   |   |
|--|---|---|
| Too little workspace, close together. Narrow hallways. What did work: flexibility, different use for same rooms etc. | Total New Working skills with COVID patient.        | Waiting Rooms too small.  |
| Not enough isolation rooms   | Need to be nimbleExpand and contractAdapt Cooperate | Claustrophobic but in a small dept it was helpful for human connection. |
| Workung from home/ use of webex  | Constante change                                    | Social distancing does not work in small corridors                      |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|   |  |  |
|---|--|--|
| We want to be together                                    | Poor accessibility to support hand washing | Big chance can happen quickly with a common goal           |
| We need flexible buildings where we Can upscale very fast | More digital                               | Our 50 y old estate needs really lacing                    |
| transversal cooperation                                   | We isolated patients from their loved ones | Separate offices made it possible to stay in the workplace |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|                                     |  |   |
|-------------------------------------|--|---|
| Team work is dream work!            | Shortsge of isolation Rooms                                  | Not room enough   |
| No infectionsrooms in the emergency | We need more connection between outpatient clinic and clinic | Digital working   |
| The pandemin knew no borders        | Fast decision. Lot of task could be done. Collaboration.     | Experts didn't always take care of the sickest patients |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |  |  |
|--|--|--|
| Home workingAlternative care provisionTelephone consults | Not enough space for lines             | Lack of isolation units                          |
| Not flexible   | Not enough knowledge about the disease | More serapate doors elkö be needed in the future |
| Together   | Bravery!                               | Working from Home                                |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|                   |                      |                                  |
|-------------------|----------------------|----------------------------------|
| Worked Well       | We all came together | Work environment was didn't work |
| Working from home | Source scarcity      | Teleconference                   |
| Crowded           | Education            | Use of technology                |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |                            |   |
|--|----------------------------|---|
| Family involvement in care reatrickted                             | Up site Down, and teamwork | Inequity got clearer  |
| As an administrative employee, it totally works working from home. | Tellmedicin                | Difficult to provide safe care with the team and patients split up geographically across the hospital |
| We need to get people more outside                                 | Strong organisation        | Many people in the same room, spred ivirus  |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|                           |   |  |
|---------------------------|---|--|
| Single person rooms       | Work from home  | Good teamworkDifficult to adapt physical environment |
| Fast dissisions           | Work generally ok, but our nursing homes have minor problems vith flow without contact. | Bridges between all the islands in the hospital      |
| Shortage of communication | Better workroutines   | Isolation from the working community                 |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |                                     |                          |
|--|-------------------------------------|--------------------------|
| Teamwork   | Kommunikation difficult with masks  | Bureaucravy              |
| the barrier to digital training is the employees | Poor ventilation in older buildings | everything is possible   |
| Better ressources                                | .                                   | Small roomsPersonal care |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|   |                                   |  |
|---|-----------------------------------|--|
| Digital opportunities available and work well | Need for overflow                 | Some Doors open automaticly, some don't! |
| Much work                                     | Good teamwork - everyone on board | Lack of access to outside spaces         |
| Shorter lines                                 | Fixed buildings                   | Not enough space                         |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers



|  |                                       |  |
|--|---------------------------------------|--|
| Very bad, the help come much later then you have needed too have that                | Using or's for non-covid icu patients | Worked well: telemedicine and innovationBad: ventilation and multiple pts per room |
| A lot of Viborg isolations caused by patient Roms for serveral patients in one room. | Great at adapting                     | Not enough Rooms to isolate  |
| Empowering patients to carry out their care  | How Quick we could upscale            | Mask   |

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What were the lessons from COVID about how our buildings and services work / or don't?

217 Answers

Ventilation not good for transmission of virus.. Red and green areas in ED difficult to manage

Mentimeter

What do you think is the most important aspect of the environment that promotes health and healing?

Mentimeter

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What are your ideas about new design principles ?

Mentimeter