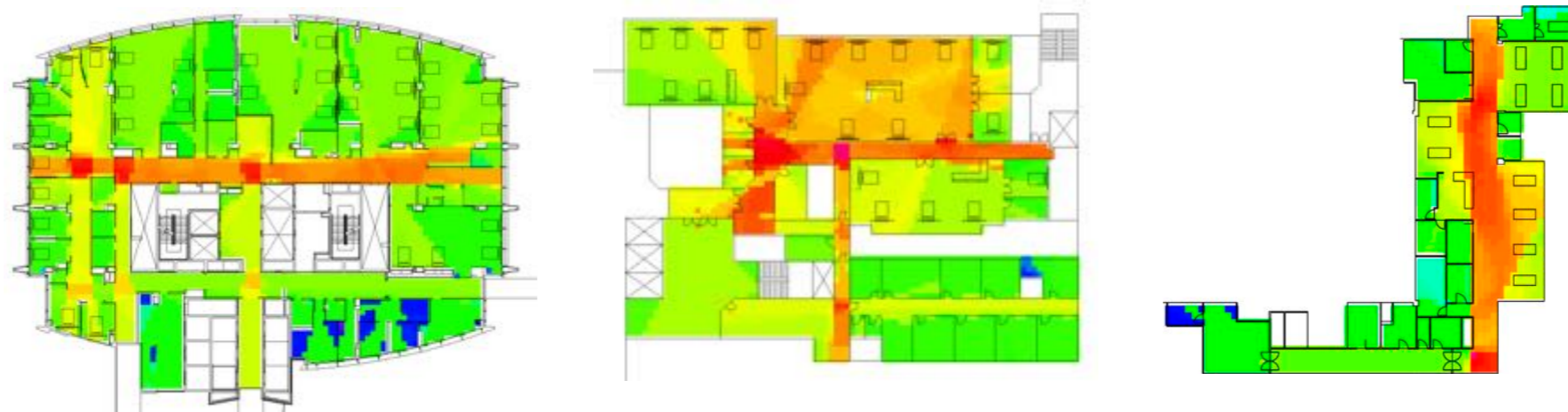


THE EFFECT OF WARD TYPOLOGIES ON QUALITY OF CARE

Lessons From the Past to Inform the Future



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12th June 2018

Predictions of Social Economic Environmental and Technological Changes by 2050



World / Urban Population



Life Expectancy



Global Warming



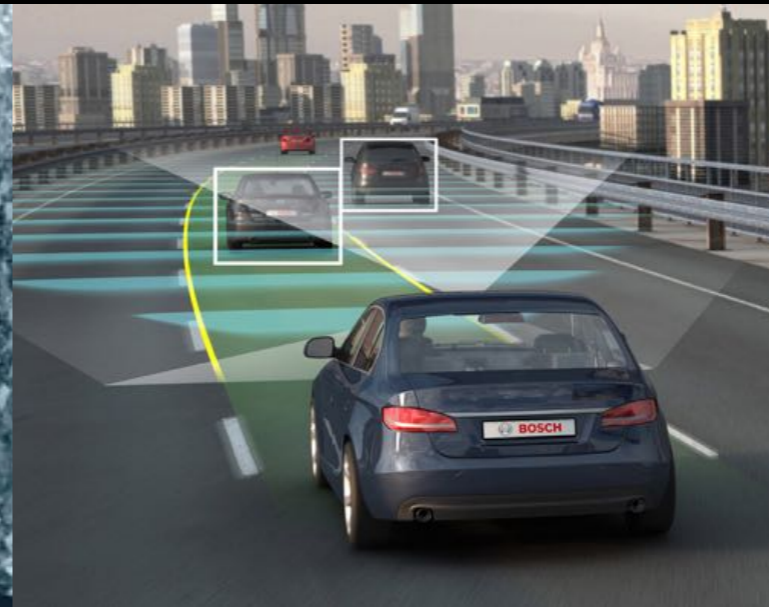
Global Oil Demand



Technology



Artificial Intelligence



Driverless Vehicles



Advances in Medicine

What Are the Predictions for Healthcare?



The Empowered Patient



Prevention of 'Lifestyle' Diseases



Rise in Alternative Therapies



Increased Focus on Acute Care



Personal Control



Design for the Aging Population



New Diseases



Caregivers as Highly Regarded

Introduction

Healing Temple



Christian Hospitals



Nightingale Ward



Mega Hospitals



Ancient Greece

- Nature views
- Natural ventilation
- Natural light

Middle Ages

- Faith as a healer
- Dark and cold

1860 - WWI

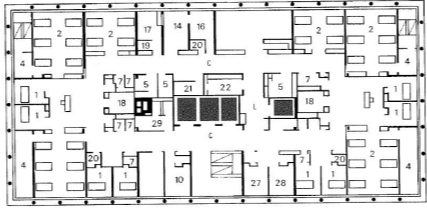
- Open ward
- Natural ventilation
- Natural light

WWI - 2000


- Deep floor plan
- Mechanical ventilation

Ward Typologies

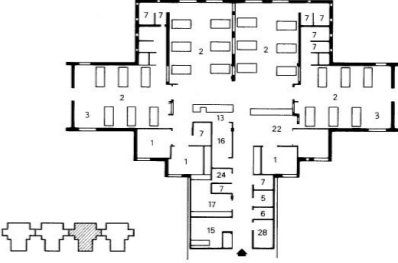
Racetrack
High Wycombe Hospital UK



Courtyard
York Hospital UK



Cluster
Weston-super-Mare UK



1867

1963

1965

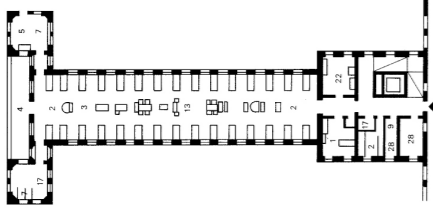
1973

1976


1984

1986

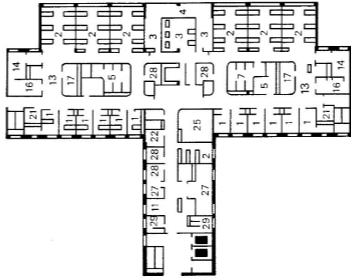
Nightingale
St Thomas Hospital UK



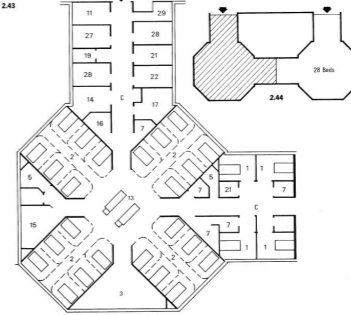
Corridor
Airedale Hospital UK



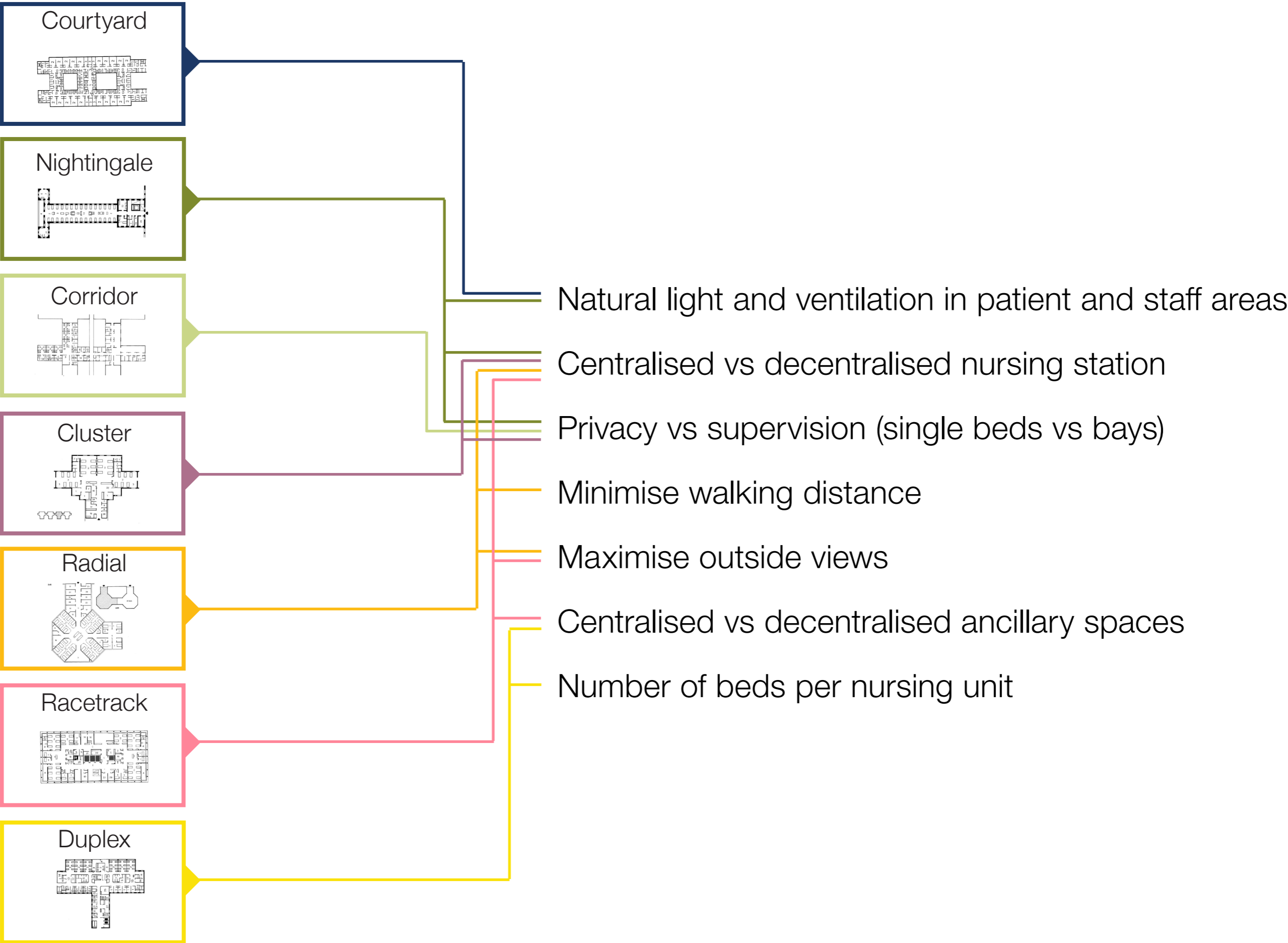
Duplex
Ninewells Hospital UK



Radial
Chesterfield Hospital UK



Why Are There Different Typologies?



How Do Design Features Influence Healthcare Outcomes?

2008



Metrics

- noise [51]
- ventilation [20]
- light [24]
- nature views [19]
- handwashing [37]
- single vs multi bed [25]
-



Environmental
Factors

How Do Design Features Influence Healthcare Outcomes?

2008

2018



Metrics

- noise [51]
- ventilation [20]
- light [24]
- nature views [19]
- handwashing [37]
- single vs multi bed [25]
-

Environmental
Factors

Metrics

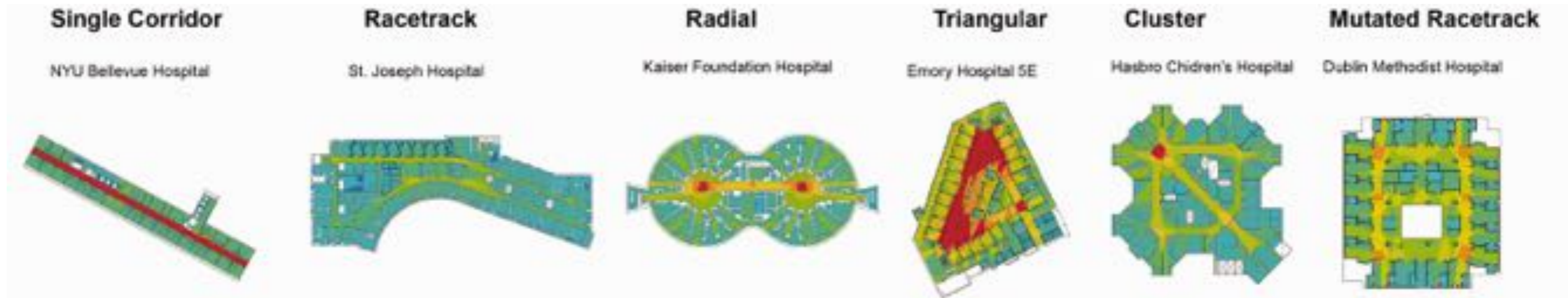
Environmental Factors

- communication
- culture
- behaviours
- human experience

Environmental
&
Behavioural
Factors

What are the Spatial Implication of Cultural Differences?

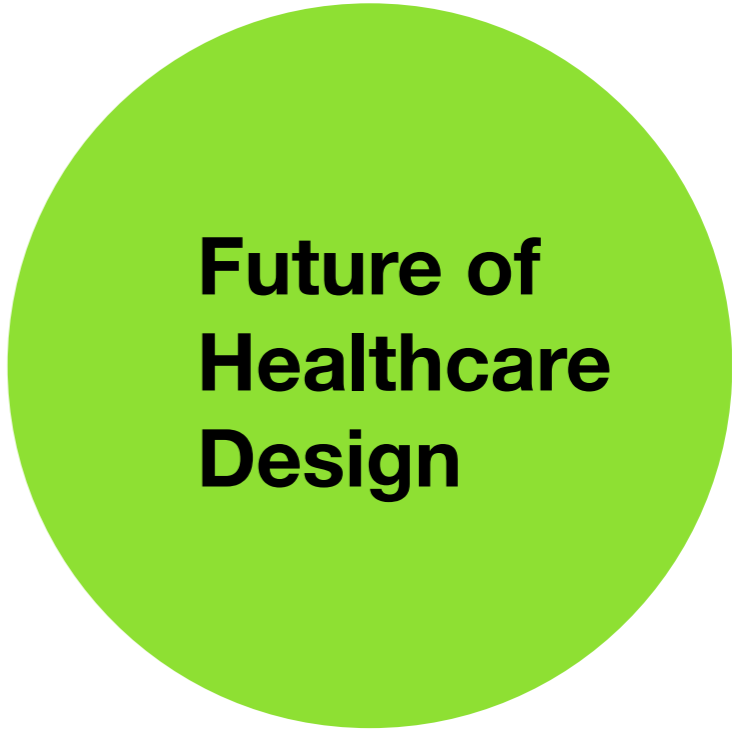
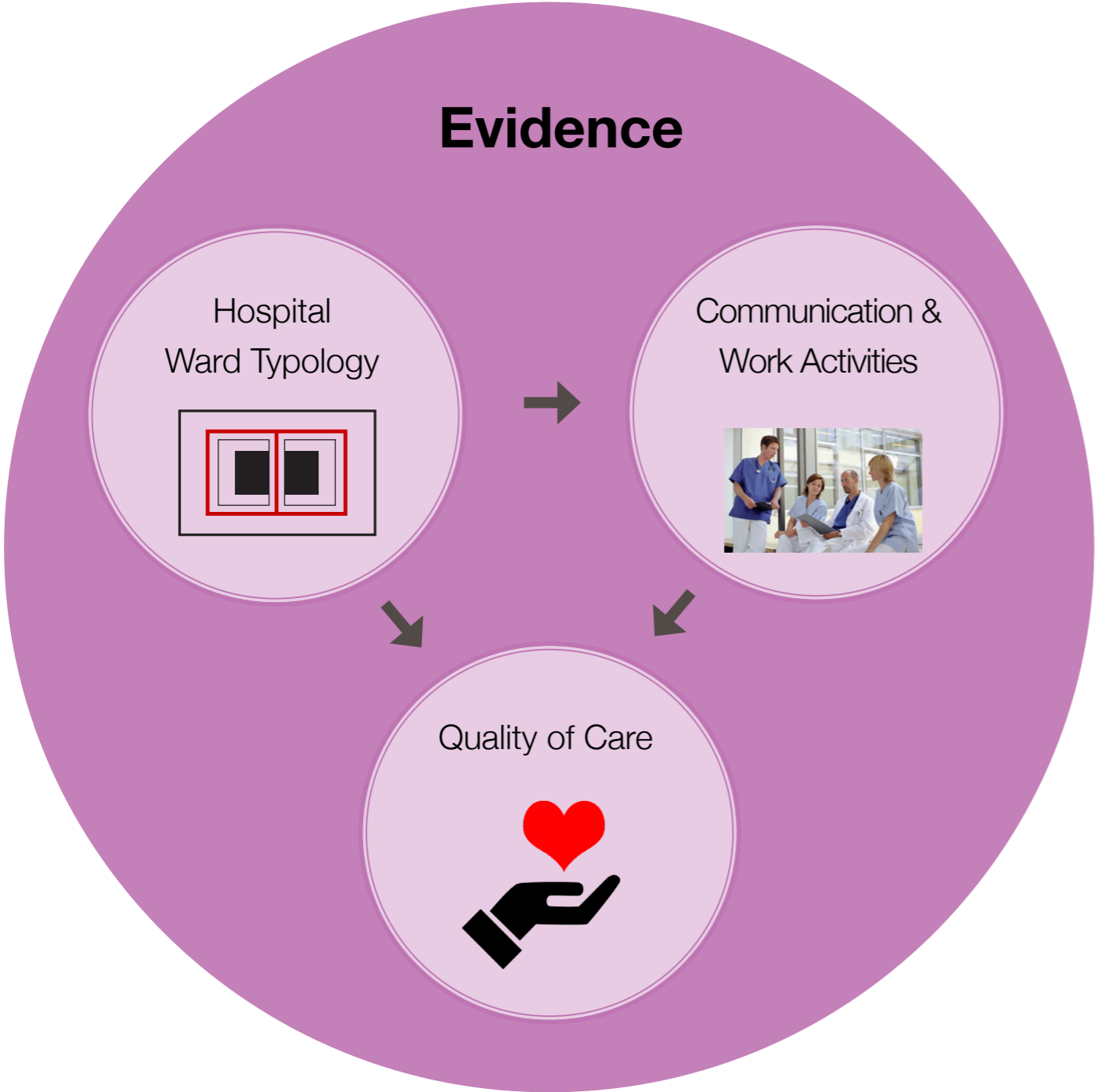
American Wards



Chinese Wards



Research Question



How different hospital ward typologies influence work processes and communication and how does this affect the quality of care provided to patients?

Knowing this kind of evidence, would we design differently and can we inform future healthcare design?

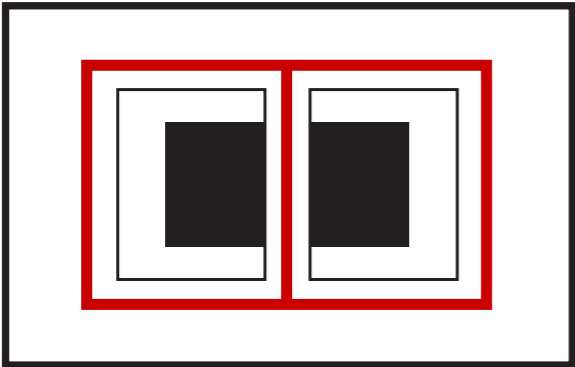
- 1 introduction
- 2 case studies
- 3 methodology
- 4 analysis & results
- 5 conclusions

Case Studies

University College London Hospital



Racetrack layout

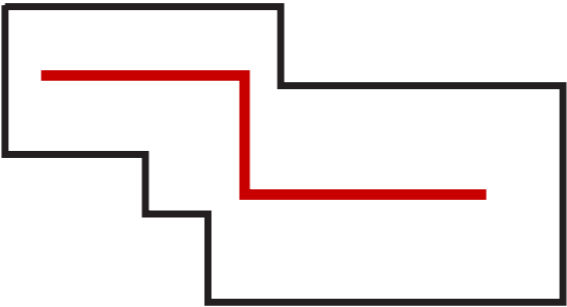


Area - 1420 m²
Number of beds - 43
Single rooms - 22

National Hospital for Neurology and Neurosurgery



Duplex layout

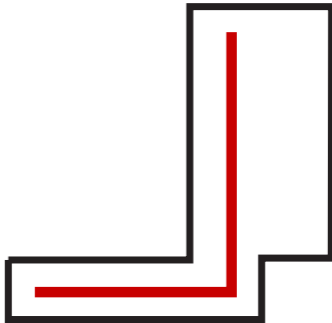


Area - 1380 m²
Number of beds - 20
Single rooms - 3

Chelsea and Westminster Hospital



Corridor layout

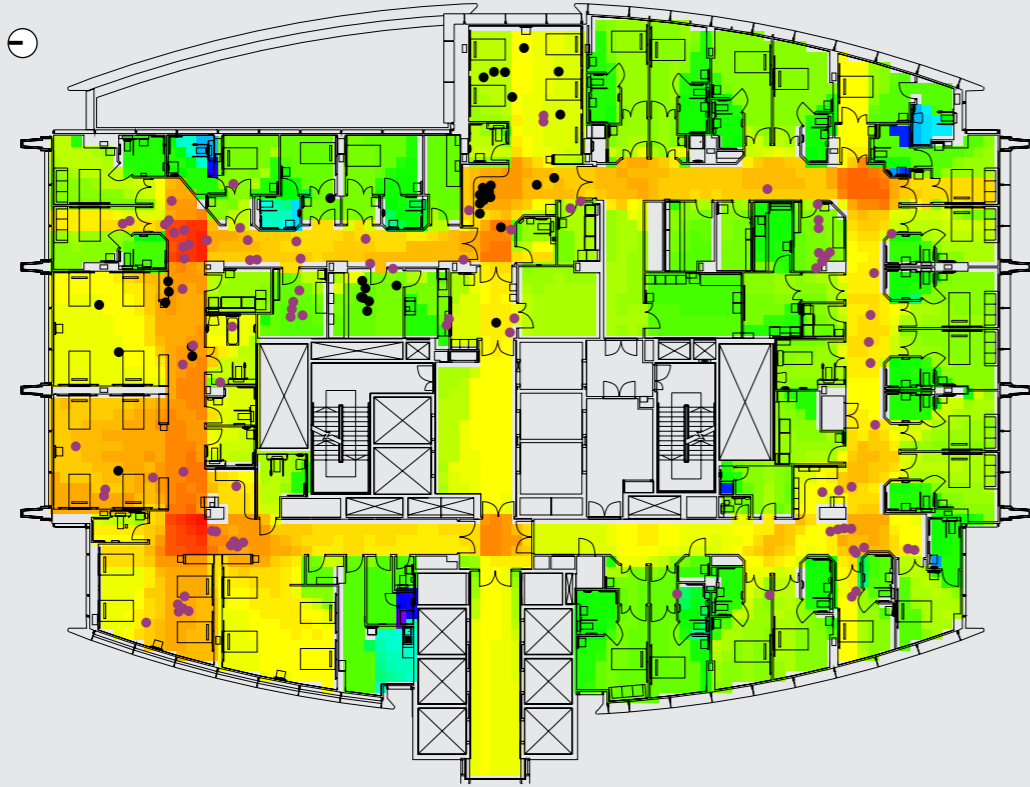


Area - 470 m²
Number of beds - 11
Single rooms - 1

Methods

SPATIAL LAYOUT

SPACE SYNTAX



COMMUNICATION

SOCIOMETRIC BADGES



WORK PROCESSES

DIRECT OBSERVATIONS



QUALITY OF CARE

PERFORMANCE DATA

diseases & infections
health outcomes
building maintenance
patient services
staff satisfaction

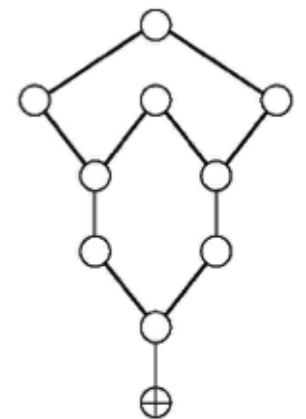
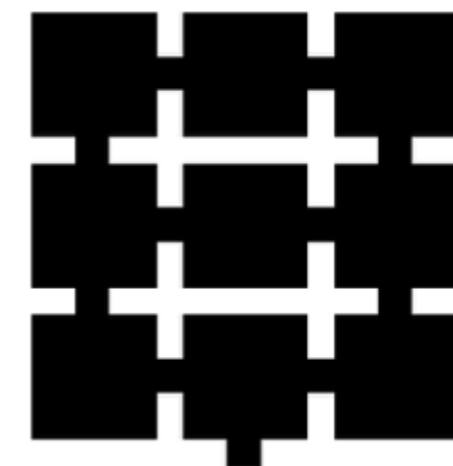
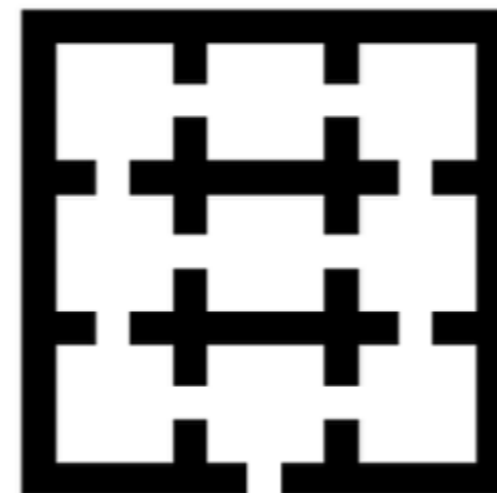
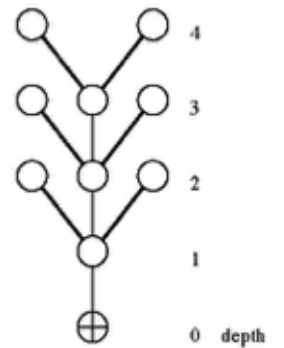
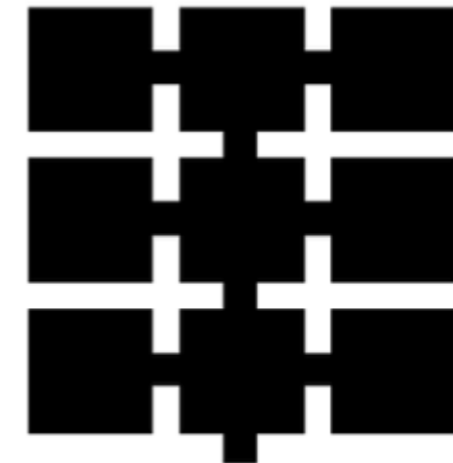
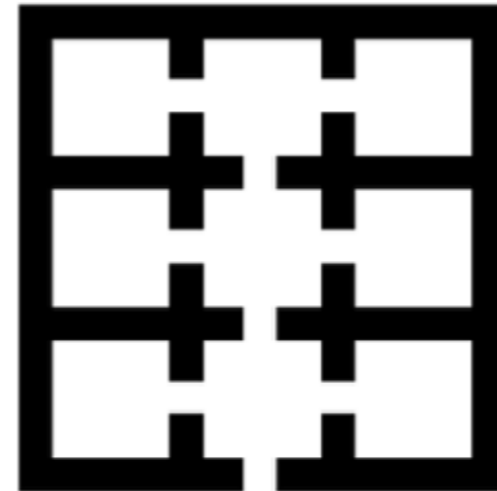
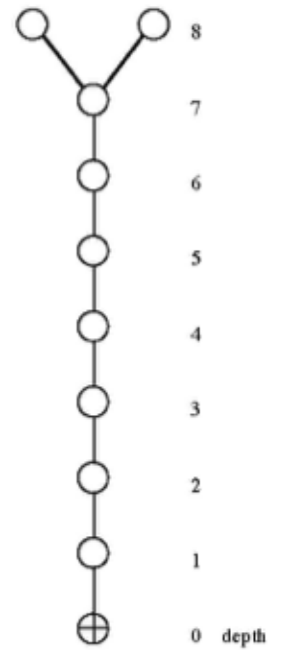
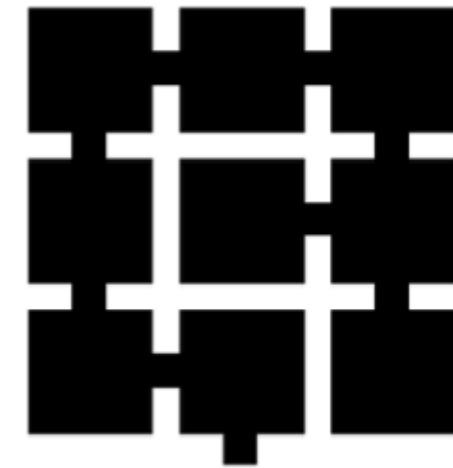
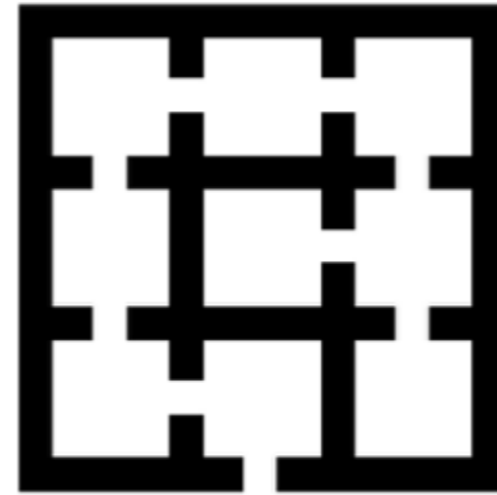
Methods

THE ARCHITECTURAL SPACE AS A NETWORK - THE METHOD OF SPACE SYNTAX

Space Syntax is a theory and method to study spatial configurations developed at UCL in the 70s by Prof Bill Hillier and colleagues.

What is the relationship between the **spatial design** of buildings and the way they work **socially**?

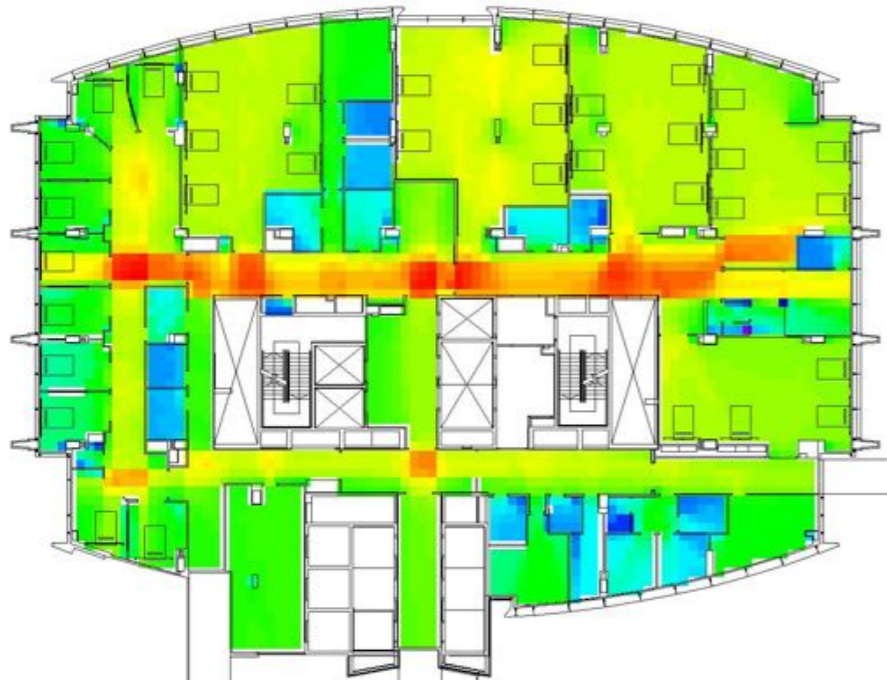
Configuration is the way in which spatial elements are put together to form an interconnected system of spaces.



Analysis & Results

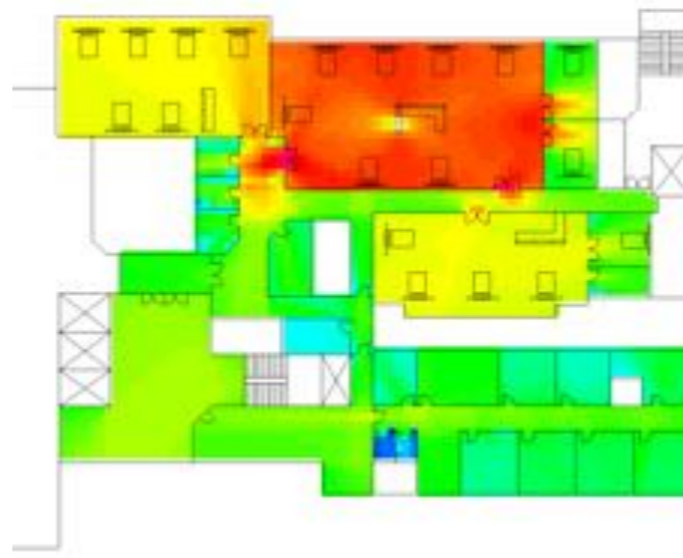
Connectivity (what one can see locally)

UCLH



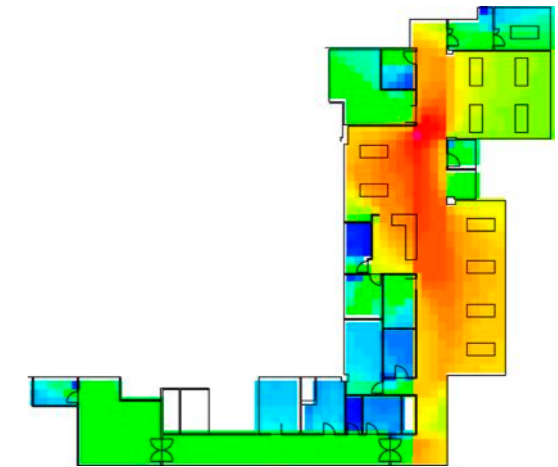
Racetrack layout

NHNN



Duplex layout

CW

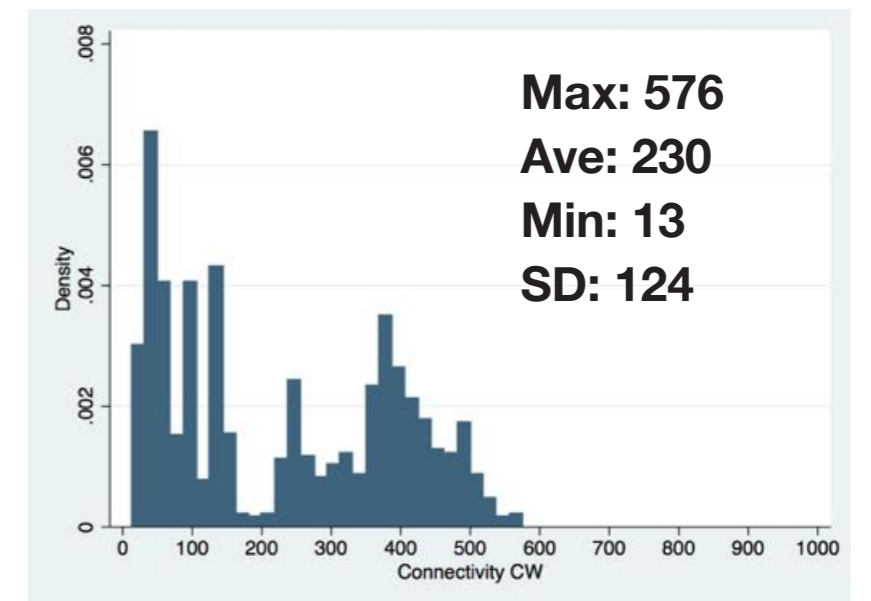
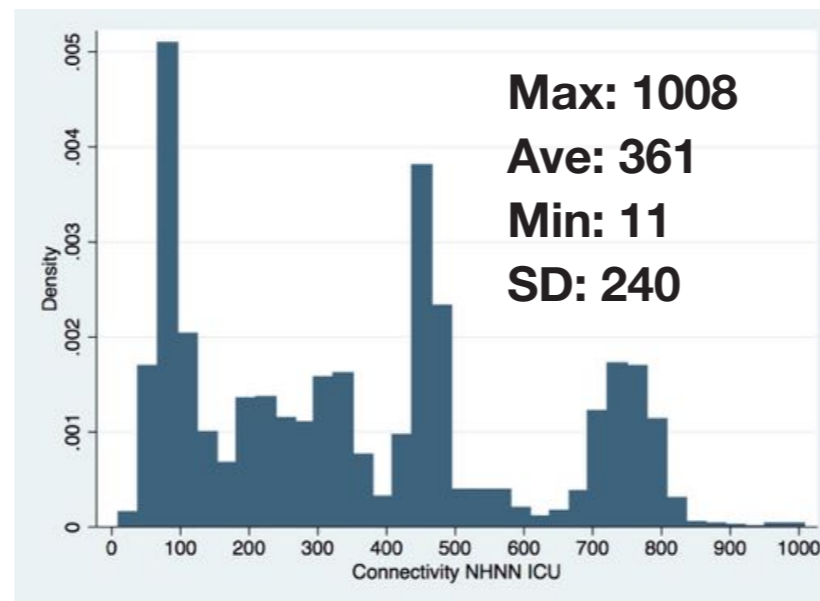
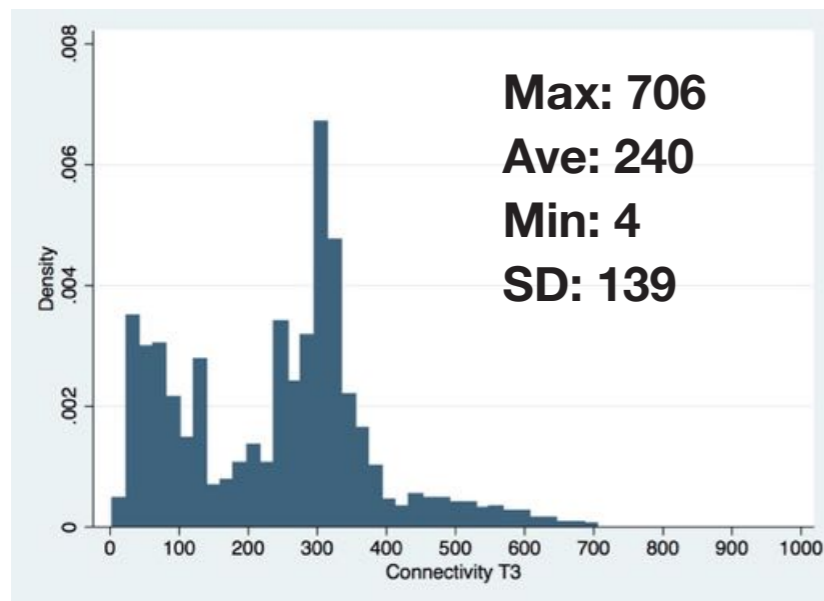


Corridor layout

Connectivity Distribution

larger distribution of values

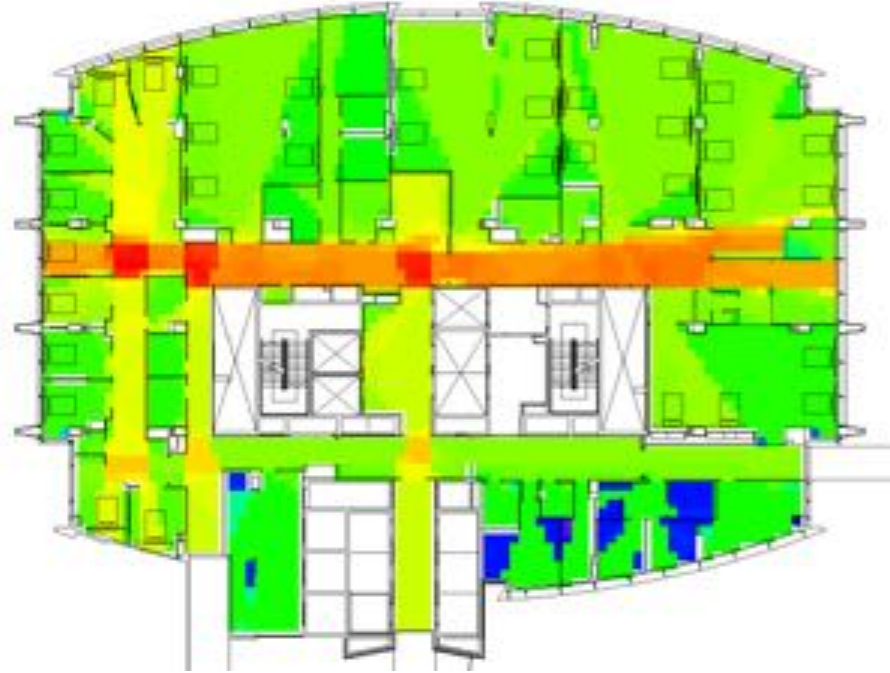
smaller distribution of values



Analysis & Results

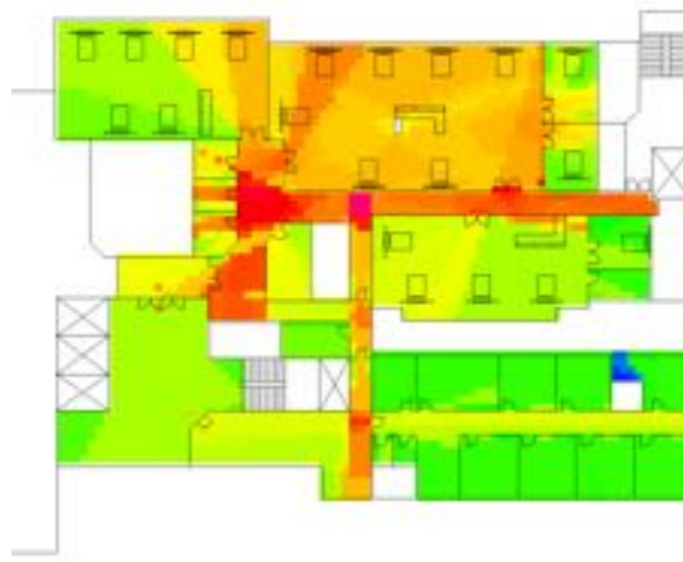
Mean Depth (what one can see globally)

UCLH



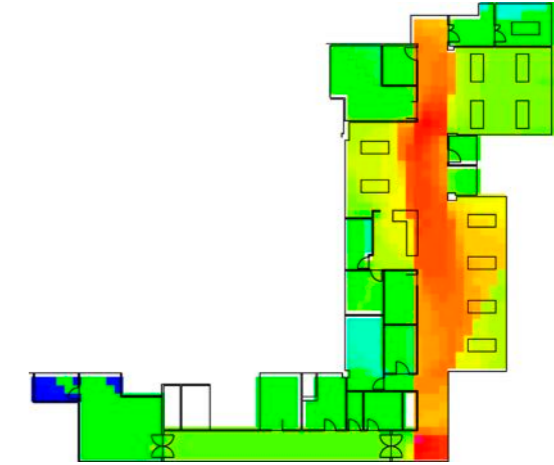
Racetrack layout

NHNN



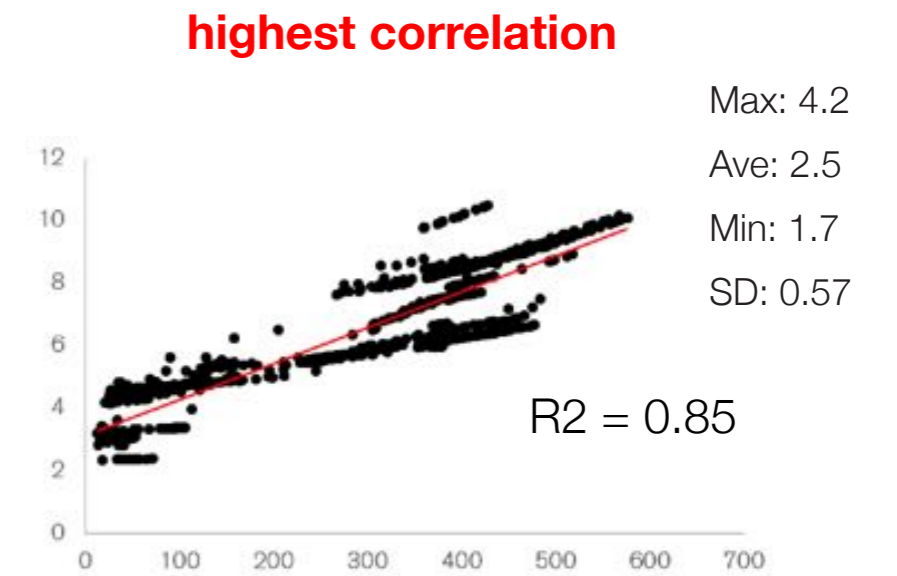
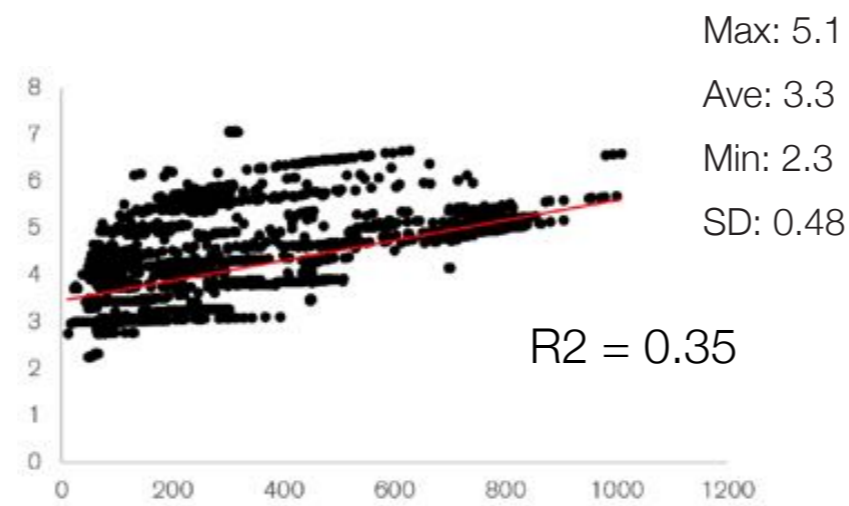
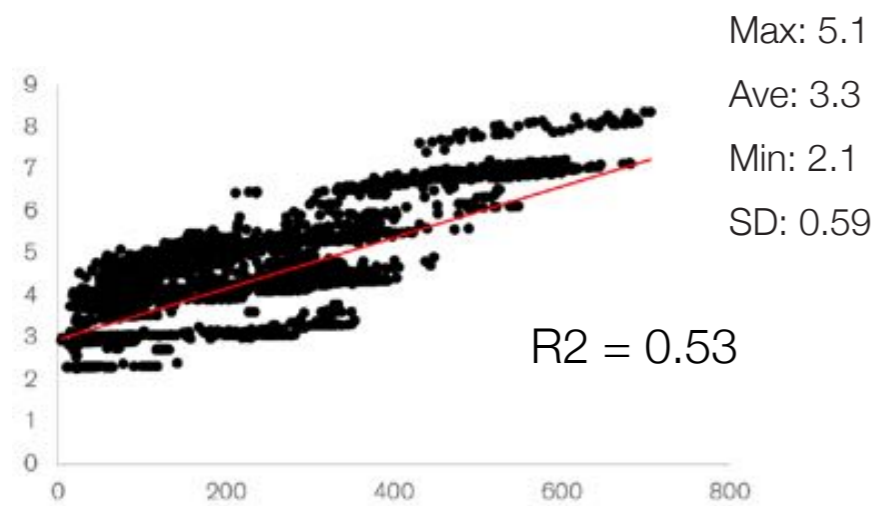
Duplex layout

CW



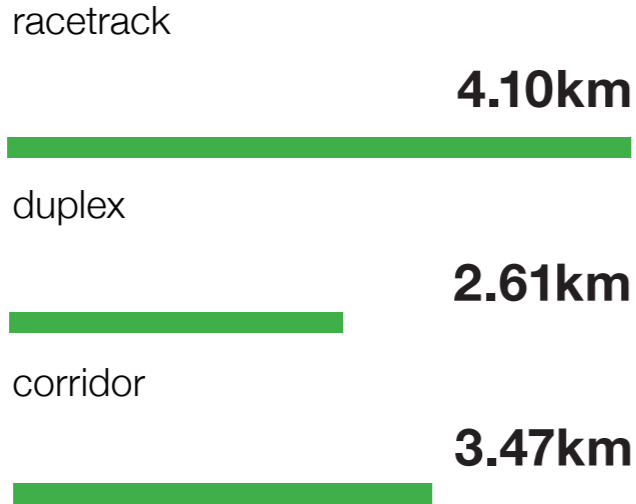
Corridor layout

Intelligibility - how much the whole environment can be understood from its parts

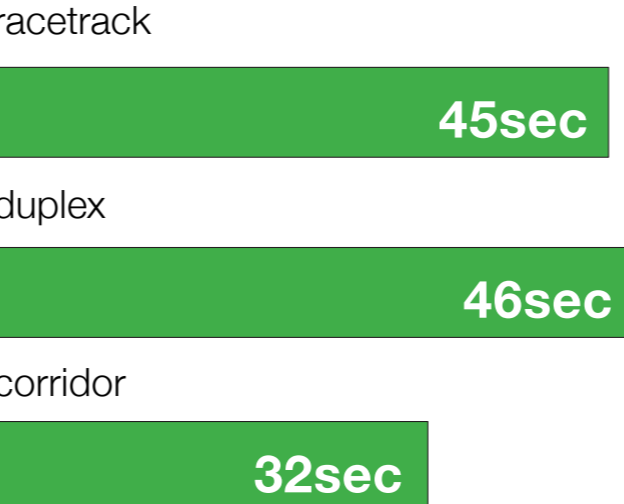


How different layouts affect activities and walking distances?

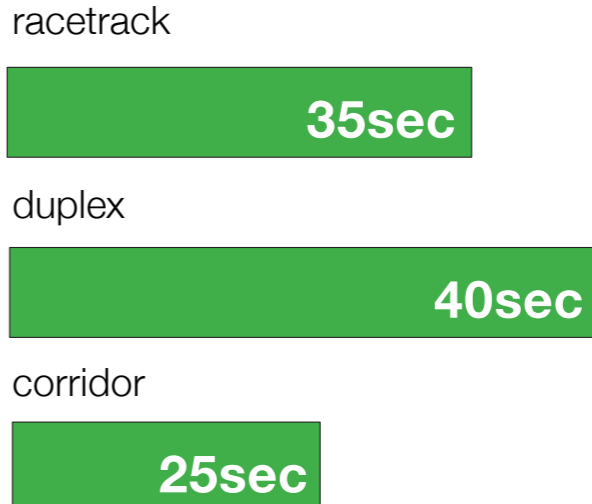
Ave walking distance per day



Ave duration of conversations



Mean duration of all activities



Racetrack layout

20 staff members [4 NIC, 8 RN, 4 doctors, 3 consultants, 1 runner]
Total: 12h 37min

Duplex layout

15 staff members [3 NIC, 7 RN, 2 doctors, 3 PT]
Total: 8h 10min

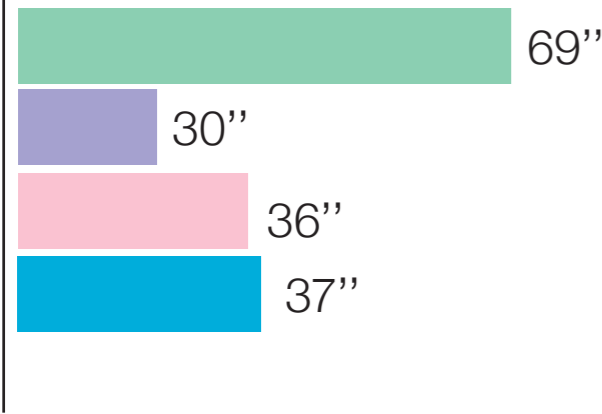
Corridor layout

17 staff members [3 NIC, 7 RN, 4 doctors, 1 consultants, 2 PT]
Total: 14h 11min

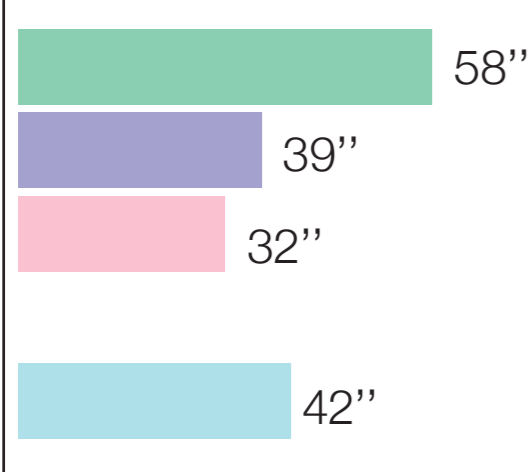
Are there significant differences between same role in different hospitals?

Mean duration of all activities by role

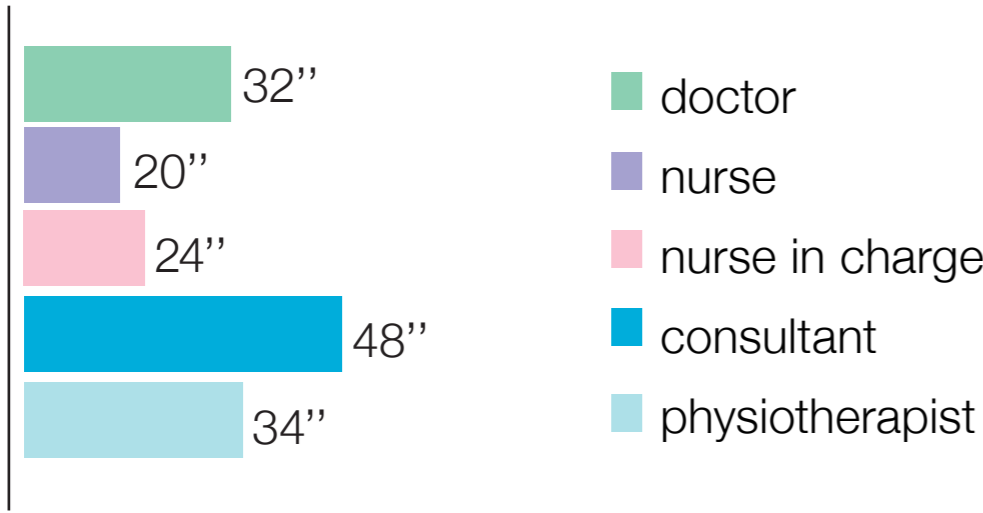
Racetrack layout



Duplex layout



Corridor layout

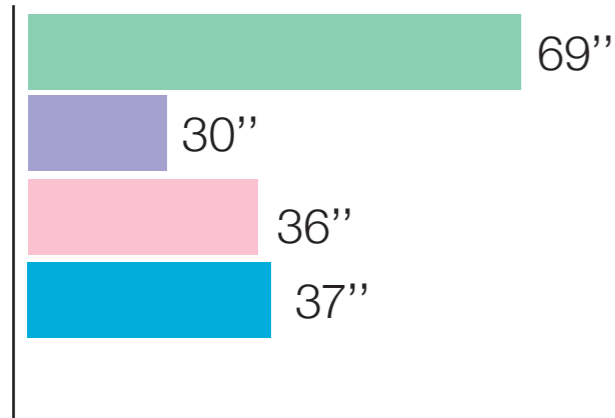


- doctor
- nurse
- nurse in charge
- consultant
- physiotherapist

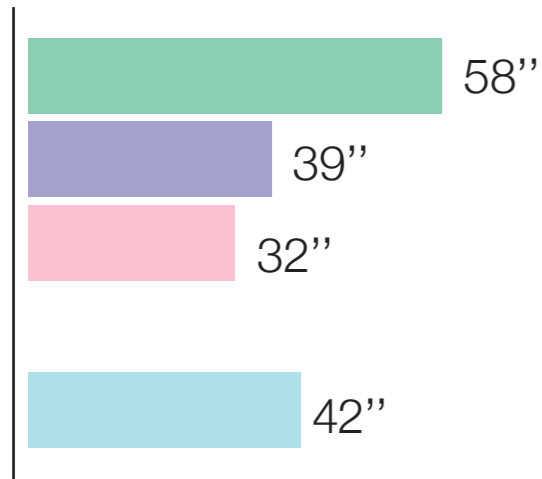
Are there significant differences between same role in different hospitals?

Mean duration of all activities by role

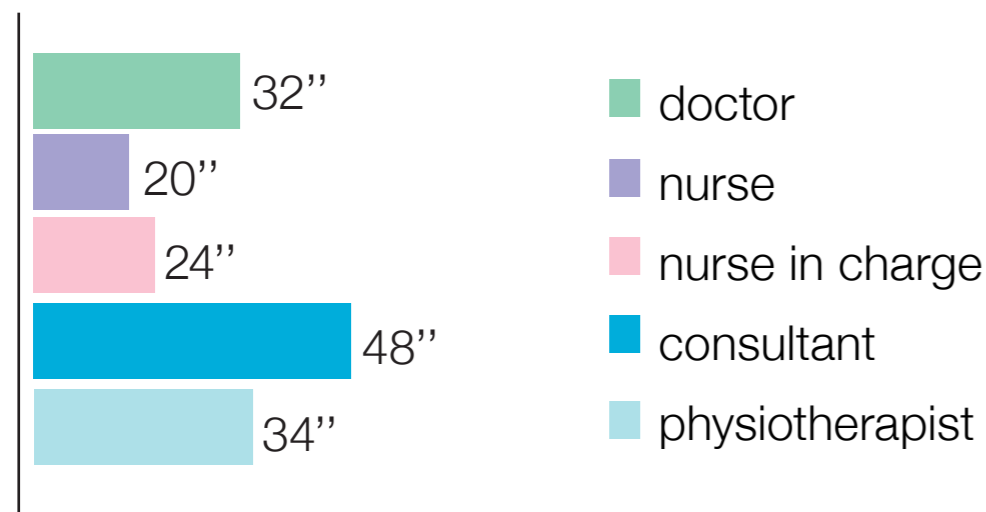
Racetrack layout



Duplex layout



Corridor layout



ANOVA

Pairwise comparison

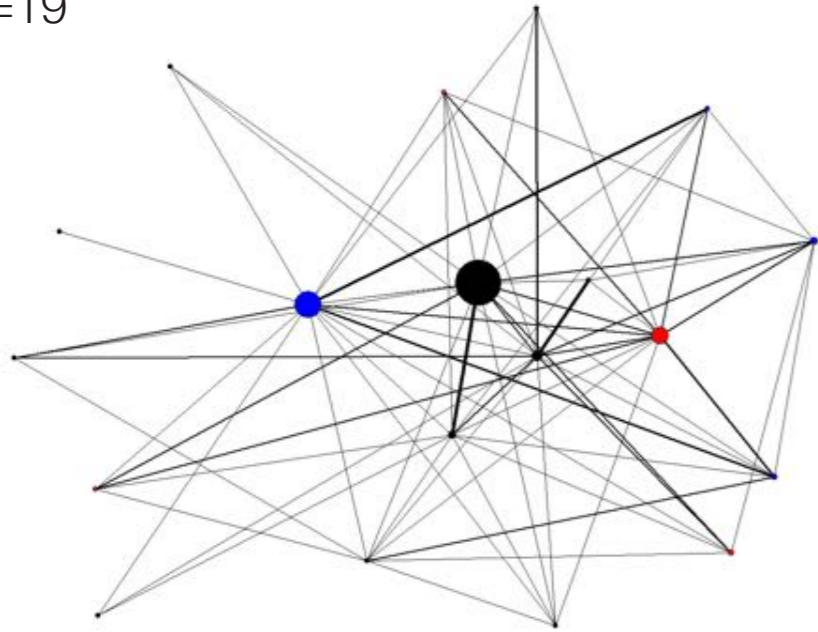
		Racetrack	Duplex	Corridor
Doctor	Racetrack	-	0.721	0.000**
	Duplex	0.721	-	0.036**
	Corridor	0.000**	0.036**	-
Nurse	Racetrack	-	0.088*	0.009**
	Duplex	0.088*	-	0.000**
	Corridor	0.009**	0.000**	-
NIC	Racetrack	-	0.626	0.003**
	Duplex	0.626	-	0.093*
	Corridor	0.003**	0.093*	-
Consultant	0.337			
PT	0.280			

- doctor
- nurse
- nurse in charge
- consultant
- physiotherapist

Analysis & Results

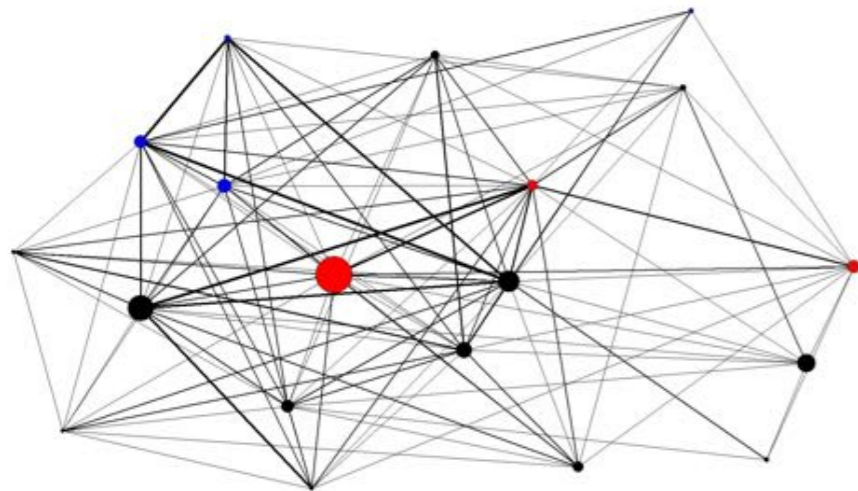
UCLH

n=19



CW

n=19



- nurse
- doctor
- other

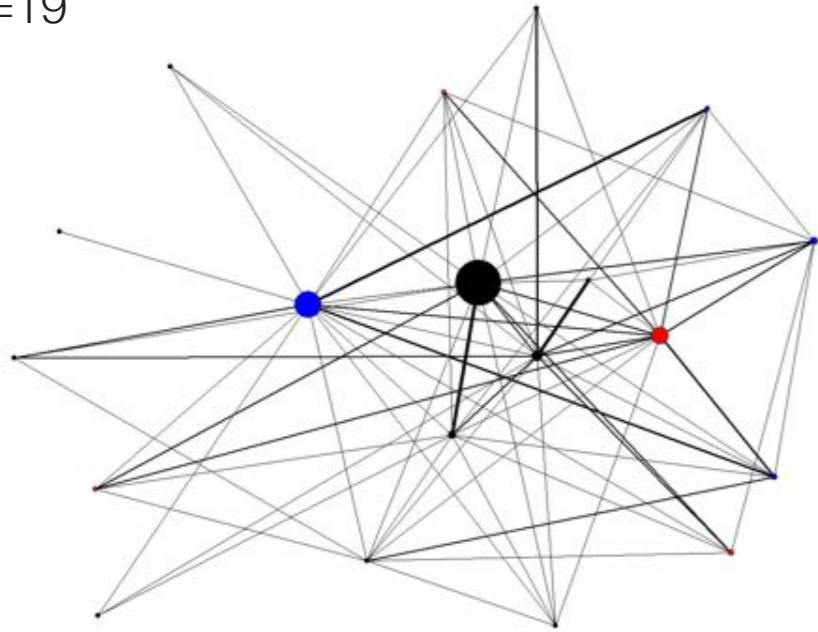
Node size: Betweenness centrality - who controls information flow

Link: frequency of communication

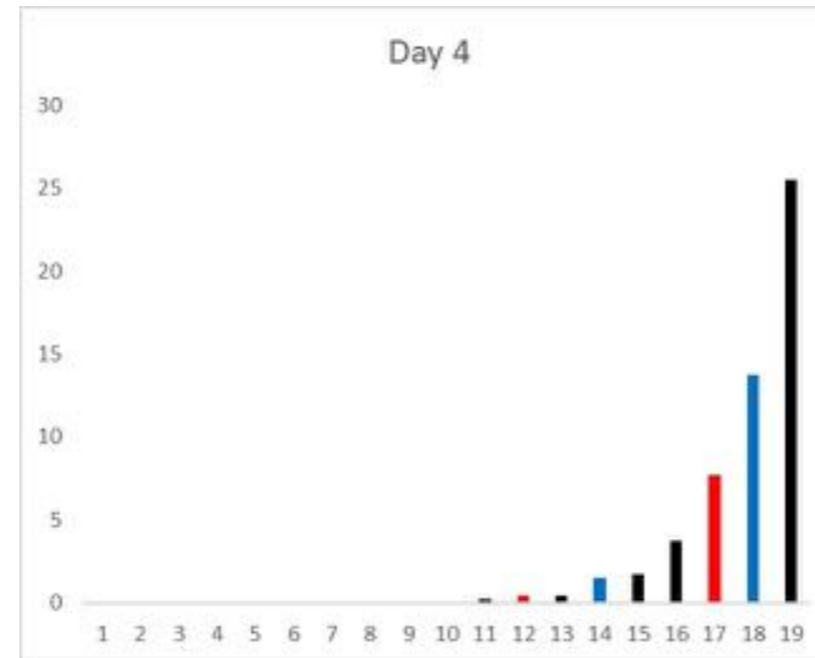
Analysis & Results

UCLH

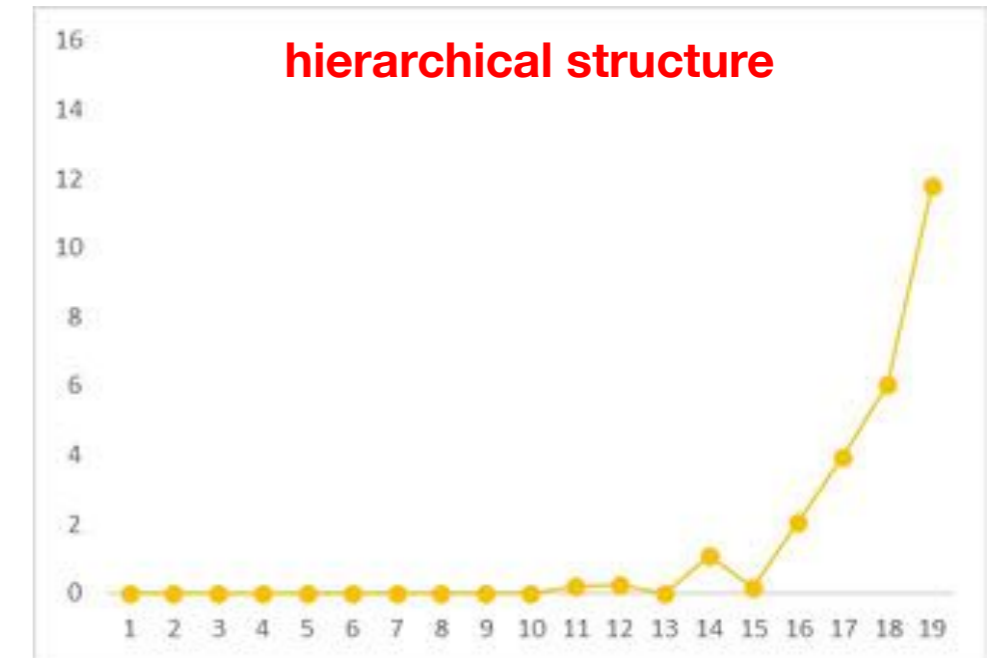
n=19



Distribution of betweenness

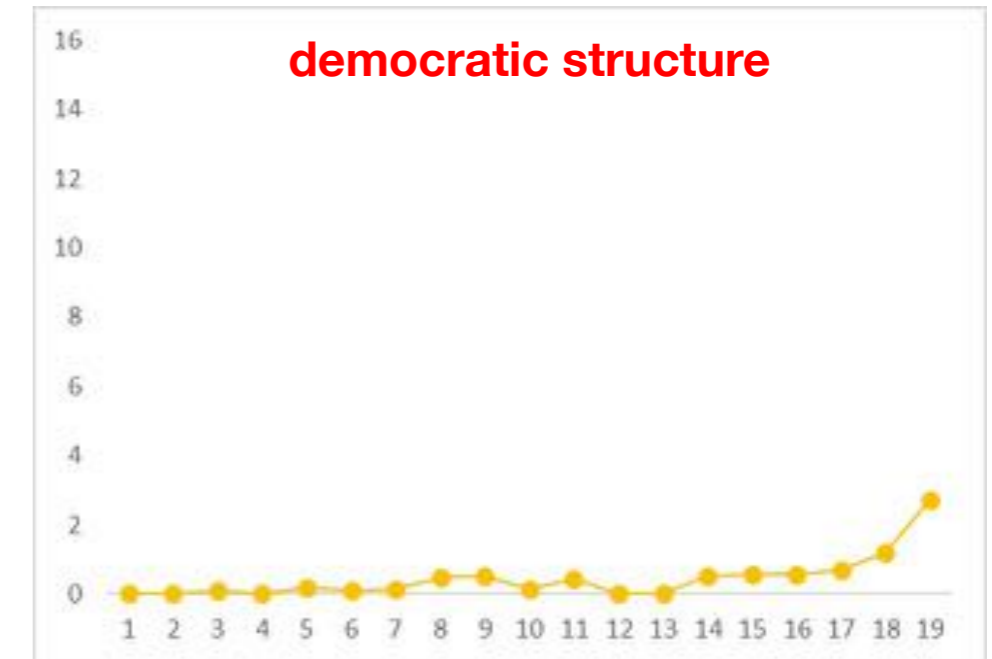
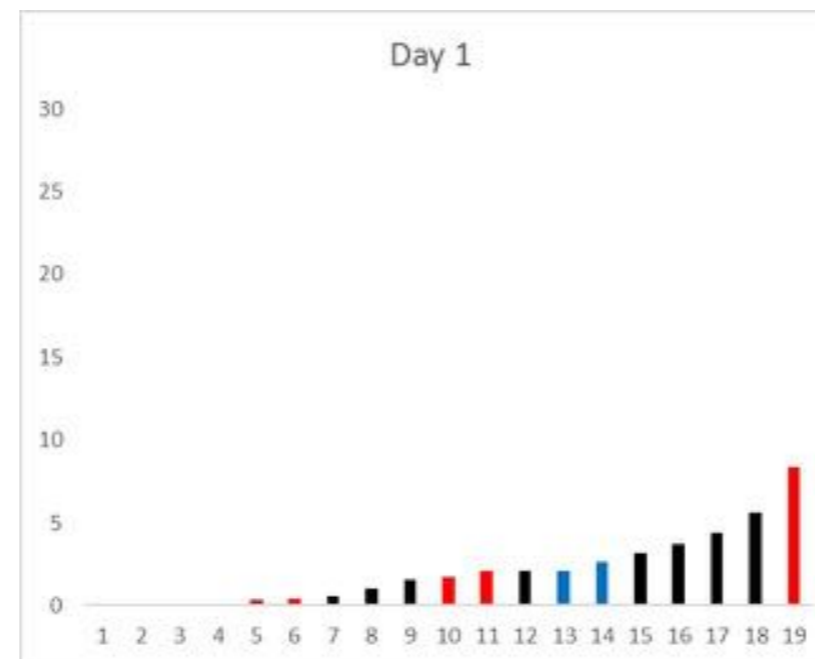
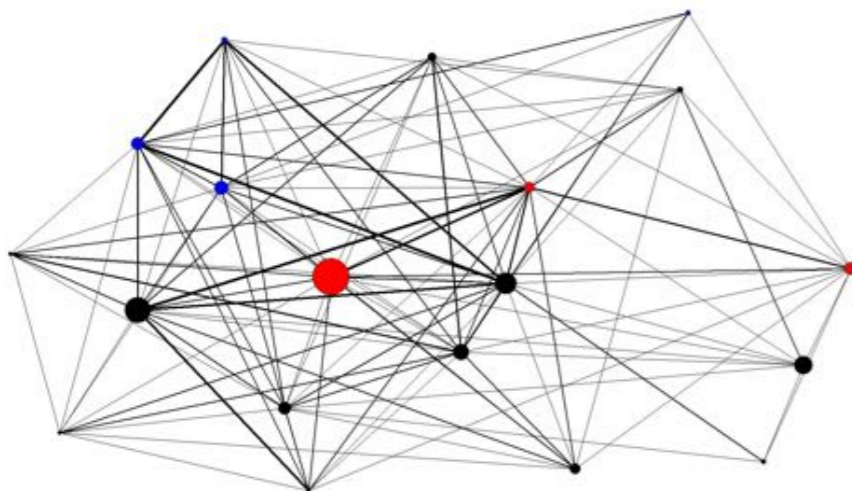


Differences of betweenness values



CW

n=19



- nurse
- doctor
- other

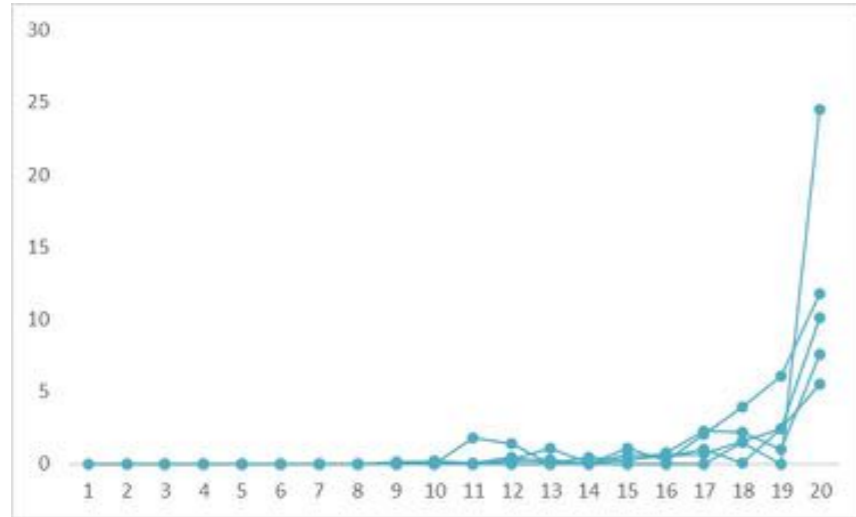
Node size: Betweenness centrality - who controls information flow

Link: frequency of communication

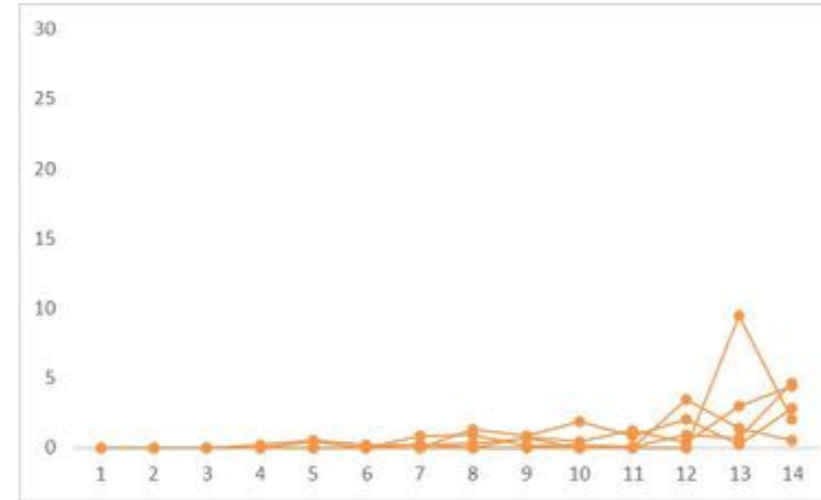
Analysis & Results

UCLH

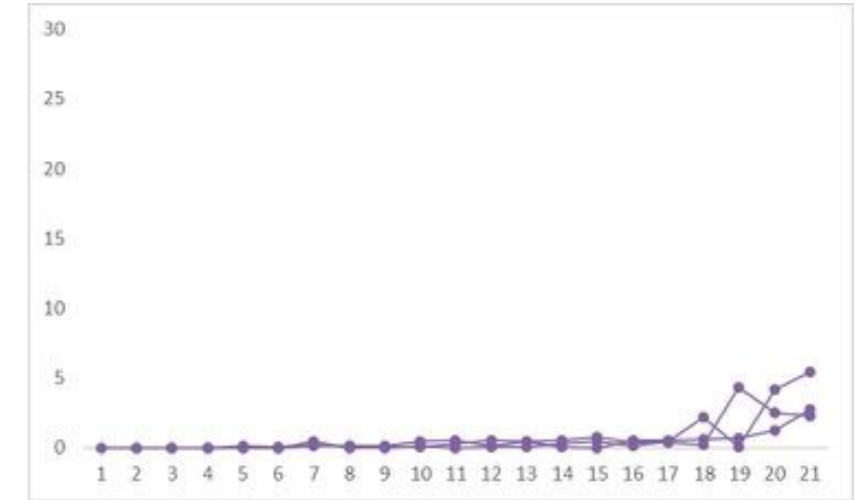
Differences of betweenness values



NHNN



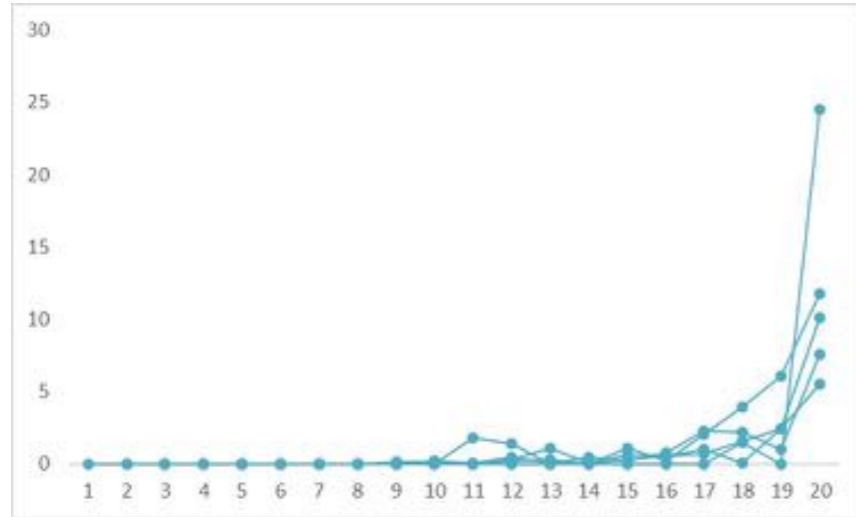
CW



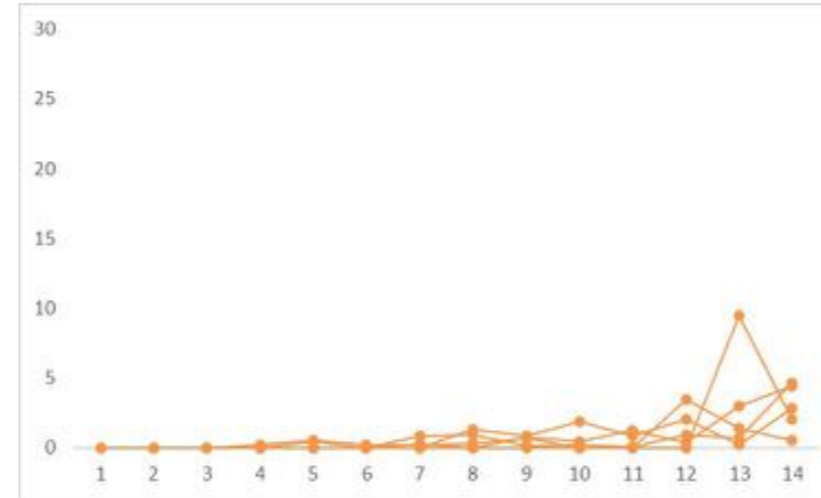
Analysis & Results

UCLH

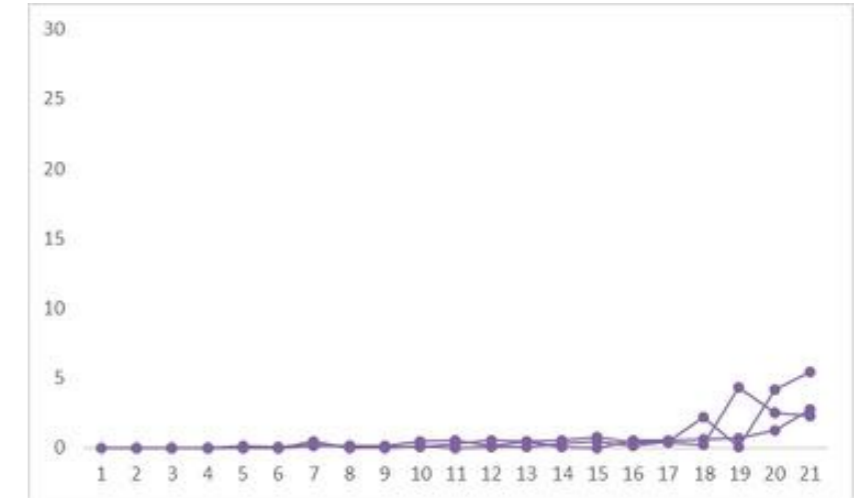
Differences of betweenness values



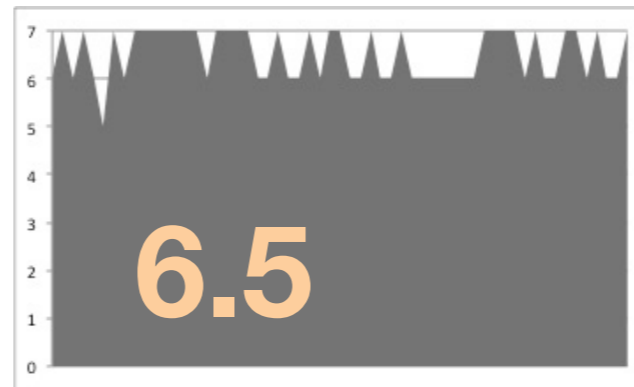
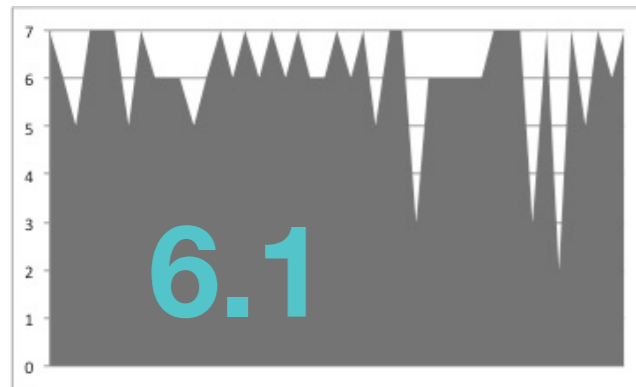
NHNN



CW



I feel part of a **team** where I work [rated on a scale 1 (strongly disagree) to 7 (strongly agree)]



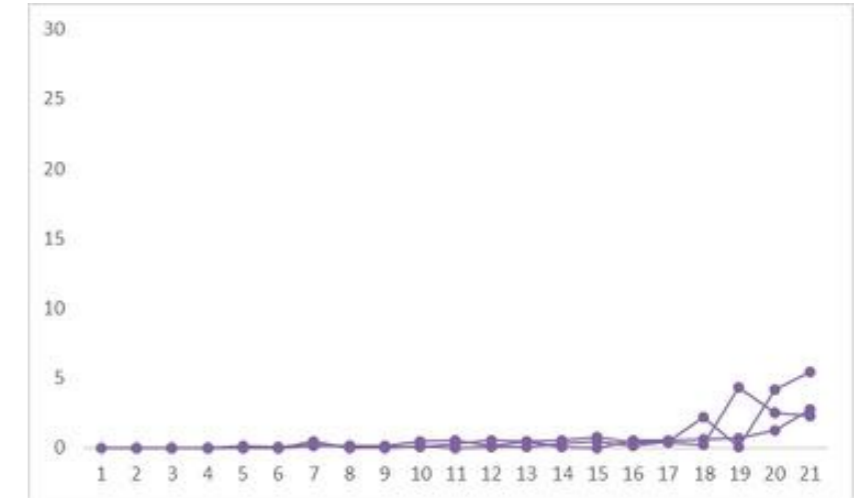
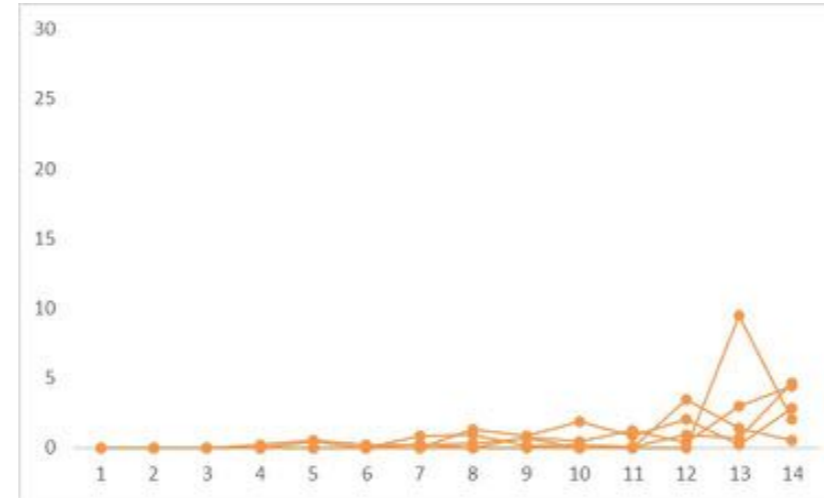
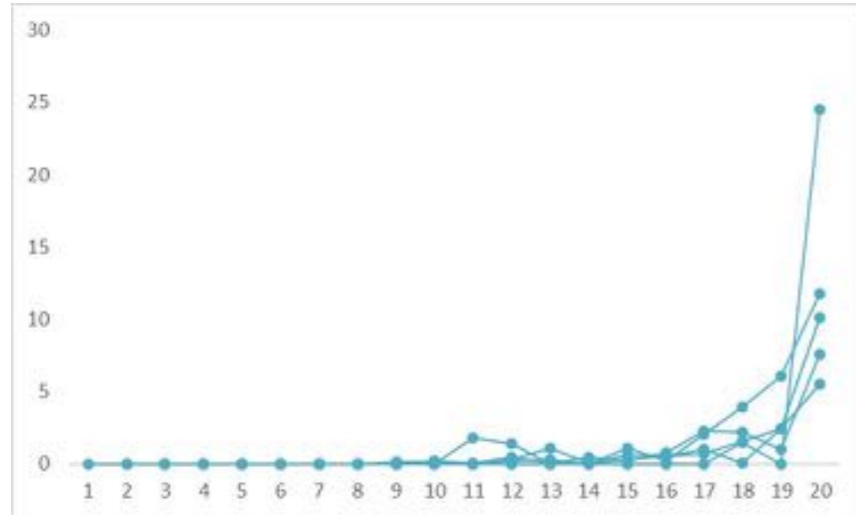
Analysis & Results

UCLH

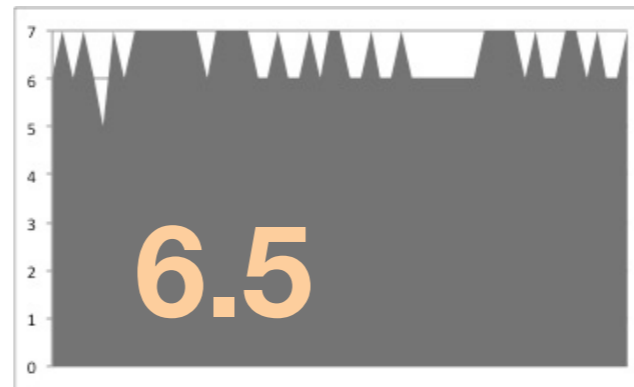
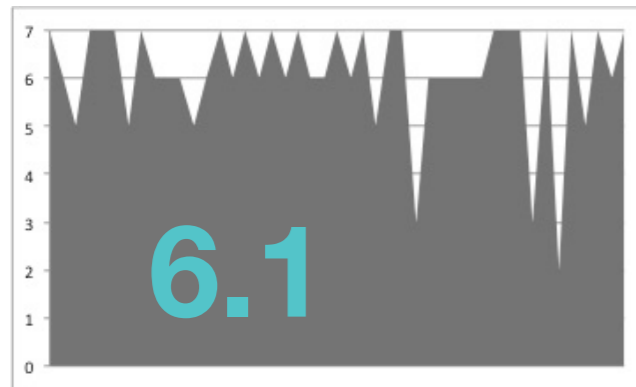
NHNN

CW

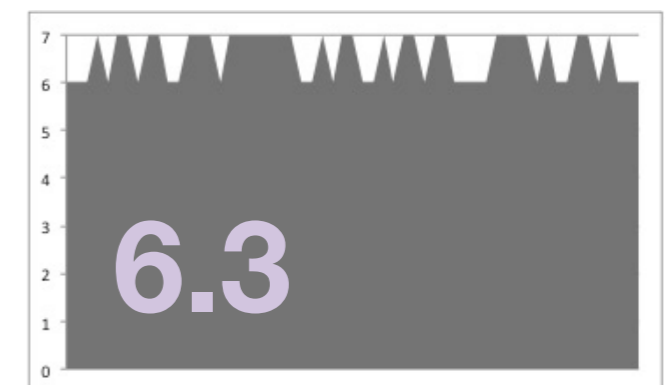
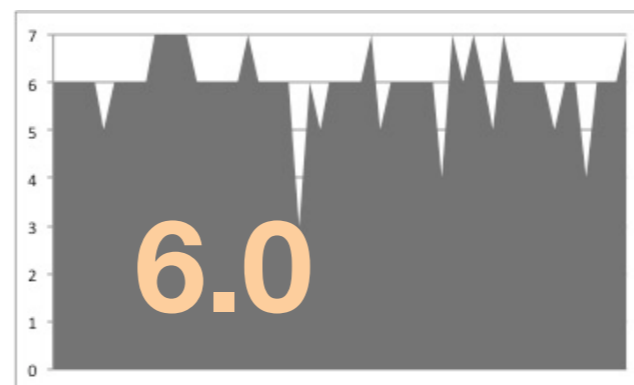
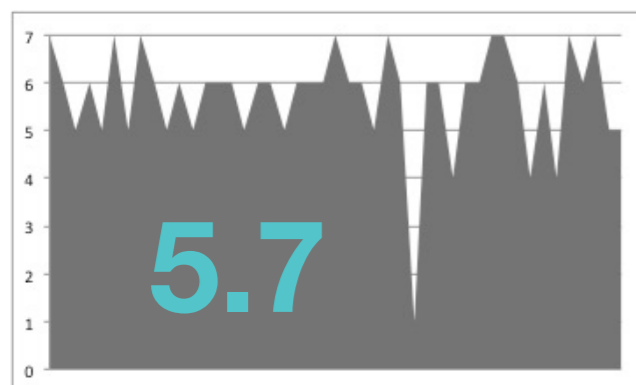
Differences of betweenness values



I feel part of a **team** where I work [rated on a scale 1 (strongly disagree) to 7 (strongly agree)]



There is good **communication** in my department [rated on a scale 1 (strongly disagree) to 7 (strongly agree)]



Conclusions

Measures

Intelligibility	corridor	>	racetrack	>	duplex
Duration of Activities	corridor	<	racetrack	<	duplex
Duration of Conversations	corridor	<	racetrack	<	duplex
Walking Distance	duplex	>	corridor	>	racetrack
Hierarchical Culture	corridor	<	duplex	<	racetrack
Teamwork	corridor	>	duplex	>	racetrack
Communication	corridor	>	duplex	>	racetrack

Conclusions

These results are based on 3 case studies and more cases are required to verify the results.

The traditional ward typology classification may not be the best predictor of healthcare outcomes. We will continue to explore spatial layout metrics similar to visibility because such a refined method will allow us to compare three different racetrack typologies. This may lead to a different ward classification which is not based on pure architecture shape.

Healthcare outcomes are influenced by multiple factors which should be taken into account.

WHAT DO YOU THINK?

Can this evidence be used to inform future design guidelines?

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