

SESSION n2 HEALTHCARE DESIGN

**Design
& Health**
International Academy for Design and Health

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Design & Health

13TH WORLD CONGRESS & EXHIBITION

REVITALIZING HEALTH BY SALUTOGENIC DESIGN
Healthy environment | Healthy people

Design a microbial safe hospital for
patients and health care workers;
lessons from hospital acquired infections,
outbreaks and the COVID-19 pandemic

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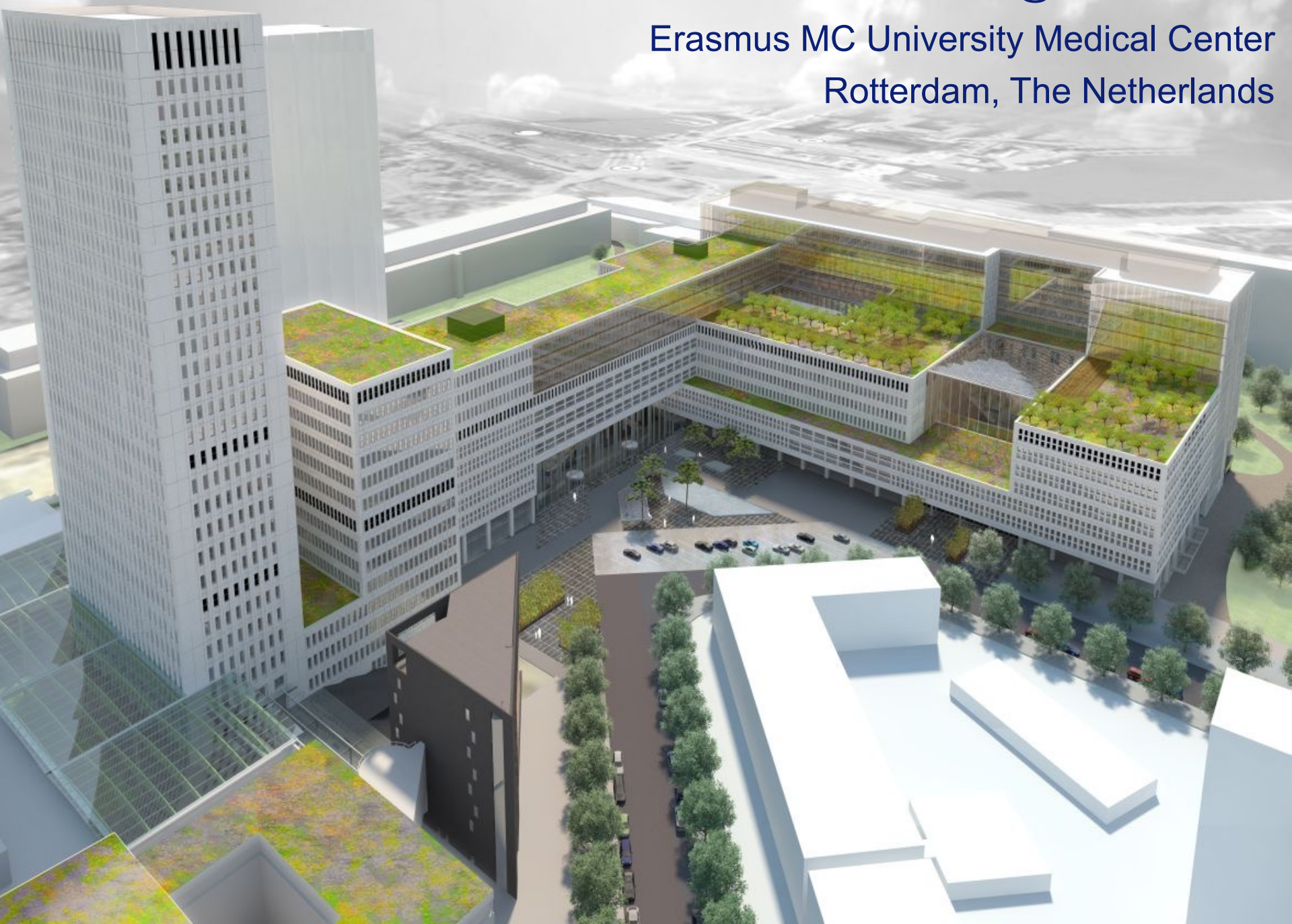
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Rotterdam, The Netherlands



- Introduction of myself...
 - A professor of Infection Prevention/Clinical Microbiologist at an architect's conference...

- No disclosures



Design of the hospital: some history

Hospital of St. John, Bridgewater, 1219

Bishop Joscelyn of Bath and Wells:

“No lepers, lunatics, or persons having the falling sickness or other contagious disease, and no pregnant women or sucking infants, and no intolerable persons, even though they be poor and infirm, are to be admitted in the house; and if any such be admitted by mistake, they are to be expelled as soon as possible”



A microbial safe hospital...

- Hospital Acquired Infections: HAI

1 in 20 hospitalized patients gets an infection!

Hospitals are ideal incubators for transmission:
crowded space, antibiotic use, procedures:

opportunities for entry of bacteria into the body!

A microbial safe hospital...

- Hospital Acquired Infections: HAI
 - From your own body; endogenous
 - From another one; environment or directly; exogenous
- In a Microbial Safe Hospital:
 - The risk on acquiring infectious diseases is minimal
 - The design of the hospital enables and enhance prevention of HAI



Hospitals of the future

A technical brief on re-thinking the architecture of hospitals



...the issue of single versus multiple beds and rooms; infection control is a complex area of study, but based on specific evidence from available studies, **single rooms with flexible solutions should be favoured** (Stiller et al., 2016; O'Neil, Park & Rosinia, 2018; **van der Schoor et al., 2022**)

Hospitals of the future: a technical brief on re-thinking the architecture of hospitals. Copenhagen: WHO Regional Office for Europe; 2023. Licence: CC BY-NC-SA 3.0 IGO

A microbial safe hospital...how?

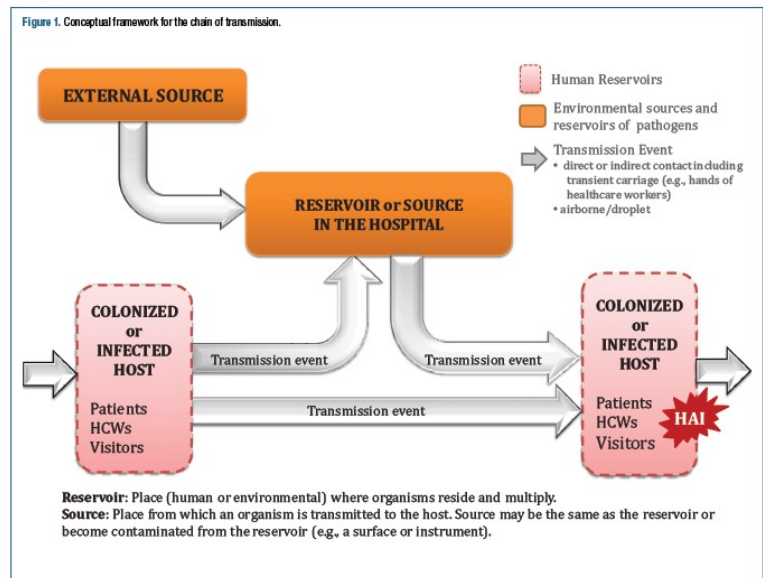
Some infection control background...

- Infection prevention measures:
→ based on “every patient is infectious”

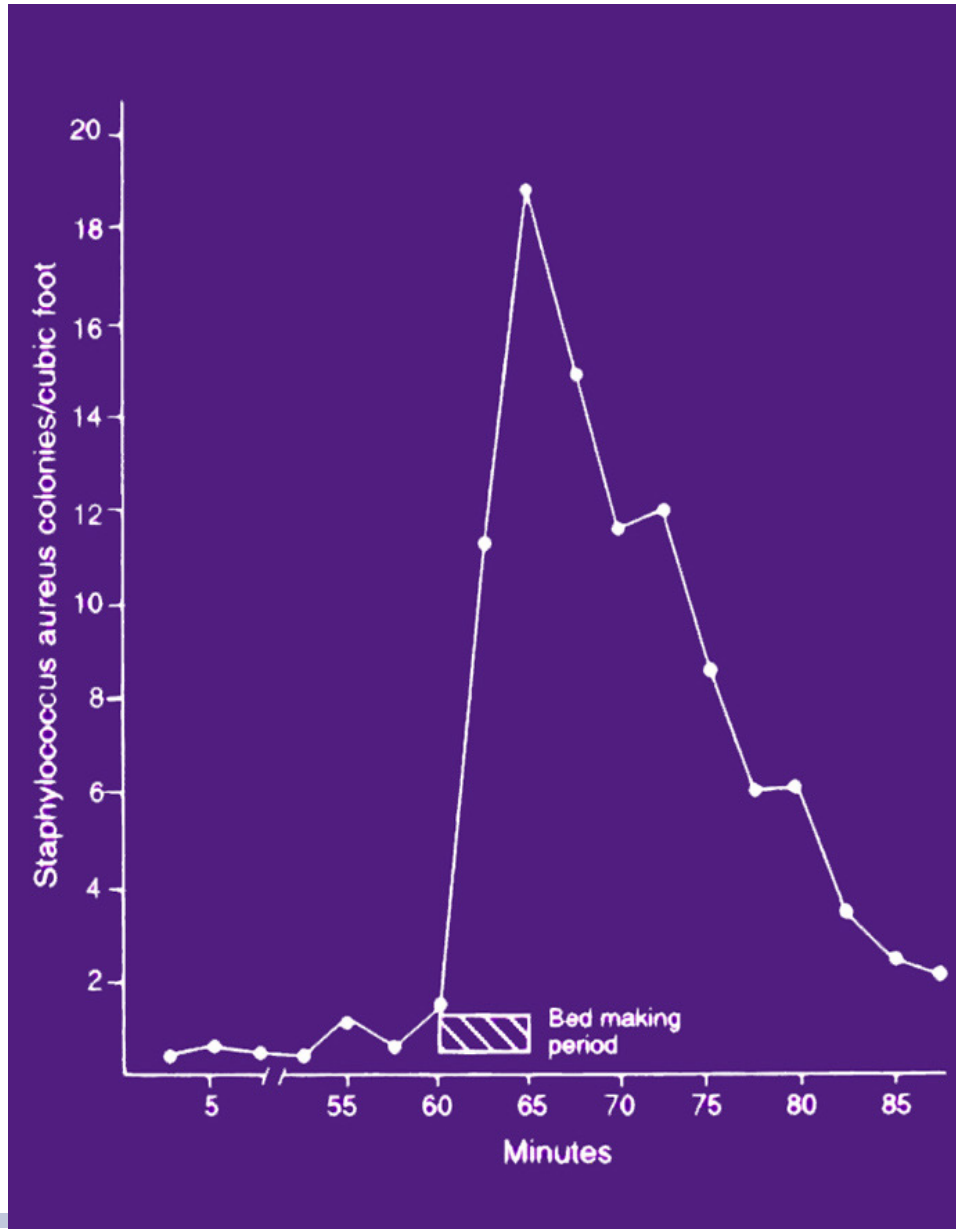


- general precautions
- transmission-based precautions

BMJ 2010;341:e5621



Staphylococci: dispersion studies



The presence of humans leads to the dispersion of microorganisms in the environment.

Performing care activities amplifies this dispersion even further

Patients in hospital carry bad bugs:

- Severe infections
- Resistant bacteria
- Highly contagious micro-organisms (COVID-19)

Conflicting interest of microbial safety and comfort



Photo by Scott McDonald, © Hedrich Blessing

Of all the recent changes in hospital interior design, perhaps the most dramatic have taken place in the patient room. Patient rooms have been transformed from cold, strictly utilitarian spaces into clean, safe, therapeutic environments with the comforts of home and the aesthetics and amenities of a fine hotel.

For the patient with an infection: Transmission-based precautions

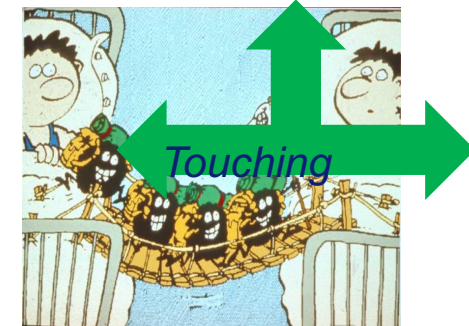
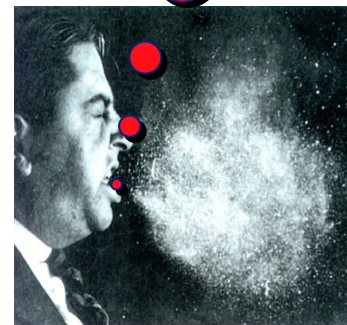
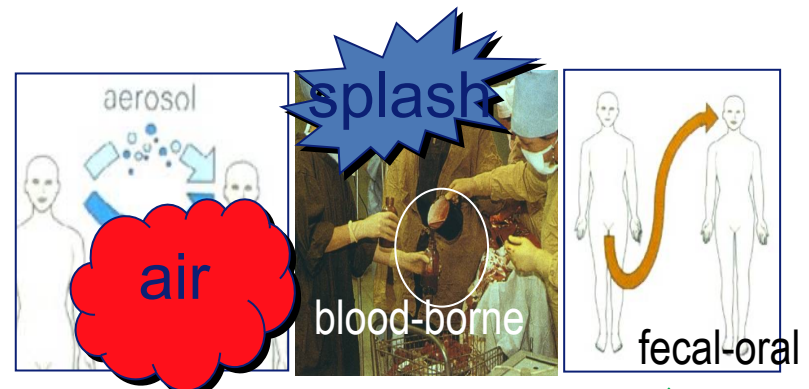
- For patients documented or suspected to be infected or colonized and:

Requiring single rooms and additional precautions beyond the standard precautions



- Airborne
- Droplet
- Contact

→ Impact on design

→ Impact on engineering



Transmission and isolation: Impact on hospital design

Transmission	Isolation	Measures	Example m.o.
Contact; Direct/indirect	Single room	Gloves/gowns	clostridium, resistant bacteria, Influenza, Covid-19
Droplet 	Single room	Mask	pneumococci, streptococci, bordetella, meningococci
Airborne 	Isolation room, air handling, special ventilation	FFP2 mask	TBC, varicella, measles, aspergillus

With 100% single rooms: maximal flexibility in converting a patient room into an contact/droplet isolation room!

Impact of design on patient safety

- *Patient room level*
 - 1 bed in a room and no more than one: **Single rooms** for everyone!
 - Space between beds is not enough:
 - No sharing inventory
 - No sharing bathrooms
 - Dedicated PPE, medical devices and disposables per patient
 - Finishing materials and surfaces:
 - Smooth and suitable for cleaning and disinfection

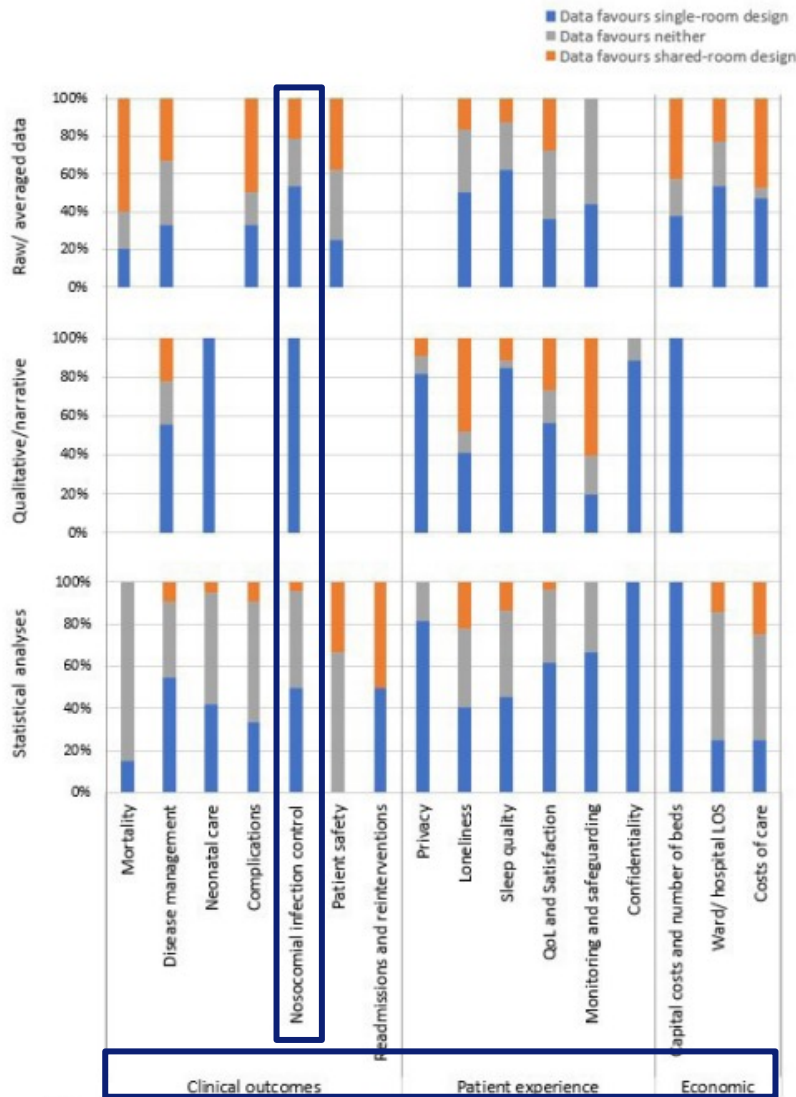
NHSE Director: 'Single Rooms Should Be the Default'

However, in September it was revealed that officials were considering a 100% requirement. In October 2021 NHSE medical director Stephen Powis was quoted as saying that single patient rooms should be the 'default' for inpatients. "Personally, I feel coming out of the pandemic one of the things we need to think really hard about is the number of single beds that we have", he told the *HSJ*.

"I think that we need to move in our hospitals much more to single rooms being the default, for privacy and dignity, for infection control and for flow issues... That's something we need to think hard about as we build the hospitals of the future."

At the NHP event this week, NHS estates minister Lord Markham said that single rooms promoted "efficiencies" in terms of bed capacity, utilisation, and infection control, as well as reducing the number of potential mixed sex accommodation breaches.

Evidence for single rooms?



For HAI (nosocomial infections);
Nearly all studies favour single rooms

Outbreak control and reduction:
Not included

Figure 2 Percentage of studies reporting data in favour of either single-room or shared-room design, according to the type of data available and outcome reported. LOS, length of stay; QoL, quality of life.

Our new hospital: 100% single rooms; an intervention!



Dropping down:

- Number of acquisition of resistant bacteria
- Contamination rates
- Translocations of patients to other rooms:
 - Decrease in exposure to environment, decrease in workload
- Number and size of outbreaks

COVID; hardly any transmission within the hospital

Flexible conversion to isolation rooms, continuation of non-COVID care

Antimicrob Resist Infect Control. 2022 Jun 2;11(1):76.
Int J Hyg Environ Health. 2023 Jan 6;248:114106. doi: 10.1016/j.ijheh.2022.114106.

Determinants Influencing Single Room Provision

Single rooms hospital

- NEW? No
- Needed? Yes
- Implemented? No



A Report for NHS Estates, England
by the
EU Health Property Network

Authors:

Barrie Dowdeswell, EUHPN Executive Director

Jonathan Erskine, Research Associate
Michael Heasman, Research Associate

November, 2004

- -**Intra-hospital spread** of infection may result from patients being **transferred** to more than one ICU or more than one floor during their hospitalization.
- -Patients length of stay in hospitals and cost is increased due to nosocomial infection
- Ongoing research is demonstrating that nosocomial infection **rates are low in private rooms** with proper design and ventilation systems (The Center for Health Design, 2003).

The patient room of tomorrow...

Single rooms with bathroom:

- Pro = microbial safety, privacy, flexibility
- Against= social deprivation, staff workload

- Let design be the solution
- Let not the patient become the victim of HAI by designing multiple-bed rooms as solution for loneliness...
- Median admission period = 4-5 days

- Measure staff working load

Flexible solutions?

- I need your help!



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New children’s hospital being designed now..

NICU = default single rooms

→ Question from neonatologist: Twins asks for multiple-bed rooms...

→ Answer: Default is single rooms with flexible design by which 2 single rooms can be easily converted for a short period into a 2-bed room!

Impact of design on patient safety: the ward

- *Ward level:*
 - Cohorting patients and staff in units;
 - Containment in space and air
 - Separate and dedicated rooms
 - e.g. Sterile goods storage: + positive pressure
 - Mutual space relation of different functional rooms
 - Design for social distance

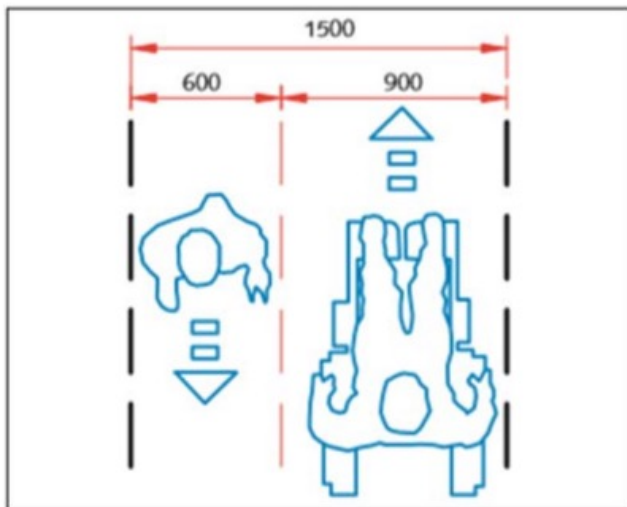
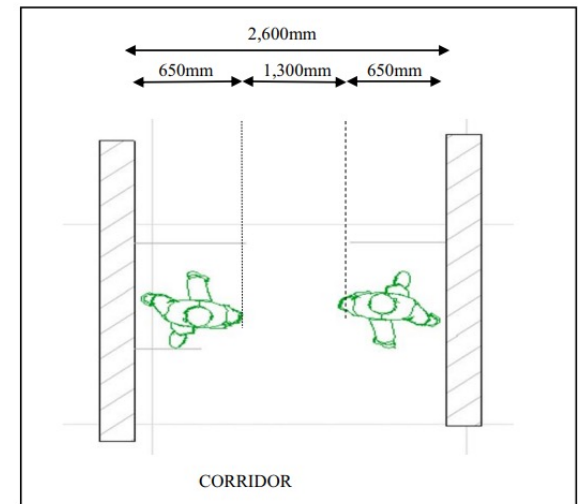


Fig. 4 Corridor width as recommended by UKDH [28] 2013

Fig. 5 Suggested minimum Corridor width (Author)



Routes

- “Separate, dedicated lifts for waste, clean supplies, food, and patients and visitors should be carefully positioned within the functional design.
- “Functional design is fundamental in hospitals to fulfil the needs of different people by separating different hygienic departments and distributing all kinds of flows.”



- Passing each other in a corridor with sufficient width is not a great risk for transmission
- Supplies, waste etc should be contained (boxes) during transport
- Every single room can be converted for contact/droplet transmission-based precautions: no need for hygienic wards
- Infected patients are transported with protecting measures

Conclusions

Single rooms

No sharing of

▪ The environment

▪ The ward should



cross-organisms:
organisms

charge

rd

Clinical Microbiologists and Health Care Architects
are working in a team for a healthy microbial safe salutogenic hospital....!

ErasmusMC; a salutogenic hospital

