

Hospital Construction

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Evidence-based recommendations for construction and design of healthcare facilities?

Dettenkofer *et al.*¹ looked for connections between the design of hospital facilities and nosocomial infection rates and concluded that there was a lack of stringent evidence linking these two factors.¹ They discussed that this might be partly attributable to the multifactorial nature of infections transmission and acquisition. Despite the lack of evidence in the strict sense, some improvements might be seen if basic conditions such as the availability of sufficient bedspace, isolation capacity and facilities for handwashing are met. Perhaps the most relevant of these is ensuring hand hygiene.

There are a lot of factors which should be thought about if one is planning a study on hospital construction and the outcome of nosocomial infection rates:

- bedspace available,
- how many beds in a room,
- cleanability of floor,
- water quality,
- ventilation and air quality (windows? Air conditioning? Cooling units?),
- number of nurses and doctors,
- knowledge and experience of staff,
- number of operations and examinations.

It seems impossible to control all these possible influences, e.g. the "Lidwell" study of the 1970s² had to look at around 8,000 very similar surgical procedures to show some difference in infection rates associated with operating theatre ventilation, and even this study would not fulfil the present day requirements for robust evidence. It may be possible to compare similar well defined patient groups in different hospitals with respect to buildings-related factors, e.g. ventilation types in hematology-oncology or bone marrow transplantation.

A good example may be the case-control study of Yu *et al.*³ about SARS outbreaks in Guangzhou and Hong Kong, during the SARS epidemic in 2003.³ They included 124 wards in 26 hospitals. Cases were wards with superspreading events of SARS and controls were wards without SARS outbreaks but with single cases. They found 6 significant risk factors including a minimum distance between beds <1 m (OR 6.9) and the availability of washing or changing facilities for staff (OR 0.12). Both are typical construction factors.

With respect to hospital construction, some demands seem very clear and need no evidence:

- Clean water supply and electricity must be available 24 hours a day.

- Surfaces must withstand cleaners and disinfectants.
- Clean and dirty work should be separated as far as possible, best of all in different rooms.
- A maximum of about 40 beds on a ward should not be exceeded because of very long walking distances for the staff.

Considerations in planning new healthcare facilities

During planning of new healthcare facilities, some existing and future developments should be kept in mind:

- The number of day care and outpatients will increase.
- Patients will stay shorter periods in hospitals so that less rooms are needed.
- The number of really sick (and thus susceptible) patients will increase and, consequently, the need for more protection.
- Patients will get bigger and need longer beds and bigger rooms.
- A lot of patients will become more obese. Thus beds and stretchers will need more strength.

This is the situation in developed countries.

The problems are quite different in developing and transitional countries:

- Building structure is poor (Figure 1).
- Water and electricity supply is inadequate and often unpredictable.
- Wards are overcrowded.
- There is more than one baby/child in a cot/bed.
- Decontamination of equipment is grossly inadequate.
- Alcohol handrubs are absent.
- Handwash sinks and soap are infrequent.
- There are more community-associated infectious diseases, that can also spread within hospitals.
- The number of TB/MDRTB/XDRTB is growing, mainly in the context of high HIV rates in South Africa.

Different needs in developed and developing/transitional countries

There is a discussion about more or even exclusively single-bed rooms in Western countries. Advantages of single-bed rooms are overwhelming and evidence-based in many respects:



Figure 1: Operating theatre, Nigeria

- Shorter length of patient stay.
- Less medication errors and costs.
- Lower nosocomial infection rates.
- Nearly no patient transfers between wards.
- Higher privacy, better communication with family and visitors.
- Confidentiality in doctor-patient communication.
- Lower noise level and less sleep disturbances.
- Higher patient satisfaction.
- Bed reprocessing can occur in the room.⁴

Unfortunately, an important argument against single bed rooms is economical: the insurers of first-class patients may demand single bed rooms only for their patient group.

There are other very new developments and discussions in wealthy countries:

- Financing by public-private partnership;
- "Hotel quality" and "wellness" in hospitals;
- "Low care" patients and "hotel wards" and "patient hotels";
- hybrid operating theatres (cardiologists and cardio surgery working in parallel);
- intermediate care wards.

Whether these new ideas will really bring improvements for patient outcome and safety will only be answered in the future.

The necessities in developing and transitional countries are quite different:

- Clean water supply and electricity must be constantly available.
- More rooms are needed, each with fewer beds.

- Basic hygiene has to be improved, e.g. hand cleaning and disinfection.
- Better knowledge and practice of isolation precautions, sterilisation and waste disposal is needed.
- Laboratory facilities have to be built up.

Some solutions might be quite innovative for those countries. Based on the study of Escombe *et al.* TB spread in hospitals could be prevented by a good planned natural ventilation system.⁵

Within the medical staff of healthcare facilities, only infection prevention/control staff have experience in construction, design and renovation. Therefore infection control and prevention staff must be consulted for advice concerning construction issues!

IFIC Special Interest Group “Construction, design and renovation”

In 2007, IFIC formed a Special Interest Group (SIG) on “Construction, design and renovation”. The SIG is open to everyone who is interested. The SIG meets once a year during the IFIC congress, but most of the work and discussion is done by e-mail contacts. Evidence-based guidelines are its aim, but it is the explicit goal of the SIG to make practical, short and easily readable recommendations. The SIG intends to make the following categories of recommendation for low and high income countries:

- Basic: even with severely limited resources, “this is what you should do as a minimum”.

- Standard: “this is what you should aim for in less wealthy countries”.
- Ideal: “if you have the resources, this is what you could do”.

Until now, two papers were prepared and published on the IFIC website, www.theific.org:

- Design of a general ward.
- Protection of immunocompromised patients during building work.

Further topics are under discussion:

- Water supply, bathrooms, showers... in hospitals.
- Construction standards for emergency departments.
- Construction standards for ICUs.
- Endoscopy units.
- Control of airborne infection transmission.

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