Workplace design:

how it affects clinical and financial outcomes

What is it: Workplace design aims to use evidence-based design principles to improve clinical outcomes, economic performance and productivity, and customer and staff satisfaction.

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1. Why does workplace design matter?

Workplace design has more than merely decorative purposes. In general, it aims to use evidence-based design principles to improve clinical outcomes, economic performance and productivity, and client and staff satisfaction. In a hospital environment, this approach is of higher importance than in a "normal" office building, where working in a poorly designed environment would potentially cause staff dissatisfaction, hinder communication or lead to minor health complaints. But in a hospital setting, the consequences may not only include staff dissatisfaction (in turn leading to higher staff turnover and increased costs for hiring and training new personnel), but it can also have graver consequences, such as contributing to the worsening of a patient's condition or even leading to death.

From a strictly financial point of view, studies have shown that such serious consequences are associated with increased costs for the hospital, not only because of the need for longer and more complicated care of the patients, but also for possible lawsuits. In addition, hospitals put a considerable strain on the public purse (1):

In the US alone, $200 billion in tax payer's money are estimated to be spent per decade on hospital construction, and the US spends approximately 14 percent of its Gross National Product (GNP) on healthcare, much of which is provided in hospitals.

These numbers provide another strong argument for ensuring that these buildings function well for patients and staff and are as cost-effective as possible (2).

2. How can workplace design improve outcomes?

2.1 Definition of workplace design

"Workplace design" is defined as the way a workplace is organized and equipped. The aim is to create the space to allow optimal productivity **by** workers as well as maximum safety and job satisfaction **for** workers. The most commonly used terms to describe optimal workplace design include flexibility, connectivity and ergonomics.

2.2 Definition of healing environment

The idea of a "healing environment" to support the patient's recovery has been around for quite some time: For instance, hospitals in 18th century Vienna were famously high-ceilinged and light-flooded, with large windows allowing views on to trees in parks, all with the idea of improving the patient's state of mind. In modern times, one seminal paper of 1984 demonstrated that patients with tree views had shorter postoperative hospital stays, needed fewer moderate-to-strong analgesic doses and had slightly lower scores for minor postsurgical complications than patients whose windows faced a brick wall (3).

"Better healing from better hospital design" was also the headline of a 2015 article in the Harvard Business Review, which quoted a study showing that amenities such as good food, attentive staff and pleasant surroundings with gardens are a larger factor in driving traffic to hospitals than clinical quality (4).

2.3 What current evidence shows

According to an extensive paper, the hospitals should consider the following factors when redesigning their facility (5):

- **Noise** produces annoyance for pretty much every patient group, and many studies agree that noise may affect outcomes by increasing sleeplessness and elevating heart rate (6).
- **Windows / daylight: A lack of windows / daylight** for example in the ICU has been associated with higher rates of anxiety, depression and delirium, while lower mortality rate have been demonstrated in myocardial infarction patients who had been assigned to sunny critical care rooms (compared to north-facing rooms) (7).
- Good **lighting** is essential to improve employee performance, health and safety. One study found that flickering lights, glare and unwanted shadow were a major disturbance to healthcare staff (8).

- A poor **layout** of patient care units and patient rooms will reduce the amount of time nurses have available for care: According to one motion study of more than 1,000 hours of nursing time on a medical-surgical unit, nurses only spend 1.1 to 3.3 hours in every 12-hour-period caring for patients, the remaining nine to 11 hours were spent walking between the patients rooms and the nursing unit core (9). A badly designed patient room can also directly affect patient safety: the majority of falls of hospitalized patients occur in the patient's room, usually when going to the bathroom (10).
- A lack of **adequate storage space** means that medication carts or wheelchairs are often found in the hallway, blocking travel for both patients and caregivers and introducing safety hazards (falls, fire, public access to medications and supplies).

- **Air quality**: According to some estimates, up to 50 percent of all illnesses are either caused by, or aggravated by, polluted indoor air (11). It is therefore particularly important for hospitals to maintain proper heating, ventilating, and air-conditioning (HVAC) systems and other engineering systems (12).

- **Air ventilation** is essential for diluting indoor air pollutants by exhausting the contaminated indoor air and introducing clean outdoor air into an air-conditioned building, while **filters** can effectively trap particulate contaminants, including microbiological pathogens, and remove them from the circulating air.

- Finally, **"soft touches"** can have a huge impact, as the following example shows: At an acute psychiatric clinic in the U.S., "as needed" injections of antipsychotic drugs was 70 percent lower during the weeks that posters of nature scenes were hung on the walls than when the walls were blank. By reducing the number of as-needed injections, the hospital projected a potential cost savings of over US$30,000 (13).

2.4 Cost recovery

Data have demonstrated that investments into a "healing environment" can be recovered, possibly even quicker than generally thought (14). According to one business case study on a 300-bed urban facility designed to replace a 50-year old building with 250 beds, the one-time incremental costs of designing and building optimal facility of 12 million US$ were earned back within one year, through operational savings such as reduced patient falls, infections, room transfers and nursing turnover, and through higher revenue from market shares (14).

2.5 How can workplace design affect hygiene?

Good hygiene is crucial for the prevention of infections and pathogen transmission in the hospital. And as recent data have shown, older, multimorbid patients, more invasive methods in diagnostics and therapy, and more medical devices have all contributed to the rising risk of infections during the past years (15).

Surface disinfection

There is good evidence that contaminated dry surfaces contribute to the spread of nosocomial pathogens (16). Proper use of disinfectants contributes to the control of pathogens in outbreak situation (16). In Germany, the national Hospital Hygiene and Infection Prevention Commission KRINKO attaches particular importance to the regular and appropriate disinfection of the surfaces with "frequent hand and skin contact" (17).

These critical surfaces include handles, buttons, switches, computer keyboards, bed controls, as well as noninvasive clinical equipment, such as electrocardiogram (ECG) machines, blood pressure cuffs, patient hoists, stethoscopes, and intravenous drip stands. Correct cleaning requires sufficient trained staff, constant upgrading of practice, and two-way communication between those responsible for cleaning and those responsible for infection control. Factors that increase the risk of poor cleaning include poor ventilation, clutter, and inappropriate storage further (18).

Cable management

Many cables and wires have grooves, crevices and gaps that are ideal pathogen hiding places. One study from 2004 found that 77 percent of reusable ECG leads harbor one or more antibiotic-resistant pathogens, even after cleaning and reprocessing (19). Effective disinfection and sterilization after every use is therefore mandatory for all cables that come into contact with the human skin or mucous membrane. Cable covers and organizers should not collect dust easily and be easy to clean in between room or patient changes; the cable covers should also be able to withstand cleaning chemicals without corroding or breaking apart.

Product design

Medical devices and instruments need to be of the highest quality to ensure functionality and safety standards. They are exposed to frequent use as well as cleaning with harsh products and / or sterilization and must resist corrosion and staining.

- High-performance metal alloys like austenitic stainless steel, titanium, or cobalt chrome with rounded edges increase resistance against pitting or scratching
- A smooth, robust surface decreases the risk of bacterial contamination (especially important in all invasive instruments) and allows easy wipe sterilization with the main disinfectants on the market.
- A non-glare finish prevents distraction during surgical procedures
- Toilets should be rim-free and have a touch-free flush option.
- For washing fixtures, a solid, seamless and non-porous surface material is best.

For staff and patients alike, medical devices with closed systems can increase safety, for instance during the application of hazardous drugs such as chemotherapeutics: So-called “closed-system drug-transfer devices” (CSTD) mechanically prohibit the transfer of environmental contaminants into a system as well as the escape of hazardous drug or vapor concentrations outside the system.

Hand washing

Hospital-acquired infections cause approximately 80,000 deaths per year, and hand-washing is the simplest and most effective, proven method for reducing the incidence of nosocomial infections (20). Workplace design can be critical: In a survey of health care workers, 75 percent stated that rewards or punishments would not increase hand-washing, but 80 percent said that easy access to sinks and hand-washing facilities would (11).

This was confirmed in a recent publication, which stressed that hand sanitizer dispensers at each point of patient contact (e.g., in every room) improves hand hygiene and therefore infection control (21). By contrast, deficiencies in the structural layout of hand hygiene resources hinder their usage. These include poor visibility, difficulty of access, placement at undesirable height, lack of redundancy, and wide spatial separation of resources that are used sequentially (22).

One study found that a combination of bedside antiseptic hand-rub dispensers and posters to remind staff to clean their hands substantially increased compliance (23), from 48 to 66 percent within three years (during the same period, overall nosocomial infections decreased from 16.9 to 9.0 percent, MRSA transmission rates decreased from 2.16 to 0.93).

Furthermore, studies showed that providing each single-patient room with a conveniently located sink reduces nosocomial infection rates in intensive care units (ICUs), such as neonatal intensive care or burn units, compared to when the same staff and comparable patients are in multi-bed open units with few sinks (24).

2.6 How does workplace design affect staff satisfaction and turnover

Many countries struggle with shortage of good staff, the UK for instance reported 94,000 full-time vacancies in its National Health Service (NHS) (25). In addition, retraining and hiring of staff is an expensive process. This makes it vital for hospitals to attract and retain healthcare professionals.

According to an extensive report by the University of Melbourne, Australia, the design features that matter most to nurses in their daily tasks are (26):

- An adequate space to work, learn and rest (space for storage, education and training, staff amenities for rest, meals and learning).
- Proximity: walking distances, proximity to other staff, storage close to patient rooms.
- Indoor environmental quality: access to natural light, variable temperature, acceptable noise levels and good maintenance of the building.

Nurses also see a comfortable, effective and efficient workspace as both a symbolic and practical demonstration of how highly a hospital values its nurses, a factor that plays a more important role in attracting and retaining the best nurses than their salary.

3. Summing it up

Evidence-based design can improve hospital environments in three key ways, namely by:

- Enhancing patient safety due to reduced infection risk, injuries from falls, and medical errors.
- Eliminating environmental stressors, such as noise, that negatively affect outcomes and staff performance.
- Reducing stress and promote healing by making hospitals more pleasant, comfortable, and supportive for patients and staff alike.

According to a report by the Robert Wood Johnson Foundation, which supports health research in the US, the most important steps for hospitals to take are (27):

- **Single rooms** for patients allow significant savings due to lower rates of infection, readmission and transfer as well as LOS.
- **Improved air quality** with good ventilation systems help to prevent nosocomial infection.
- **Better lighting** reduces stress.
- **Orderly, well-lit spaces** organized around the nurses' and physicians' critical activities reduce medication errors.

Consequently, workplace design might not be the obvious first thing to improve hospital finances, but studies show investments will pay off. Improving the workplace design is therefore not only the clinically, but also the financially smart thing to do.

One US hospital used an evidence-based approach in the $181 million redevelopment of its hospital campus, including private rooms for all patients; creative use of light and nature and shorter walking distances for patients and families with seating along the way.

This led to:

- **11 percent reduction in nosocomial infections**
- **Nursing turnover rates below seven percent (the national average is 20)**
- **95.7 percent overall patient satisfaction**
- **Improved staff satisfaction and an**
- **Increase in market share. (27)**

Sources (last access 4th June 2019)

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