A Review on Future Directions in Hospital Spatial Designs with a Focus on Patient Experience

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Abstract: Patient centred approaches are getting significance in Today’s healthcare industry. While this trend influences the sector very broadly from user centred medical device designs to the provision of medical service itself, there is an increasing need of designers working in this field in an effort to enhance patient experience. As Hospitals are being one of the important components of the healthcare system, the attention on their architectural and spatial designs—from a patient centred perspective—has also increased.

This paper presents the findings of a literature review study regarding hospital patient rooms from a patient-centred design perspective and discusses certain concepts in an effort to enhance patient experience in hospital spatial designs. As a result; a list of future directions on designing patient rooms are inferred with a focus on patient experience.

Keywords: Patient experience, Hospital environment, Human centred design, Future hospitals

1. Introduction

Patient-centred approaches are getting significance in Today’s healthcare industry. Although patient-centeredness is a commonly used concept that is generally associated with healthcare quality (Berwick, 2009), in fact, it covers a wide range of dimensions and aims "... to restore psychosocial concerns to a central place in medical encounters, involve patients more fully in medical decision-making, and support continuity in the doctor-patient relationship" (Bromley, 2012; p.1058).

As Hospitals are being one of the important components of the healthcare system, the attention on their architectural and spatial designs has also increased. Hareide et al. (2016), define hospital as an exterior shell in which the optimal conditions are created for effective delivery of healthcare services. However, it is also discussed in the literature that hospital environment itself has an impact on patients’ well-being and recovery process, and therefore, new concepts like therapeutic environments, healing spaces/environments, supportive design and hospitality healthscapes have
been emerged (Ulrich, 2001; Day et al. 2000; Schweitzer et al. 2004; Mourshed & Zhao, 2012; Wood et al., 2015; Iyendo et al., 2016; Suess & Mody, 2017).

On the other hand, it is argued that hospital environments are traditionally designed in a way to maximize functionality and workflow with an attention on the needs of healthcare professionals (Dinis et al., 2013). In many cases, hospitals are poor at meeting the needs and expectations of patients and their emotional requirements (Ulrich, 1991). This could be due to the reason that the concept of patient-centeredness has not been clearly understood within the industry yet. As suggested by Berwick (2009), in today’s mindset, patient-centeredness sits between the boundaries of two contradicting views like professionalism and consumerism, although partnership needs to be the key word to provide better solutions. In this respect, patient experience could be considered as a key phenomenon, because it covers a wide range of qualities from functionality to more intangible dimensions such as emotional requirements, comfort and satisfaction (Harte et al., 2014).

This paper particularly reviews the relevant literature regarding hospital patient rooms from a patient-centred design perspective and aims to infer certain future directions in terms of environmental designs of hospitals.

2. Methodology

This paper presents the early results of a literature review study in the topic area. For this purpose ScienceDirect, Summon and Google Scholar databases are searched for relevant papers. The key words used are: “hospital design”, “patient experience”, “healthcare environment design”, “patient-centred design”, “hospital furniture design”, “patient room design”.

In total 40 papers are reviewed and, based on the information gathered, six categories are generated regarding the design of hospital patient rooms from a patient-centred design perspective: i.e. “patients and their needs”, “patient stress”, “objects”, “overall atmosphere”, “technological implications” and “design process”. Based on the findings, a number of future directions in designing hospital patient rooms are proposed to be inferred. Table 1 summarizes the papers used under these categories.

Table 1: The categories identified and references used regarding hospital patient rooms

| Categories                  | References                                                                 |
|-----------------------------|-----------------------------------------------------------------------------|
| Patients and their needs    | Ulrich, 2001; Steele et al, 2005; Waller & Masterson, 2015; Schweitzer et al., 2004; Devlin et al. 2015; Douglas & Douglas, 2005; Berwick, 2009; Verschoren et al; 2005; Davidson et al, 2007; Mourshed & Zhao, 2012; Gezer, 2014. |
| Patient Stress             | Black, 2015; Schweitzer et al., 2004; Iyendo et al, 2016; Ulrich, 1991; Ulrich, 2008; Harte et al., 2014; Harris et al., 2002; Devlin et al., 2015; Bromley, 2012; Foque & Lammineur, 1995. |
| Objects                    | Suess and Mody, 2017; Waller & Masterson, 2015; Iyendo et al, 2016; Beukeboom et al., 2012; Malone & Dellinger, 2011; Xie H. & Kang J., 2012; Mourshed & Zhao, 2012. |
| Overall Atmosphere         | Stidsen et al., 2010; Hareide et al, 2016; Norman, 2005; Ulrich 2008; Suess and Mody, 2017. |
| Technological Implications | Hoffman et al., 2004; Banos et al., 2012, Saposnik et al., 2010; Stidsen et al., 2010; Dunston et al., 2007; Dinis et al., 2013; Khaddar et al., 2012; Thakur et al., 2012; Gurden & Hagood, 2012; Chen & Chang, 2013; Iyendo et al., 2016. |
3. Patients and their needs

A diverse range of users including patients, their families/visitors and professional users like nurses and doctors use hospital environments. Different users may have different expectations from a healthcare environment. In many cases, hospitals provide relief to unique conditions of patients by enabling their access to professional skills (Cottam and Leadbeater, 2004) which means that patients' requirements are utmost importance. However, as suggested by Waller and Masterson (2015), staying in a hospital environment is not always a pleasant experience due to several reasons besides having a health problem. In this respect, patient-experience has emerged as a key concept, and therefore it gets significant attention in today's healthcare delivery research (Steele et al., 2015).

When focused on patients, they are likely to vary in their demographics, levels of capabilities and cultural backgrounds, which also likely to affect their perception (Mourshed & Zhao, 2012). Different types of health-related problems might necessitate different environmental requirements; therefore, it is important to adopt a universal design strategy (Gezer, 2014). For example, the study of Waller and Masterson (2015) on patients with dementia and their needs regarding the design of hospital environments presents that these patients may have trouble due to being in an unfamiliar environment, or misinterpret shadows, dark strips and shiny floors. In addition, they are likely to be older people with impaired capabilities. As could be seen, it is critical for designers of healthcare spaces to consider vast amount of dimensions regarding patients, their capabilities and specific requirements due to their health conditions.

From a design perspective, Berwick (2009) argues that a better health system design should support individualization and customization as a design target, and recommends flexible solutions in an effort to meet individual needs. Except energy efficiency and ergonomic requirements, a well-designed space provides a greater patient/family control of the environment (Davidson et al., 2007). In addition, giving patients "an opportunity to personalize their environments by bringing comforting items from home may help patients a sense of control and familiarity" (Schweitzer et al., 2004; p. 72). Similarly, Verschoren et al. (2015) discusses how a hospital environment could be designed child-friendly, and the results of their qualitative research showed that young patients want an environment in which they can feel like being at home that could also enable them to continue their daily life; socially and spatially. They argue that rather than decorative decisions, more complex design principles such as flexibility and customizability are important during the design process.

Social support is also another important criterion for patients and needs to be considered during the design process (Ulrich, 2001; Davidson et al. 2007). It is argued that design of the physical environment influences behaviours, actions, and interactions of all users of hospitals (Schweitzer et al., 2004). Devlin et al. (2015) highlight the importance of adjustable environmental features, which enable patients to rearrange their environment in order to meet different levels of social needs. A sense of personal space, usability, accessibility, controllability and effective communication between all the users of the environment are other important factors to be taken into consideration during the design process (Douglas & Douglas, 2005).
4. Patient stress

Physical design of the hospital environment has a direct influence on patient stress, and good designs may promote healing (Black, 2015; Schweitzer et al., 2004; Iyendo et al, 2016). From a design perspective, it is suggested that appropriate aesthetic decisions could help patients to cope with the frightening reality of their illnesses (Bromley, 2012), because "people experience space and space influences them in its turn. Specialized medical care buildings are no exception to this statement" (Foque & Lammineur, 1995; p. 47).

Ulrich (1991), identifies three criteria to decrease stress by providing supportive designs for the healthcare environments. These are provision of (1) a sense of control with respect to physical-social surroundings, (2) access to social support, and (3) access to positive distractions in physical surroundings. As suggested by Harte et al. (2014) it is important to stimulate positive feelings since negative experiences might result in frustration, disability or stigmatisation of users of the system. Significance of positive distractions on patient wellness, such as having a window, a view of nature and other furniture/elements (such as controllable TV or music) are widely discussed in the literature (Ulrich 1994; Ulrich, 2008; Devlin et al., 2005). Ulrich (2008) and Iyendo (2016) also emphasize privacy as another important criterion in their papers.

On the other hand, Harris et al. (2002), argues that although many of the available research in the relevant literature focus on stress; patient satisfaction with healthcare environment is also another aspect to look at. In their paper Harris et al. (2002) describes four physical comfort categories for designing hospitals, i.e., (1) ambient features, (2) architectural features, (3) interior design features and (4) maintenance/housekeeping. They also highlight the importance of providing a home-like environment. As could be seen, these categories cover the complete atmospheric features as an entirety; therefore, overall atmosphere should be considered as a whole and a part of patient experience (Devlin et al., 2015).

5. Objects

Interior design features play an important role in the satisfaction of patients regarding the healthcare environment that they require to stay and experience (Suess and Mody, 2017). Small design decisions can dramatically increase the quality of stay of patients and enable them to continue their certain daily activities. For example, creating resting points in the corridors may result in improved socialization or wards providing snack trolleys are likely to improve patient nutrition (Waller & Masterson, 2015). There are also a number of studies suggesting artworks to reduce stress and support patient wellness; however, it is important to make the right choice since certain patterns are likely to negatively affect patients with cognitive problems (Ulrich 2008; Iyendo et al. 2016).

Beukeboom et al. (2012), in their study, particularly focus on hospital waiting rooms and investigated in the stress-reducing effects of aesthetic enhancements by adding real (e.g. flowers) or artificial (e.g. posters) elements of nature. Their results suggest that both real and artificial elements result in reduced psychological distress for patients while waiting for their procedure, which suggests that environmental aesthetics relieves stress.

Furniture are also an important component of a hospital room and influence both the quality of stay for patients and their carers/visitors/families, as well as, are directly linked to social support, and efficiency of workflow of hospital staff (Malone & Dellinger, 2011). Furniture is also an important element of interior design and directly affects the overall atmosphere of the room. Furniture choices inside a patient room even have an essential role in creating an acoustic comfort to the patients.
based on the material used (Xie & Kang, 2012), and as emphasized by Mourshed & Zhao (2012), noise level is a critical design problem for such environments. Regarding furniture designs, Suess and Mody (2017) suggest that it is not only the quality of the materials used in hospital furniture but also their finishes are perceived as an important attribute for patients. Moreover, their hygiene and maintenance aspects are also utmost importance to prevent possible hospital infections (Malone & Dellinger, 2011; Iyendo, 2016).

As suggested by Malone & Dellinger (2011), all the objects used inside of a hospital require evidence based design process because stress has a direct impact on patients' comfort and wellness. Regarding the design of furniture for healthcare environment, they recommend the "Evidence-Based Design Checklist" that they developed for manufacturers, which covers patient safety, psycho-social communication and work associated outcomes, environmental safety and their practicality inside the space.

### 6. Overall atmosphere

The atmosphere is a tricky concept for hospitals since it is very hard to decompose it to its subcomponents that are relevant to design concept, such as emotional design, design to affect mood, creating of ambience or lighting design (Stidsen et al., 2010). From patient perspective, a hospital building needs to be attractive and requires giving a holistic impression of good health (Hareide et al., 2016). As suggested by Norman (2004), positive emotions enable users to adopt a holistic view while interacting with a system and ignore design flaws, whereas negative emotions may result in their focus on problems. While it is important to support positive emotions of patients, at the same time, it is critical to meet functional requirements and reduce the risks concerning patient safety, such as hospital-acquired infections, patient falls or other issues causing patient discomfort like privacy issues or sleep problems due to environmental noise (Ulrich 2008). From staff perspective, the design decisions regarding the overall atmosphere should contribute in reducing medical errors, staff injuries and stress, as well as increase their work effectiveness and satisfaction (Ulrich 2008).

Lighting is another important component of the overall atmosphere, which should support the changing needs of different types of users in a hospital environment. In this respect, Stidsen et al. (2010) identify four important parameters for 'pleasurable light' in hospital environments; i.e. users (patients and staff), light source (daylight or artificial light), space (including all the objects inside) and time (morning, evening or seasons). These parameters highlight the importance of the adaptability of lighting in accordance with the changing needs of a diverse range of users in time and space.
On the other hand, Suess and Mody (2017) investigate the overall atmosphere from a commercialist perspective and examine the influence of hotel-like attributes in a hospital room and from patient-centred perspective. For this purpose, they conducted a survey of 406 respondents and examined hotel-like attributes and their effect on patient experience. As the result of their research, Suess and Mody (2017) came up with a scenario for maximum utility, which is shown in Figure 1. As could also be seen from the Figure, rather than individual elements, patients recognize and experience the overall atmosphere of a hospital room in its entirety including both product and service related attributes.

7. Technological implications

7.1 Virtual reality

Using of virtual reality (VR) technology is not a new approach in the healthcare domain. This technology provides a computer-generated/virtual environment, which is completely independent from the real world and fakes our sensations of presence. For example, Hoffman et al. (2004), in their paper, argue that this technology could be used to reduce severe burn pain on patients and provide an alternative pain control strategy instead of medication during painful wound care sessions. For this purpose, water friendly VR helmets are developed and used, because the procedure needs to be carried out in sterile hydro tanks. The VR system that they used takes patients into a snow world in which they can virtually throw snowballs to different characters. The patient ratings showed that, in fact, the virtual environment helped them control burn pain during the painful procedure. Similarly Banos et al. (2012) use VR technology on hospitalized patients with advanced stages of cancer and enable them to visit virtual environments such as walking through nature. Their results suggest that such technologies promote positive moods of inpatients.

On the other hand, Saposnik et al. (2010), in their paper, investigate using of Wii Gaming Technology in stroke rehabilitation, in which they screened 22 patients in two groups; i.e., 11 receiving virtual reality therapy and 11 receiving recreational therapy. Their results suggest that virtual therapy
proves to be a safe and feasible alternative to traditional stroke rehabilitation and result in improved motor functions of patients. Therefore, it could be said that for clinical settings, VR technologies have the potential for providing low cost solutions towards providing positive distractions for patient.

7.2 3D Simulation technologies

3D simulation tools enable designers to examine and verify their design ideas before production. Such tools are also used in design research on healthcare environments. For example, Stidsen et al. (2010) use 3D simulations in their study to understand the influence of lighting on patients in their private space, active space and public space. Similarly, Dunston et al. (2007) use virtual reality mock-ups for design review, which allow an interactive assessment of patient-centred design ideas of a hospital ward including the 3D representations of objects inside and simulate ambience settings. They argue that VR mock-ups provide a cost effective and informative solution to assess design ideas and could be used instead of real mock-ups. On the other hand, Dinis et al. (2013), use VR technology from a different aspect and focus, in particular, on the emotional responses of participants to different interior design elements in a hospital room. They argue that, the results were comparable with responses in a real-world design assessment setting.

7.3 Information technologies

Advances in information technology and databases has important implications in the innovative healthcare services, and likely to bring better communication opportunities between doctors, patients and other staff, and improve internal awareness within the system (Thakur et al., 2012). Telemedicine solutions are also a part of this trend and, in this respect, advancements in wireless technologies are likely enhance patients’ quality of life and support their freedom. Such technologies should be considered as a part of intelligent environments and therefore environmental challenges such as electromagnetic interference or interference of multiple wireless technologies should be taken into account during the design process of hospital environments (Khaddar et al., 2012).

7.4 Intelligent environment

The concept of ‘intelligent environment’, which is also known as ‘intelligent assistive environment’, refers to a technological infrastructure, which consists of a series of sensors that is integrated into different parts of the environment (such as bed, floor, toilet or other equipment) and provide critical information related to patient management and safety to the hospital staff in real time (Black, 2015). Such technologies improve medical management, provide caregivers with real time information about the patients, deliver safer care and reduce workload of hospital staff (Gurden & Hagood, 2012; Chen & Chang, 2013).

7.5 Personalized atmosphere

As mentioned before, the feeling of control is an important quality for patients and contributes to emotional comfort, which promotes therapeutic process of inpatients (Iyendo et al., 2016). Inside a hospital room there are many variables that could be controllable by patients, such as privacy, music, lighting, air conditioning, heating and so on. Regarding the atmosphere, lighting is of vital importance in order to create a pleasant ambience (Iyendo et al, 2016) and is controllable in different parameters such as its colour temperature or intensity, and these could provide personalization of atmosphere for different circumstances (Stidsen et al., 2010) and increase both patient experience and staff satisfaction.
8. Design process

Designing healthcare spaces is a complex task due to the variety of users, their diverse needs and other parameters that influence efficiency and safety of patient care (Price & Lu, 2013). A well-designed hospital environment may contribute to better patient safety, patient outcomes and staff outcomes (Ulrich et al, 2008).

From a broad perspective, Cottam and Leadbeater (2004) states that co-creation will be a central quality for future public healthcare services. It is a fact that a participatory strategy is necessary in the design process in an effort to shed light on complex needs and wants, although the problem of communication between parties is common due to different languages they have (Foque & Lammineur, 1995). Evans (2015) argues that there is a need of the medical practitioners to influence design of the built environment since design decisions directly affect the ability to carry out the work inside and patient satisfaction as well. Similarly, Reay et al. (2015, 2016) recommend user-centred design as a fundamental strategy to provide successful environmental solutions for the healthcare sector, which involve collaboration with patients, their carers and staff in an interdisciplinary design process in order to focus on real needs of real users. In their study, they used a physical space inside a real hospital context to generate design solutions and allow prototyping activity within its own ecosystem, which enabled receiving new ideas and direct insights from the stakeholders and hospital staff. They used the metaphor of ‘Trojan Horse’ for their approach since designers infiltrate into the hospital and perform the changes internally. There are also other papers (Ulrich, 2001; Payne et al. 2015; Waller & Masterson, 2015) recommending a participatory design strategies in order to provide better healthcare environments.

On the other hand, Price & Lu (2013), in their paper, discusses the impact of standardization on healthcare environments and argue that standardization of clinical areas may promote safety and efficiency and reduce possible medical errors due to reducing reliance on short-term memory. The standardization covers the entire area including same room size, shape, layout, equipment, furniture and their location, however, their flexibility and adaptability is also mentioned as necessary to meet changing needs of different users of hospitals. Price & Lu (2013) also recommend involving users in order to take the correct decisions in the design process.

9. Future directions

The relevant literature suggests that hospital environment and their interior designs affect patient wellness and dignity, where stress reducing environments support patient wellbeing and recovering process. There are also researches available in the literature regarding the importance of inclusive design, furniture and colour choices for different patient types and possible standardization of hospital spatial designs; however, very limited papers focus on the future design directions and methods in relation to enhancing patient experience. It has also been identified that a number of technological implications have potentials to influence future of hospital spatial designs. However, as suggested by Gurden & Hagood (2012), although technology have made undeniable improvements in hospital environments regarding patient safety and facilitated work for the hospital staff, it could also likely to bring new types of problems if it is insufficiently implemented to the healthcare system. For this reason a participatory design approach should be taken as a core strategy in design process, and allow real users’ participation and contribution. Figure 2 summarizes the interrelation of the categories identified and discussed in this paper.
A Review on Future Directions in Hospital Spatial Designs with a Focus on Patient Experience

As could be seen from the figure, ‘patients with their needs’ and ‘objects inside a hospital room’ are in continuous interaction within the overall atmosphere and in time. The design decisions should support patient control and facilitate workflow at an optimum level. It is critical that all these dimensions are taken as a whole system and assessed/verified in a participatory design process.

Based on the findings of this research a number of future directions in designing hospital patient rooms—with a focus on patient experience— are inferred below:

- Flexible solutions to meet individual patient needs will get more attention of designers. Patients will be more in control and healthcare professionals will provide better care by means of intelligent environmental solutions/smart rooms.
- With the help of advancements in technology, patient stress will be reduced by providing more engaging positive distractions. In addition to this, patient control and individualization features will get more attention.
- Objects used inside a patient room will not only reflect functionality for the hospital staff but also have their own aesthetics in an effort to support patients emotionally during their stay. All the objects will be a part of the overall system and communicate with each other by means of advances in information technologies and wireless systems.
- Overall atmosphere will be customizable by patients and also enable social support, facilitate workflow of hospital staff and decrease medical errors.
- More participatory design approaches will be adopted in an effort to provide patient-centred innovations in patient rooms rather than technology driven solutions.

10. Conclusions

Hospitals are mainly designed in a way to maximize functionality and work flow with an attention on the needs of healthcare professionals, however in many cases they are poor at meeting the needs and expectations of patients and their emotional requirements. Since the users of hospitals are very diverse (e.g. doctors, nurses, patients and their carers and visitors), architects and designers need to balance complex levels of hierarchical requirements in order to optimize their final designs.

This paper, which presents the result of a literature review study, particularly focuses on patient rooms’ spatial design with a focus on patient experience; and intends to infer future directions in this domain. One of the limitations of this research is that it particularly focuses on patient rooms,
although there are several other spaces inside a hospital (e.g., waiting rooms, toilets, intensive care units, operating rooms and etc.) in question. As a future research, both patients’ and hospital professionals’ considerations are proposed to be researched regarding the future directions identified in this paper, and their scope and applicability will be investigated in detail.

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A Review on Future Directions in Hospital Spatial Designs with a Focus on Patient Experience

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