


## STUDY PROTOCOL

# The built environment and its impact on health outcomes and experiences of patients, significant others and staff—A protocol for a systematic review

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## Abstract

**Aim:** This review will identify, evaluate and synthesize the literature related to evidence-based design of healthcare environments and to identify impacts of the built environment on the outcomes and experiences of patients, significant others and staff.

**Design:** A mixed-method systematic review of literature 2010–2018.

**Methods:** Database searches for evidence in peer-reviewed journals will be conducted electronically using CINAHL, Medline, SCOPUS and Web of Science. Abstract, full-text screening and data extraction will be completed independently by the reviewers. Quality assessment will follow Swedish Agency for Health Technology Assessment and Social Services Assessment.

**Results:** This review will offer knowledge for informed decisions about the design of the healthcare environment. The review is comprehensive, includes a large volume of literature various research designs and will highlight the knowledge gap in evidence-based design and provide a breadth of knowledge about the built environments and its impact on health and well-being.

## KEYWORDS

built environment, evidence-based design, health facilities, health outcomes, healthcare users, physical environment

## 1 | INTRODUCTION

Evidence-based design (EBD) has been defined as a process for using the best available evidence from research and practice to inform the design of healthcare environments, with the deliberate goal of improving outcomes (Hamilton & Watkins, 2009; Zengul & O'Connor, 2013). The purpose of applying EBD for the planning of healthcare environments is to provide possibilities to develop supportive

environments for patients' health, improve clinical results, facilitate effective work and reduce nurses' stress and account for waste of resources and sustainability issues (Stichler & Hamilton, 2008; Ulrich, Berry, Quan, & Parish, 2010; Ulrich et al., 2008). Similar to evidence-based medicine (EBM), which is used to support decisions and intervention in the medical field, EBD for healthcare environments is increasingly important to enhance design decisions for a planned environment. EBD should support decision-making across

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all phases of the process to develop new healthcare environments from planning to designing and construction (Elf, Fröst, Lindahl, & Wijk, 2015). Systematic reviews are required to contribute to evidence in all areas, including healthcare environments (Pati & Lorusso, 2018).

Healthcare environments are complex and dynamic settings where technologies, organizational systems and various users such as patients, significant others and staff are constantly interacting with one another. Such interaction is dynamic in the sense that care and technologies, as well as patients' needs, are not stable over time but subject to changes, which places great pressure on the way the built environment is designed. Brambilla and colleagues (Brambilla, Rebecchi, & Capolongo, 2019) suggest that healthcare environments should be resilient to the continued evolution of the healthcare system; in this sense, that is, the possibility of constantly adding new knowledge about the impact of certain design solutions on health and organizational outcomes, EBD is essential.

The role that the built environment has in affecting health-related outcomes has been recognized since the second half of the nineteenth century, when the environmental theory proposed by Nightingale, was developed (Medeiros, Enders, & Lira, 2015). Nightingale observed that specific design elements, such as good ventilation, cleanliness, light and noise, were crucial for health outcomes. Nightingale also emphasized the importance of always considering the individual in the interaction with the environment to design environments that support the best possible conditions for healing to occur. This view corresponds with today's person-centred approaches for healthcare service (Ekman, Hedman, Swedberg, & Wallengren, 2015; Olsson, Jakobsson, Ung, Swedberg, & Ekman, 2013).

There is increased awareness that the built environment is of crucial importance to the quality of care and can affect several important health results. This has created an exponential growth of research studies from several research areas (Brambilla et al., 2019).

The latest comprehensive systematic review conducted on EBD (Ulrich et al., 2008) is from 2008, and the results predominantly stress evidence related to hospital design that reduced the frequency of acquired infections. This design includes implementation of single-bed rooms, effective air quality control, the placement of alcohol-based hand-run dispensers, clean surfaces and floors and proper water system design to minimize water stagnation.

The present work seeks to undertake a new review and build on Ulrich's work from 2008. The framework for the present review is the Institute of Medicine's (IOM's) dimensions of quality (Institute of Medicine, 2001; SOU, 2006). The challenge of ensuring quality of health care remains high on the public and political agenda internationally (Nergårdh et al., 2018; Fratiglioni, Marengoni, Meinow, & Karp, 2010; Stiernstedt, 2016). We also based the review on important concepts such as person-centred and shared decision-making, as the quality perceived by the patient is significant today. Patient expectations and experiences of care have been an important

outcome of care (Ekman et al., 2015; Elf et al., 2017). Recipients of healthcare services are more likely to expect quality from many perspectives, driven by their changing needs. For example, an acutely unwell patient may rate the dimension of effectiveness highly, but during rehabilitation, they may rate person-centeredness as the most important dimension of healthcare quality. The IOM's overall quality goals are summarized in the concept of good care, where the environment is seen as an important part of achieving good care (Institute of Medicine, 2001; The National Board of Health and Welfare, & Socialstyrelsen, 2007). However, little is still known about what aspects of the built environment can contribute to good care outcomes.

This work aims to reduce such knowledge gaps and it is part of a larger research project where an update of the latest EBD reports and a detailed description of the current finding of EBD and its contribution to the field of healthcare environments are developed. The focus of this paper is, however, exclusively on the overview of the material found and a descriptive evaluation of it expressed in terms of healthcare areas investigated, target groups involved, types of research design and methodology, built environment interventions and IOM goals addressed.

## 1.1 | Aim

The aim of this systematic review is to identify, evaluate and synthesize the existing literature related to evidence-based design (EBD) of healthcare environments and to identify the reported impacts of the built environment on the outcomes and experiences of patients, significant others and staff.

Overarching research questions:

- What types of outcomes have been investigated in relation to the built environment in hospital settings?
- In what settings have the studies been performed?
- What are the impacts of the built environment on the outcomes and experiences of patient's health and their significant others and staff?
- What aspects of the built environment have been studied?
- What aspects of the built environment have shown to have an impact on outcomes and experiences of patient's health and their significant others and staff?
- What research designs and research methods are used to investigate the impact of the built environment on outcomes and experiences of patients, their significant others and staff?

## 1.2 | Review design and search method

A systematic literature review about EBD for healthcare environments will be performed according to the method proposed by The Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) (SBU, 2019) and the Preferred Reporting

Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2015).

### 1.3 | Search strategy and data screening

The adaptation of the patient, intervention, comparison and outcomes strategy will be adapted from the (PICO) technique (services). The following criteria for PICO will be used as a support for the literature search and relevance review:

- Population (P): persons (adults and children) with health conditions treated at healthcare environments, as well as significant others and staff.
- Interventions (I): all studies that analysed the impact of the built environment of healthcare environments on their users (i.e. patients, significant others, staff) (studies that can relate outcomes to specific aspects of the built environment).
- Control intervention (C): not applicable or all kind of studies, such as cross-sectional, RCT and descriptive.
- Outcomes (O): quantitative and qualitative measures that reflect the built environment and its association to IOMs six domains of healthcare quality: safe, effective, patient-centred, timely, efficient, equitable.

The exclusions criteria will be: reviews, articles about the design process, studies in nursing homes, simulation studies, environmental measurements without human's response, instrumental development (validation), cost-effectiveness studies. A Boolean search strategy, developed with the support of the university library at Chalmers University of Technology, will be adopted (Table 1).

The electronic search will be performed by two authors. Furthermore, a free search will be performed based on the references found and the expertise among the researchers involved during the same timeframe.

All articles that study the influence of the built environment in healthcare settings on their users (i.e. patients, staff and visitors), are written in English and published in peer-reviewed scientific journals between 2010 and 2018 will be eligible for inclusion.

The screening process will comprise the following steps:

- Selection for inclusion will be performed based on the title and abstract and will be performed by two authors; all duplicates will be eliminated at this stage.
- Abstracts will be screened to determine relevance of the topic by all four authors and a three-grade system will be adopted where each author independently evaluates the eligibility of the material as either retained, excluded or uncertain. Uncertain material will be solved by means of discussion among the authors (i.e. cross-checking technique per uncertain abstract).
- Full texts of relevant papers will be retrieved.
- Each full text will independently be evaluated by the authors.

The search will be performed in the following data bases: PubMed, Cochrane Library, CINAHL, Web of Science and Scopus, for material published between the years 2010 and 2018. A flow chart will be used and reported. The literature search will end in 2019.

### 1.4 | Qualitative appraisal

A quality appraisal of the included papers will be completed and will be reported. The guidelines followed to estimate the quality of the material included will be those of the "GRADE" system, provided by SBU, which focuses on person-centred perspectives (i.e. patients' benefits and risks) (services). The authors will independently assess the quality of the material retained by means of the guidelines suggested by the SBU (services). Different protocols developed from the "GRADE" system used in medical science, which implies different grids of evaluations depending on the study design (e.g. randomized control trial,

**TABLE 1** Boolean search strategy

AND		
Architecture	Patient(s)	Healthcare setting(s)
OR		
Architectural design	Client(s)	Healthcare facility(ies)
Building design	Consumer(s)	Healthcare space(s)
Environment design	Family	Healthcare building(s)
Physical environment	Relatives	Health facility(ies)
Built environment	Visitor(s)	Hospital(s)
Health facility environment	Caregiver(s)	Healthcare service(s)
Evidence-based facility design	Health personnel	Ward(s)
Evidence-based design	Staff	Care unit(s)
Environmental design	Nurse(s)	
Hospital construction	Physician(s)	
Hospital design and construction		
Facility design		

qualitative studies and systematic review), will be used to assess the quality of the paper retained. The degree of evidence will be based on the reliability, consistency and transferability of the data collected. In the case of disagreement, the researchers will discuss their assessments and pursue further evaluation until an agreement is achieved.

## 1.5 | Data extraction and synthesis

A mixed-studies review approach will be performed (Caruth, 2013), combining quantitative and qualitative analysis. Descriptive statistics will be used to identify the frequency of appearance of the different healthcare outcomes, to establish which domains are explored and which are overlooked. Furthermore, the data synthesis will determine what target groups are investigated, what aspects of the built environment, where hospital area they are located and what type of research design and methodology is used. A qualitative content analysis as appropriate to the type of data retrieved (Assarroudi et al., 2018).

For this data extraction and synthesis analysis, an overarching template (extraction sheet) will be created where the co-authors report the information for each full paper included in this study. We developed a data extraction sheet, based on the Cochrane Consumers and Communication Review Group's data extraction template (group). Disagreements will be resolved by discussion between the review authors. The template will be saved on google drive.

## 2 | DISCUSSION

The EBD area is growing; however, the last comprehensive review used by architects, planners, healthcare staff and policymakers was performed in 2008. Overall, the present work will hopefully confirm the growing body of studies in the area of EBD in health care. However, our hypothesis is that the study will reveal that up until now, certain IOM goals are more studied than others. For example, greater evidence will probably be available concerning the topic of safety. On the other hand, how the environment can support the IOM goals that account for a more active view of the person receiving care, such as that of participation and self-support, will probably be less investigated.

Most of the EBD outcomes until now appear to stress the importance of integrating the users' experience of the environment into the evaluation of healthcare environment quality. Thus, rather than report medical and physiological responses such as heart rate, blood pressure and infections, more commonly, the focus appears to be to report the psychosocial experience of place (i.e. overall impression, beliefs, attitudes, perceived quality of care and social support).

## 3 | ETHICS AND DISSEMINATION

This study does not require ethical approval since it is a review of published papers. The results of this review will be published in a

relevant, open access journal about evidence-based design. The elaboration of the study will map the gaps in the area of EBD in health care. This research will be important for several audiences, including researchers, health professionals, architects and planners. The findings of this review will also be useful for health organizations, universities and architecture firms. The results will also be presented at events and conferences in the area of EBD in health care.

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## CONFLICT OF INTEREST

None declared.

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