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The design and decisions when developing a special birthing room, as part of a hospital building project, at Sahlgrenska University Hospital, Sweden

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Abstract: The physical environment can have an impact on women's birth experiences and is suggested to also affect health care staff. As part of a new hospital building project a specially designed birthing room was built at a hospital in Sweden. The, so-called, *test room* was built and furnished with physical features designed to be more adaptable to women's personal wishes and needs during labour and birth. This paper presents the design and decisions made concerning the test room and how the birth environment have been assessed by women giving birth in the room. The objective of the paper is to share experiences from a hospital building project where a test room was built in the planning phase and studies made in an interdisciplinary research project, Room4Birth (R4B), that follows the test room and the hospital building project. And as an effect of this argue for the need for active testing of healthcare physical environments. Furthermore, the paper aim to contribute to knowledge, development and planning of birthing rooms and labour wards.

Keywords: birthing; healthcare environment; healthcare design; labour ward; evidence-based design

1. Introduction

There is limited knowledge on how the physical design of birthing rooms affects labour, birth and childbirth experiences among women. Further, there is also lack of knowledge of how the hospital environment impact healthcare staff, as a work environment.

In the planning phase of a new hospital building for maternity and neonatal care at a University Hospital in Sweden the need for test environments emerged and was realized at one of the labour wards. This was the driver for the initiation of the interdisciplinary research project Room4Birth (R4B) that intends to increase knowledge about how the physical design of the birthing room influence the maternal and neonatal outcome. The main focus of R4B is how the physical environment can contribute to a physiologically normal birthing process for both mother and child, and to an overall positive childbirth experience. Such knowledge is valuable both when existing birthing rooms are being refurbished and new ones being built (Berg et al., 2019). This paper describes the project concerning the design and decisions made when the specially designed birthing room was built in a labour ward, at Sahlgrenska University Hospital, Sweden.

2. Framework, where do we start

The design of healthcare environments affects its occupants both physically and physiologically. It also contributes to improvements in quality of life (Ulrich et al., 2008) by supporting integrity, control, and a perception of being well taken care of (Fridell, 1998). Research within the area of health care environment is under expansive development both on national and international basis (Nordin et al., 2017).

2.1 Aspects of healthcare environments on staff

The design of healthcare environments can have effects on the healthcare quality, safety, and satisfaction of staff (Sadler et al., 2011) both with regard to physical, psychological as well as social aspects (Ruohomäki et al., 2015). Midwives are affected by their work environment as well, and poorly designed environments can lead to stress and subsequent negative effects (Symon et al., 2008). Medical led labour wards are experienced to have too much focus on the clinical design with insufficient space which can be hampering the midwives work ability (Hammond et al., 2014). On the other hand, midwives working in labour wards, with a design approach and intention of providing a homely and comfortable birth environment express how it can affect their state of mind as well as their way of working in what they consider a more positive direction (McCourt et al., 2016).

2.2 Framework concerning birthing

To give birth is a crucial and meaningful event in women's life (Parrat, 2002; Simkin, 1991) in which the physical environment plays an important role (Fahy et al., 2006) and can affect the experience of giving birth (Carlsson, et al., 2020; Nielsen et al., 2020; Nilsson et al., 2020; Setola et al., 2019). There is a global interest in improving the

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quality of maternity care (Oladapo et al., 2018; WHO, 2017; WHO, 2022). The recommendations are not only restricted to maintaining the health of woman and child but also for women to have a positive childbirth experience in clinically and psychologically safe environments, support from a birth companion and technically competent clinical staff (WHO, 2017).

In Sweden, approximately 115 000 children are born every year (The National Board of Health and Welfare, 2021). Maternity care in Sweden is state-funded, and almost all women give birth in hospitals (Lindgren et al., 2014) where a traditional birthing room, characterized by an emergency hospital design is standard. This can evoke emotions of danger and abnormality among birthing women (Carlsson et al., 2020). An unfamiliar and stressful environment that emphasizes high-tech and focus on emergency can increase stress and decrease endogenous release of oxytocin (Uvnäs-Moberg et al., 2014). Oxytocin is a crucial hormone during labour and birth, and beneficial because of its positive effects, e.g., enhanced well-being and contractions, decreased levels of stress, less anxiety, fear and pain (Uvnäs-Moberg et al., 2019). By lessening the visual intrusion of medical and technical equipment, the mixed messages between either giving birth as a natural event or a high-tech incident can be avoided (Harte et al., 2016).

Thus, the environment in which birth takes place is important for women's childbirth experience and a birthing room perceived as safe, secure, and private can contribute to the natural progress of birth and decrease risks for adverse events (Buckley, 2015). Positive distraction in health care environments can also decrease stress and anxiety, and support recovery (Sadler et al., 2011). If women have a sense of control and better endure giving birth they may probably have a better experience than expected (Nilsson et al., 2020). Features of familiarity in the birth environment have been associated with shorter length of labour and decreased intensity of labour pain (Nilsson et al., 2020). Other factors suggested to affect the childbirth experience in a positive direction, is to have a trustful relation with the midwife (Eri et al., 2020; Karlström et al., 2015) and continuous presence of a supportive companion who encourage the woman to maintained self-confidence and control (Bohren et al., 2019). Also to be able to take part in decisions is important (Gibbins et al., 2001; Henriksen et al., 2017). In contrast, a negative birth experience can contribute to post-partum depressions (Gottvall et al., 2002) or fear of giving birth (Bell et al., 2016; Nilsson et al., 2020). A more complete understanding of the relationship between physical design features and support of the birthing process is therefore desirable (Setola et al., 2019). Implementation of test environments and research in hospital building processes is yet sparse.

The objective of this paper is to share experiences from a hospital building project and the development and design of a test room and studies made in the interdisciplinary research project Room4Birth (R4B). And as an effect of this argue for the need for active testing of healthcare physical environments. Furthermore, the study aims to contribute to knowledge, development and planning of birthing rooms and labour wards.

3. Method

This descriptive paper is based on documents, written summaries from workshop with different stakeholders, reports and pre studies from a new hospital building project at Sahlgrenska University Hospital in Sweden, which is planned to be completed in 2028. Data also includes interviews with stakeholders engaged in the planning and

design phase of the test room, which is part of the hospital building project. Further, the paper is part of, and based on several studies, in the interdisciplinary research project Room4Birth (R4B), and in particular the mixed methods study by Skogström et al. (2022) investigating women's experiences of physical features in the birth environment.

4. Result: Design and decisions in a hospital building project regarding a test room

It all started during the planning and design phase of a new hospital building project, where the possibility of having a test room was discussed and made reality at a current maternity ward. Thereafter an interdisciplinary research project was initiated and included in the new hospital building project, with the aim to contribute to knowledge in the actual project as well as to design of future birth environments. These parts, all together, forms the results in this paper.

4.1 A hospital building project and development of a test room

The hospital building project was initiated already in 2010, with the aim to expand and refurbish the existing building for maternity and neonatal care at the Sahlgrenska University Hospital, situated in Gothenburg in the western part of Sweden (Västra Götalandsregionen, 2012). Due to extensive renovation costs, the plans were changed to developing and planning for a new building for maternity and neonatal care (Västra Götalandsregionen, 2013; The Sahlgrenska University Hospital and Västfastigheter, 2018).

Several development projects, feasibility studies and reports, as well as workshops with newly become parents, user associations and staff were performed to address as many needs and wishes as possible. The vision in the planning phase was to focus on the health care environment in the new hospital building to be supportive for both patients, companions and staff (The Sahlgrenska University Hospital & Västfastigheter, 2018). In addition, representatives from the hospital's real estate and facility department were included in the development of the new facilities. Several visits to other hospitals, for inspiration, were also performed. In the early planning phase temporary test rooms were built up and furnished, but were not perceived as realistic and could not be tested and evaluated in authentic situations with patients and health care staff. In the process, requests emerged for test rooms for both maternity and neonatal care units, primarily to have the opportunity to test the new rooms and evaluate, and possibly make improvements, prior to final design and construction. There were no possibilities in the process to do this for the neonatal care, but on the maternity side a test room was realized in the current maternity ward building, in 2018 (Skogström et al., forthcoming). Construction of the new building is planned to start in 2023 and is expected to be completed in 2028 (Västfastigheter, 2022). The test room has been part of the development and preparation for the new building for several years, encompassing birthing and maternity care from the hospital side (Skogström et al., forthcoming).

4.2 The design of the test room

The test room (Picture 2, below) was, in addition to general building regulations, designed partly based on spatial physical aspects for which evidence has been identified

(Nilsson et al., 2020) and partly based on aspects identified in other projects and in labour care (Berg et al., 2019). Furthermore, the design was inspired by a similar birthing room project at a labour ward in Denmark (Lorentzen et al., 2019).

The test room and the regular rooms (Picture 1) are designed based on the same medical safety considerations and the care is conducted similarly. The test room has the same medical-technical equipment as the other rooms, but most of it is hidden behind wooden panels.

The test room is sized 23,8m², with a small entrance hall of 3m². When the light wood-like door opens, there is a hall with a mirror and a hanger for clothes and a door to a private bathroom with toilet and shower, directly to the left. The entrance hall contributes to lower noise from the corridor and that sound from inside the birthing room is not as noticeable in the corridor and that sound from inside the birthing room is not as noticeable in the corridor as from a regular room. Between the entrance hall and the birthing room is a drapery that shields the birthing room from the corridor, with the intention of maintaining privacy and integrity for the woman and her companions. The test room is decorated with green colors and decorated with green textiles. It is equipped with a sound installation enabling selection of different accompanying sound. (Berg et al., 2019).



Picture 1. A regular birthing room in the current labour ward with visible equipment. The standard rooms have no entrance hall, the door faces directly into the corridor.



Picture 2. The test room in the current labour ward, with medico technical equipment hidden and a more homey design.

Of all design features differing from the regular birthing rooms, the following nine prominent features were selected to be ranked from 1 to 9 by the women being cared for in the test room and who were also the participants in some of the studies in the R4B project:

1. **Curtain** between entrance hall and birthing room prevents visible contact when the door to the room opens onto the corridor in the ward.
2. **Full-length sofa** with cushions is a place for the woman giving birth and the partner to be together and a space for the partner to sit or lie down to rest. The sofa can be turned into a simpler bed. Hygiene – wipeable with disinfection possible as the material can withstand it. All textiles are removable and washable.
3. **Adjustable chair** for birth companion, moveable on wheels in the room. The birth companion is given the opportunity to sit comfortably in connection with supporting the woman giving birth in different positions or e.g., for massage or next to the bathtub.
4. **Bathtub** that can be moved in the room. It provides the opportunity for different positions both sitting, lying down and hanging with the arms over the edge or squatting. The hot bath is used for pain relief purposes and for childbirth if desired. The bathtub is also height-adjustable, which facilitates the staff's work environment and comfort.
5. **Lighting, general in the room**, with a panel for the birthing women and companions to create an environment according to their wishes. There are also spotlights for staff in need of better work light.
6. **Lighting, dimmable**, adjustable light points around the room that can create an environment according to the wishes of the birthing women and companions.
7. **Projection on two walls**, covering the window, in the birthing room with its own touch screen to choose from a number of nature films with different environments, landscapes and seasons with associated nature sounds or calm music where sound volume can be adjusted.

8. **Wooden panels** covering the medico technical equipment, easily accessible when needed though. Birthing bed with a bedspread that gives a more familiar/homely look in the room.
9. **Birth support rope**, hangs down from the ceiling and can be used as support in upright positions.

4.3 The interdisciplinary research project, Room4Birth (R4B)

Thus, the test room was initially built for the development of the design of the forthcoming hospital building, but as the planning proceeded the Room4Birth research project (R4B) was established. A collaboration between the planning group of the forthcoming hospital building and the research group was initiated. This contributed to the test room being further developed, for example, it was equipped with more homelike furniture, the birthing bed was placed along a wall with a bedspread and the chair for companion was replaced with one designed to support the partner's active participation. In addition, a well visible birthing ball and a birth support rope from the ceiling was installed (Berg et al., 2019).

The hypothesis for the entire R4B project is that a birthing room designed with increased opportunities for personal adaptation can promote and enable a positive impact on the birth process and outcome by reducing stress and increasing the release of the body's own oxytocin. This may lead to reduced need of medical interventions, an increased proportion of positive birth experiences and smaller proportion of fear of childbirth, and a reduction in negative effects on mother and child (Berg et al., 2019).

Among the studies in the R4B project, were a systematic review by Nilsson et al. (2020) investigating the effects of the design of birth environments on maternal and neonatal outcomes that later contributed to certain updates in the test room. An ethnographic observation study by Goldkuhl et al., (2021) investigated the meaning of the birth environment and how it influence birthing women, who were either giving birth in a standard room or the test room and the results identified that birth environments consists of the physical space, human interactions and the institutional context within it. The atmosphere in the labour room was emphasized by the institutional authority and this applied regardless of what birthing room the women were giving birth in. An imbalance between the institution's requirements and the needs of the women giving birth could be identified, which highlights that birth philosophy plays an important role in creating a safe birth environment.

An interview study by Andrén et al. (2021) aimed to explore midwives' experiences of how the birthing room affects them in their work to promote a normal physiological birth. The study highlights difficulties for the midwives to offer birthing women a place to feel safe, supportive and private since hospital based birthing environments mirrors a care approach both being public and pathogenic-oriented.

A Randomized Controlled Trial (RCT) by Goldkuhl et al. (2022a) comprises women from 18 years of age in full term pregnancy with a single fetus, arriving to the labour ward in active labour and who understand either Swedish, English, Arabic or Somali. The aim was to compare effects of giving birth in regular birthing rooms, so called standard rooms, (picture 1) and the test room (picture 2). The RCT had to terminate earlier than planned due to the covid-pandemic. The result showed no differences in the primary outcomes in terms of e.g. bleeding beneath 1 liter, oxytocin infusion or a positive

experience between the regular birthing rooms (control group) and test room (intervention group). Although, secondary outcomes show less use of epidural analgesia and a more positive experience in a long-term perspective among birthing women in the intervention group and they also assessed that the test room contributed to enhanced feelings of control, safety and integrity. However, even if women did not have a better experience in the test room two hours after giving birth in the test room, in a follow-up study, it emerges that the women had better experiences three and 12 months post partum (Goldkuhl, et al, 2022b).

The intervention group in the RCT (Goldkuhl, et al. 2022a) constituted all participants in the Mixed Methods study by Skogström et al., (2022) making the studies partly linked. The Mixed Methods Study consisted of a quantitative questionnaire two hours post partum, where women who gave birth in the test room assessed the importance of the physical environment and ranked nine prominent physical features where the first was the most important. The test room was different from a traditional hospital birthing room, in which the women had been examined when arriving to the hospital. There after semi-structured interviews one to two years post partum was conducted with a smaller group of the participants. It evaluated how birthing women experienced the physical features in the test room and the result from that study shows that the birthing room was experienced as positive and exceeded the women's expectations. It created a welcoming feeling and the women felt strengthened by the design, which shifted the focus to a more positive emotional state. The variety of physical features and the fact that the room had comfortable space for companions was appreciated.

Of the nine listed physical features above, the bathtub was ranked most important, followed by the projection of nature scenery with sound, and the dimmable lighting. However, it must be noted that the whole room as a concept was more important than physical features one-by-one. And the entire birthing room environment was as a supportive function part of the conclusion. Further there were suggestions for improvement regarding, for example, access to a visible window, fresh air and daylight (Skogström et al. 2022). Several studies, master thesis, participation at scientific conferences and popular science publications and presentations have been conducted within the R4B project. More information about the studies is available at the homepage: <https://www.gu.se/en/research/room4birth>.

5. What did we learn from the test room and what further work should be done?

After finalizing data collection to the different sub studies in R4B, the test room is used equivalent to the regular birthing rooms at the maternity ward. There might be advantages for the health care staff that are now working in the test room, since they will partly be familiar with the environment when it is time to occupy the forthcoming hospital building. The birthing rooms in the new health care building, which is expected to be completed in 2028, will largely be designed as the test room but be somewhat updated after comments from different staff categories having worked in the test room as well as well as different craftsmen's input regarding safety and function (Skogström et al., forthcoming). The current hospital building for maternity and neonatal care was built in 1968 and will partly be demolished and partly be reconstructed to a minor building

(The Sahlgrenska University Hospital and Västfastigheter 2018). A, so called, evacuation building, will cover the need for care buildings during the construction period (Västfastigheter and Sahlgrenska University Hospital, 2017). More of this will further be presented in an extended CVA report by Skogström et al., forthcoming in 2023.

5.1 A comment on the test room

When childbirth occurs in medical environments, women tend to interact with the environment in a passive way (Carlsson et al., 2020). The mixed methods study by Skogström et al. (2022) showed the importance of the design of the test room, and many were the positive experiences. The birthing room designed to be more adaptable to women's wishes and needs was found to be beneficial and supportive for women's experience during labour and birth. It provided interaction with the environment, supported a shift of focus from pain to a more positive emotional state as well as maintained integrity (Skogström et al., 2022). Although framed by first time mothers, one could say, that there are numerous other situations to test. Even though this is logically sensible, it still does not diminish the meaning of the physical environment and the importance of it, also in other types of birthing situations. If context and culture is understood it is likely that several observations from studies, such as the R4B project, can be transferred to other settings (Lindahl et al., 2012).

5.2 Considerations about work environment in hospitals

In addition to the effects on birthing women it is also likely to be effects on staff and companions (Shen et al., 2004). In a situation where staff retention is a challenge, a work environment stimulating the work situation and context is one way of addressing this challenge (Sadatsafavi et al., 2014). However, the labour ward is not only the birthing room but also other areas for administration, contemplation, learning and exchange with colleagues, breaks and recuperation. A review by Setola et al. (2019) identifies several types of building spaces in maternity care that require more studies, among them the labour ward layout, the midwives' desk, social rooms, and aspects of the birthing rooms. Thus, the ward layout and other spaces are aspects to investigate further.

5.3 Need for test rooms

In times of seeking evidence for particular designs there is of course a challenge to subdivide and collate functions and design features. The endeavor of defining data and outcomes must however be done, both based on quantitative and qualitative approaches, making research to identify data that can be identified as evidence even richer and more complex – as well as challenging.

An actually used test room for actual care is an arena seldomly available and nor commonplace but has a potential to develop into a very useful approach. Such an approach opens for a discussion on how we can utilize existing facilities in an everyday approach to build knowledge on effects of design of built environment on healthcare outcomes. An approach needing hospital business objectives to also include design of its facilities as an objective.

5.4 Further work

Research that examines how the environment affects women, birth-companion and healthcare staff is yet poor, despite the fact that the majority of citizens are at some point during their lifetime at a labour ward as a birthing woman, companion, or as staff.

The need to refurbish or build new health care buildings is driven by care development, building life cycles, maintenance needs and changing requirements on operational effectiveness. Hospital building projects are complex and require extensive planning (SOU 2021:71). The buildings are also expected to meet a number of different requirements regarding economy, sustainability and flexibility and should also, ideally, be designed according to applicable evidence (CVA, 2021). Healthcare environments should also be designed to meet future demands, support safe and high-quality health care and improve the experience for patients (CVA, 2012). And, not least, the environment in hospitals should be able to meet the needs of every unique patient and their companion (Nordin et al., 2017) as well as offer a safe and stimulating workplace for healthcare workers as they spend more time at the hospital than patients (Berry et al., 2004). Strategies and processes of how to design environments for all the above requirements and stakeholders is a multidimensional and challenging research area with many gaps of knowledge, one which this paper aims to address – the design of the birthing room.

This paper points out the importance of test environments when planning and designing new hospital buildings, this to strengthen both practice and research. The data and tentative results from this project with the test room indicates that there are improvements to be made (Andrén, et al., 2021; Goldkuhl et al., 2021; Skogström et al., 2022). Although the indications clearly point to a positive experience among the mothers giving birth in the test room more tests and evaluations need to be made to further understanding of design and its implications and effects. The design process, concerning the test room, also opens for a discussion on a more interactive design development of healthcare facilities in general.

With a focus on a mix of features providing the actual outcome of a design the discussion on evidence and effects become a challenge. Dependencies and relationships need to be systematically evaluated. The design approach with an actually used and systematically evaluated test room, where practically possible one might add, is therefore an interesting way forward in healthcare design work. In addition to this, there are plans to evaluate the test room further through a digital modelling tool enabling real time visualization and testing. With a platform in a real test room supported and evaluated by modelling tool, a multidimensional and interactive planning process is possible that can be used also in other projects, an integrated physical and virtual co-design is enabled (Satei et al., 2021). The design of other birthing rooms can then benefit from modelling rooted in an actual case.

One of the drivers behind development of birth room design is a need of understanding effects of planning and design decisions on birthing rooms and maternity wards, due to lack of research specifically on these environments concerning birthing women, companions, and health care staff alike. Further, issues related to culture of birthing, structures and organizing of healthcare systems are also relevant. The Room4Birth research project, and the studies of the test room, have raised discussions on the environment where most women give birth, and most children starts life. It has proven that the design, spatial layout, functional aspects etcetera is not just a backdrop – it is real and spatial just as we are.

Contributor statement

All authors of this paper have contributed through their different professional competence, knowledge and experience and have all together formed an interdisciplinary research team. The paper is related to a report that is in press by LBS, GL, HW and AF. Furthermore, it is related to a article published in HERD, march 2022, by LBS, HW, GL and MB. A collaboration has also been initiated between GL, NS and LBS, where they have jointly contributed to this paper and its interdisciplinary content. It is hereby confirmed that all co-authors have actively participated and collaborated in joint discussions and in contributed with own and other research input to complete this paper.

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