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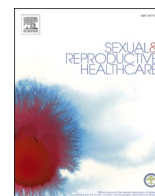
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Exploring midwives' perceptions of the multisensory birthing room work environment: A qualitative analysis

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ABSTRACT

Background: Multisensory birthing rooms are specially designed and integrate elements such as sound, light, and visual stimuli to create an immersive atmosphere.

Aim: To investigate how implementing multisensory birthing rooms affect midwives' perceptions of their working environment.

Methods: The data material consisted of 16 semi-structured interviews. The population was midwives employed before and after the implementation of multisensory birthing rooms and the setting was a labour ward unit at a Danish regional hospital. A qualitative description of the midwives' perceptions of their working environment in multisensory birthing rooms was performed and a thematic analytical approach was applied.

Findings

Four major themes were identified. 1. "Sensing the environmental transformation" in which the midwives experienced that the multisensory birthing rooms helped to create a safe and less risk-focused atmosphere. 2. "Navigating new norms" describing the espoused beliefs and values regarding new practices within the rooms in which the implementation of the rooms creates a commitment among midwives for further involvement and development of the maternity ward. 3. "A supportive atmosphere", which addresses how the multisensory birthing rooms capture different levels of affective attunement and how the calm atmosphere helps to support the work of the midwives. 4. "A sense of pride and empowerment", which addresses how the environment creates a sense of pride and empowers the midwives.

Conclusions: The physical transformation from traditional to multisensory birthing rooms has led to a cultural transformation supporting the midwives' sense of professionalism through the improved working environment.

Introduction

In recent years, the importance of the physical environment on patient care in hospitals has received increased attention. The concept *healing architecture* was first introduced in the 1980s [1–4] and refers to physical health care environments designed to promote patients' health and wellbeing [3]. Recent reviews demonstrate a positive tendency of art and design on patients' wellbeing, but robust evidence on the effects is scarce [2,5]. More studies have reported on the positive impact of healing architecture on women's birth experience or birth-related

complications. A review showed evidence of a positive impact on the women's birth experience [6], while other studies have indicated a limited effect of healing architecture on reducing birth-related complications [7,8]. Studies from other clinical areas have suggested that a friendly and homelike hospital design may also positively affect staff working environment, including stress, job satisfaction, and productivity [3,9,10]. However, other studies highlight challenges faced by healthcare professionals working in such environments [11,12], particularly related to handling emergencies.

Specific knowledge of the impact of multisensory birthing rooms on

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the working environment of midwives is scarce. This study aimed to investigate how multisensory birthing rooms affect midwives' perceptions of their working environment, *designed to integrate sensory modalities such as ambient lighting, calming nature soundscapes and videos and homely interior decoration.*

Methods

Setting

The North Denmark Regional Hospital employs approximately 35 midwives managing approximately 1,400 births annually in collaboration with obstetricians. The hospital has four identical birthing rooms of 38 m² each.

A group of artists and researchers collaborated to design multisensory birthing rooms, incorporating elements such as sound, light, and video to create an immersive environment. To explore the emotions and atmospheres central to childbirth, women were interviewed about how meaningful memories could be evoked, offering insights into both the birthing experience and broader aspects of life. The project culminated in a multisensory artwork featuring diverse scenarios filmed over 18 months in the natural landscapes of North Jutland. Midwives and other healthcare professionals were engaged throughout the process, ensuring the design supports clinical practice effectively.

Between March and May 2021, the rooms were transformed from traditional birthing rooms to multisensory birthing rooms (Table 1 and Fig. 1).

Methodology and theory

This study used Braun and Clarke's Reflexive Thematic Analysis approach [13,14], which emphasises the active role of the researcher in the knowledge production process. We chose an inductively oriented analysis that focuses on the patterned meaning and complex interaction between cultural understandings and the lived experiences and perceptions of midwives of the working environment using the theoretical lens of Schein's theory of organisational culture [15]. Edgar Schein is one of the most prominent figures in organisational psychology. Schein's overall contribution is the dynamic model of learning and group dynamics representing three cultural levels [16]:

- o *Artefacts and behaviours:* Artefacts compose objects, verbal expressions, and activities, which constitute the constructed physical and social environment.

Table 1

Description of the traditional and the multisensory birthing rooms.

Traditional birthing room	Multisensory birthing room
<p><i>Divided into four zones: entrance, toilet and a bath and birth zone divided by a ¼ hospital bed.</i></p> <p><i>In the bath zone there was e.g., bathtub, chair, table lamp, computer workstation, stainless-steel rolling table, rolling bin, and sink.</i></p> <p><i>In the birth zone, there was e.g., a birthing bed, radiant warmer, a toco cardiograph, oxygen, and lots of visible technical tubes. The walls were covered in white glazed tiles, off-white paint and one wall was painted with a matching colour to the petroleum-coloured linoleum floor. From the ceiling was e.g., a red emergency line, ventilation, a surgery lamp, and a dimmable ceiling light. The window shutters were closed, and almost no natural light to indicate time of day</i></p>	<p><i>Designed with a more home-like environment using home-like furniture, table lamps, and cabinets to hide the clinical equipment.</i></p> <p><i>An audio-visual digital art installation with content was based on circadian and seasonal local nature recordings projected onto two of the walls in the room.</i></p> <p><i>As start-up content, videos show nature scenes from the current time of day and season are clearly visualized. The videos are supported by soundscapes recorded at the corresponding nature locations and accompanied by music specifically composed with inspiration from and involving the soundscape recordings.</i></p> <p><i>The staff, the woman, and her partner can choose between the different nature sceneries, control the volume of the music, and turn it off partly or completely.</i></p>



Fig. 1. The traditional birthing room and the multisensory birthing room.

- o *Espoused beliefs and values:* Norms and rules of behaviour are less visible parts of the culture – often manifested in mission statements.
- o *Basic underlying assumptions:* A deeply embedded and unconscious level of culture determining behaviour, perception, thought, and feeling. This level composes the essence of a culture although the level is often taken for granted.

By considering all three cultural levels, we gained insights into the obvious and underlying dynamics affecting how the delivery room environment impacts midwives' perception of their working environment.

Sample

We interviewed 16 midwives complying with the following criteria: Employed (or a regular substitute) as an active midwife at Department of Women's Diseases, Pregnancy and Childbirth, North Denmark Regional Hospital before February 2021, experienced in working in the traditional birthing rooms, and who were still employed when interviews were performed. The birthing rooms had been in use for approximately two years when the interviews were conducted.

Of 25 potential participants, 16 midwives consented to participate.

Participants had verbal and written information about the project, and informed consent was obtained prior to the interview. Participation was voluntary and consent could be withdrawn at any time. All 16 participants were anonymized, and characteristics are presented in Table 2.

Data generation

Individual semi-structured interviews were performed to gain insights into how the birthing room environment impacts on the midwives' perception of their working environment [16,17]. The newly established sensory birthing rooms were the focal point of the interviews, serving as a key context for the work of the midwives. A semi-structured interview guide was prepared based on literature search, the theoretical frame, and practice-based experiences. Examples of key questions were: *How does the environment impact your experience of being in the birthing rooms during your daily work? How have you experienced the*

Table 2
Characteristics of participants (N = 16).

Characteristics	No.
Age	
25–30	2
31–36	1
37–42	3
43–48	5
49–54	2
55–	3
Midwife seniority	
0–5	2
6–11	1
12–17	5
18–23	5
24–	3
Seniority at North Denmark Regional Hospital	
0–5	3
6–11	3
12–17	5
18–23	4
24–	1
Employment status	
Employed	15
Substitute	1
Interview format	
Present	11
Teams (online) \$	3
Telephone	2

change from the previous birthing rooms to the new ones? What does it mean for you in your daily work that the environment in the birthing rooms has changed?

Interview questions were supplemented with photos of the delivery rooms before and after the transformation (Fig. 1) to facilitate parts of the conversation [18]. To support the midwives’ participation in the interviews during a high workload period, different interview formats were used (Table 2; in-person interviews at the ward (n = 11), online TEAMS application platform interviews (n = 3), and telephone interviews (n = 2). Interviews lasted approximately 30 min, were recorded and transcribed verbatim.

Analysis

Guided by Reflexive Thematic Analysis together with the organizational theoretical lens, the analysis was conducted in four iterative steps (Fig. 2). To obtain a coherence, all data from interview transcripts were

integrated at each analytical step through condensation, applying an iterative analytical approach going back and forth in the data material [14].

Familiarization – all transcriptions were read and re-read by the authors LSM, SL, AE, and MH. For the author team to get familiar with the data material, three interview transcriptions were read as a basis for an initial analytical discussion sharing individual understandings of the raw data.

Initial generation of a coding frame; organization and comparison of data. LSM constructed an initial coding frame inductively based on three interview transcripts. This phase involved a more detailed and systematic engagement with the data, discussing the meaning of semantic (surface) and latent (deeper) codes within the author team to reach a conceptual level of meaning.

Constructing themes in NVivo (The NVivo qualitative software package QSR International Pty Ltd. (2020)). Themes and patterns were identified, revised, and tested through an interpretive process. The authors LSM, SL, and MH analysed the entire dataset of 16 interviews. The same authors condensed findings of each theme supplemented with illustrative quotations, which were tested by the research team through shared discussions.

Interpretation and relationships of the thematic findings; extraction of main findings from key insights within data. LSM, SL, and MH condensed and drafted the thematic analysis and developed figures and models for the results section, qualified by the research team through joint critical discussions.

Results

The analysis resulted in four themes (Fig. 3): 1) Sensing the

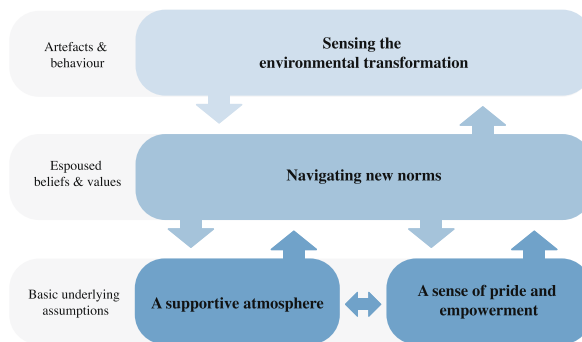


Fig. 3. The four themes: Sensing the environmental transformation, Navigating new norms, A supportive atmosphere, and A sense of pride and empowerment.

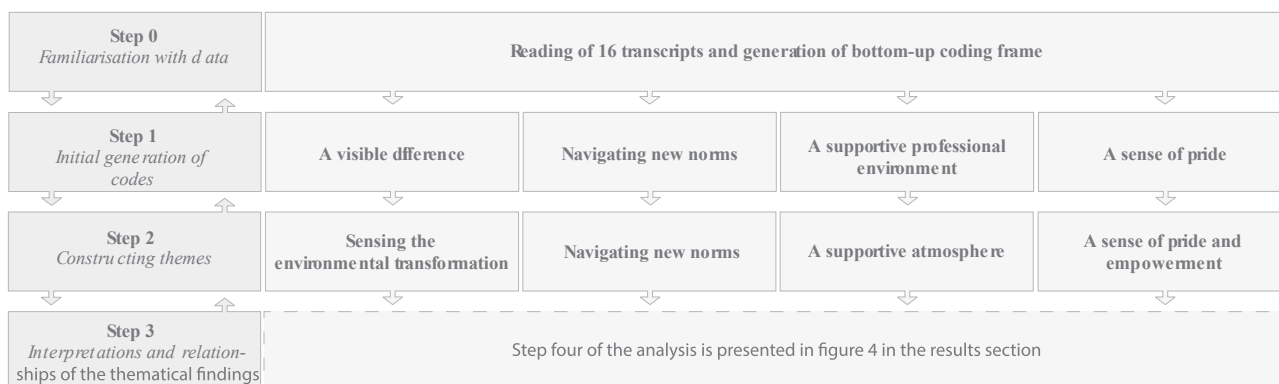


Fig. 2. Analytical steps.

environmental transformation, 2) Navigating new norms, 3) A supportive atmosphere, and 4) A sense of pride and empowerment. Drawing on Schei's model for understanding and analysing organizational culture, Fig. 3 presents the four themes and how they interact with each other. The first theme *Sensing the environmental transformation* covers the immediate impressions of the new multisensory birthing room environment with focus on the sensory moods and opportunities for adjustments. With the transformation of the birthing room, the midwives began *Navigating new norms*, concerning the espoused beliefs and values regarding new practices within the room, cross-disciplinary collaboration and taking ownership of the environment. This theme goes across all levels in Fig. 3. The two interrelated themes concerning the embedded and unconscious level of the culture, *A supportive atmosphere* and *A sense of pride and empowerment* address the different levels of affective attunement offered by the multisensory birthing rooms, and how this atmosphere creates a basis for the midwives to feel proud and empowered. Illustrative quotes are presented in Table 3.

Theme 1: Sensing the environmental transformation

This theme focuses on how midwives perceived the visible, hearable, and feelable changes in the new multisensory birthing rooms. In the context of the multisensory birthing rooms, this theme highlights how the room facilitates a meaningful and supportive atmosphere for childbirth through its carefully curated sensory and functional design. This

includes the interplay of moods, interior elements like lighting, sound, and visuals, and the ability to dynamically adjust these components to create a cohesive and responsive environment. The room facilitates a less clinical and risk-centred atmosphere. Emphasis is placed on the synergy between artistic content, furniture, the bathtub, a corner for personal items, and lighting. Collectively this conveys a sense of homeliness, allowing space for movement as well as ensuring that everything needed for the clinical work is within reach.

In general, midwives expressed high satisfaction with the multisensory entirety of the birthing rooms, both for themselves, the woman, and her partner. The more homely atmosphere places the woman and the partner at the centre and gives the midwife a positive sense of being a supporting guest in their space, especially since other rooms and hospital noises are imperceptible from within. The sense of homeliness is also cultivated by incorporating atmospheres captured in well-known locations in North Jutland, following seasonal and circadian rhythms. This connection to local nature and circadian rhythms, which often fades away in a hospital setting, is thus preserved (Table 3, Quote 1).

A midwife articulated how the multisensory entirety created a cohesive, vibrant atmosphere in the room that stimulated not only the senses of the woman and her partner but also of the midwife in a unique manner (Table 3, Quote 2).

The possibility to adjust the mood and configuration of the room and birth situation was highlighted as one of the main positive features of the multisensory birthing rooms. It is crucial for the midwives to have the

Table 3

Illustrative quotes from interviews with midwives.

Theme 1: Sensing the environmental transformation

Quote 1: *One of the atmospheres in the birthing room is called home, where all the local treasures and scenery are shown and it's completely unique. If it's a tourist coming to give birth, they may not be familiar with these local features, well, yes, they maybe know Rubjerg Knude Lighthouse...but these treasures are just unique to the people from Northern Jutland.*

Quote 2: *It's a completely different experience and your senses are stimulated differently, instead of just sitting in a white or colored room, so for me, it has made a huge difference.*

Theme 2: Navigating new norms

Quote 3: *There's a full stop button, I think that is what it's called, and the doctor pressed that as the first thing, and I was like UHHHHH – what's going on and the couple, you could really see the fear in their eyes, and they thought, shit, what's going on, now it's dangerous. (...) of course, if we have serious bleeding, we will have to use the button, but we haven't used it very much, and in this situation, it was a bad choice to use it.*

Quote 4: *I feel that we have a nice and calm environment in the birthing room. No matter how hectic the situation is, I just feel it's calm in there and it positively affects the staff working there. In e.g., emergency situations where we must work fast and efficiently, then it is as if there is just a little bit more calmness in the voices, and you know in the inherent hectic nature of a birthing room. I think that's great. I have also observed that individuals less familiar with the birthing room environment, such as laboratory technicians, notice the pleasant atmosphere.*

Quote 5: *It's about – or well, yes professionally it's about how you can see how making a difference changes something and it feels good to make some improvements in your department. I feel that the changes in the birthing rooms have given others the motivation to make some more improvements, including myself. (...) The thing that it's not in vain to fight for something and do something to get better that is, and look around a little more, and see what else we can improve and what else we need to look at.*

Theme 3: A supportive atmosphere

Quote 6: *I think that the music and lighting, it's like if you're at a nightclub – if there's a quiet and calm song, you don't go out and dance wildly, right? (...) I just think childbirth involves some energy and some movement and development, and it just fits so well with all these videos, where there is also movement. It has really been considered to harmonize the videos with the labour process, and I think it supports this work, subconsciously, yes.*

Quote 7: *I change from speaking in a loud, clear voice, distinct voice in a rhythmic pattern, and the voice kind of echoes off the walls. When I'm in that environment (the birthing rooms), I switch, and now I speak softly and calmly. I become slower, calmer, more focused on the couple and their needs. Where are they now? What is happening right now? I meet them and I put a part of the hospital atmosphere behind me.*

Quote 8: *They seem to be open and attuned to relationships, I think, because they can feel that there is space, and because they feel that we have done something to make them feel comfortable and feel that they can make themselves at home there. And they, I think it signals some calmness, and yes, which makes them get into gear well, they don't feel like they are out of their element. (...) you can start where we are somehow on the same level in relation to what is to take place, so I think that the starting point, it is really good in relation to the relationship with the couples.*

Quote 9: *Well, it's as if you were sitting in a small boat together with sea all around you even though there is no sea.*

Quote 10: *It is a great satisfaction as a midwife to have that flow. I think I meet them better. I like myself better. I think I'm a better version of a midwife in the birthing room than I was before. (...) Where you can really feel that you meet each other, you work together, you understand each other, read each other's signals and react.*

Quote 11: *So, I don't have to work on the environment anymore (...) I can shift my focus to any of the other areas where there is a significant need for attention, especially if there is a shortage of midwives.*

Quote 12: *It means that I don't die in my work, it means that I have energy also when I leave the birthing room, even though I may have been there for 16 or 20 h. It means I don't get that feeling of being down where you think, oh no, am I not going home soon, I can't stand being in here anymore, and what is the time of day. That, I think, makes all difference.*

Quote 13: *(...) I think you focus more on the people and maybe a little less on the action taking place. (...) It's a completely different focus and the woman comes first. The factors have changed from first woman in labor 6 cm dilated, and much later I would start to think of X; Now she is first.*

Theme 4: A sense of pride and empowerment

Quote 14: *We are here for you, we want to do the best for you. So, it's more of a value for me than it affects my work, that is, my breathing work, my midwifery work with the woman. So, I think that it is a good reflection of me as a midwife. Does that make sense? (...) This is what supports the professional angle, exactly the thing about calmness and security also creating oxytocin and all these things that promote a good birth, for the good labour work, so it is nice to have the institution in the background as well, supporting“.*

Quote 15: *Well, we midwives are proud people and we want to do our job well, and people should leave the hospital with a good experience and with a confident feeling about parenthood. That is our most important task, and it gives such a professional pride, and I think that it contributes, i.e. the fact that they come in and get a WOW effect. It's just so nice, and we've been in another location where we felt like we were stuck in a broom closet, and it's something they mention as part of their birth story, so that can give you a sense of pride.*

ability to adjust both soundscape and light to accommodate the needs of both the woman, the partner, and staff.

Theme 2: Navigating new norms

This theme describes the espoused values and beliefs affecting how staff interact and represent the organization. The clinical staff have made continuous adjustments in the new birthing rooms to optimise conditions for the clinical work of the midwives. The multisensory system can be turned off with the push of a single button, but most midwives rarely felt the need to press the button, even in acute situations. On the contrary, they experienced negative effects in the sudden change of atmosphere as the multisensory system aids to maintain a calmness to the situation and the people in the room (Table 3, Quote 3). To address this a midwife suggested composing an “acute mood” with a less sudden change of atmosphere.

Overall, the new multisensory birthing rooms have led to positive cultural and behavioural changes regarding cross-disciplinary collaborations. There is a calmness about the room reflected in the behaviour of clinical staff, making the collaboration in acute situations less hectic (Table 3, Quote 4). The cultural changes are also reflected in the midwives feeling more encouraged to take ownership of the environment. The new multisensory birthing rooms have made midwives feel seen and heard, which has initiated thoughts on how to engage in further improvements (Table 3, Quote 5).

With new multisensory birthing rooms and a reputation for multisensory birthing experiences, the hospital has noticed an increase in people choosing this facility for giving birth.

Themes 3 and 4: A supportive atmosphere and a sense of pride and empowerment

Concerning the underlying assumptions (Fig. 3).

A supportive atmosphere

The two themes *A supportive atmosphere* and *A sense of pride and empowerment* both captured the different levels of affective attunement offered by the multisensory birthing rooms, and how these affected the midwives’ sense of pride and empowerment. These two themes compose the essence of a culture although it is often taken for granted as it is deeply embedded and often at a subconscious level of culture, determining behaviour, perception, thought, and feeling.

Midwives focus on facilitating a natural, secure, and calm childbirth to reduce or avoid complications but also on making complicated births less traumatic. Thus, the multisensory birthing rooms facilitated a calming atmosphere and attunement of body, relation, and the connection to nature and the outside world. “Affect attunement” refers to the emotional resonance or synchronization between different elements, often observed in interpersonal relationships. This concept is particularly relevant in the contexts where individuals can understand and respond to each other’s emotions in a way that demonstrates sensitivity and connection, such as a birth process.

Midwives expressed it as helpful when they themselves as well as the woman and her partner, and other staff members, adapted to the room’s calm and secure atmosphere and rhythms. This was perceived by one midwife as a help to synchronize the rhythms of the woman’s body to support the labour process (Table 3, Quote 6).

Several midwives experienced that the rooms had a beneficial physiological impact on the women.

In relation to affect attunement of midwives and other staff members it was highlighted how they were grounded by a calm atmosphere when they entered the room, and how this helped to keep bodily rhythms and the pulse down. It was observed by several midwives that a quieter and lower tone of speech and a more relaxed vocal expression were adopted in the rooms, also by the doctors (Table 3, Quote 7).

Furthermore, the multisensory birthing room often helps the

relational attunement between the midwife and the woman and her partner, resulting in a strengthened collaboration (Table 3, Quote 8).

Thus, in many cases the multisensory birthing room makes it easier to find common grounds and meet the woman and her partner (Table 3, Quote 9). A midwife even felt that the strengthened attunement and flow with the woman and her partner helped her to be a better version of herself as a midwife (Table 3, Quote 10).

The multisensory birthing room provided a helping hand for maintaining a positive ambiance within the space and help the woman and her partner to have “their own space” and feel more empowered to take charge of their birthing experience. This may allow the midwife to be present and available, but in the background, as both the room but also the woman’s partner can take on an active role in setting the mood. This helped to free mental energy for the midwife (Table 3, Quote 11).

With the multisensory birthing rooms creating a connection to nature and the outside world, it served as a good conversation starter and established a relation not only focused on the birth process. The fact that the moods were recorded on well-known locations in North Jutland creates a common point of view, especially for the couples and the midwife where it is difficult to relate naturally. A midwife also described how this helped her feel less exhausted after long shifts and gave her energy to keep on working (Table 3, Quote 12).

The new atmosphere supports how midwives now experience a change to a more holistic and human-oriented approach to the birth in contrast to before where the tendency was to focus of the clinical aspects of the birth. In this way it felt easier to hold on to the more natural birth process, even in situations with complications (Table 3, Quote 13).

A sense of pride and empowerment

The midwives described a sense of pride in being able to offer an inviting environment to the women and their partners. They expressed to be proud to offer a unique and professional environment and that the birthing rooms supported their work as midwives. They expressed great joy in showing the new multisensory birthing rooms and this increased their job satisfaction and added value to the midwifery work? (Table 3, Quote 14).

Some midwives used the rooms in between deliveries to calm down and have team-timeouts. They felt the environment was supportive – also professionally – and it was important to them to contribute to a good experience and possibly a positive narrative of the birth (Table 3, Quote 15).

Corresponding to the espoused value of taking more ownership of the environment, the midwives felt a sense of pride and gratitude in having been part of the transformation process, which made them empowered and motivated. They felt invited in engaging themselves and taking ownership of the environment and the overall birth experience.

Discussion

Main findings

In general, the midwives in the present study expressed high satisfaction with the multisensory entirety of the birthing rooms – also for the women and their partners- and that the new birthing rooms have changed focus from risk management and monitoring to a more natural approach to birth. The midwives were grateful for and proud of the multisensory birthing rooms and found that they supported the midwifery professionalism and contributed additional value to their work.

Interpretation

The multisensory birthing room exudes vibrancy, not only by stimulating the senses of the woman and her partner but also by fostering a connection with the midwife. Midwives expressed how this setting empowered couples to autonomously adjust the environment. This is in

line with a recent study demonstrating that the implementation of sensory delivery rooms challenged the prevailing biomedical paradigm within the delivery ward context and emphasizing the shift from a task-oriented approach to a more emotional focus, which has a positive impact on the couples during the birth process [12]. The impact of the homelike environment is underscored by the midwives' and the couples ability to customize the soundscape and lighting to meet the distinct needs of the woman, partner, and staff. This aligns with recent research highlighting the positive impact of a homelike setting on midwives' sense of presence during childbirth [19]. The transformation of the birthing room is seen as instrumental in steering away from a clinical approach to birth, fostering a more natural and uncomplicated birthing process. In contrast, a previous study investigating the midwives' job satisfaction after the implementation of a multisensory birthing room showed diminished satisfaction with the working environment [11]. One explanation could be that there was a redesign of only one room in a unit with several standard birthing rooms and there could be uncertainties about acute management in an unfamiliar birthing room. Another explanation could be that the new birthing room was restricted to certain design specifications, and the midwives' involvement in the creation of the design changes was limited. This may explain why their job satisfaction did not increase in contrast to our findings where the midwives felt involved in the implementation process [11].

The establishment of the new birthing rooms prompted midwives to navigate novel behavioral norms, continually adjusting the room to ensure functionality and safety. A notable feature is a button designed for acute situations, allowing for the swift transition to a conventional birthing room. Surprisingly, this button is rarely used, indicating the perceived need for maintaining a calm atmosphere even in urgent scenarios. Additionally, the interaction of various professional groups with the birthing room enhances cross-disciplinary collaboration, particularly beneficial in acute situations. The implementation of sensory birthing rooms has not only conferred a sense of value and involvement among the midwives but has also spurred a commitment to ongoing enhancements. This contrasts with prior findings suggesting a pervasive medical risk perspective within hospital birth cultures, which caused midwives to feel uncomfortable in the setting of a new multisensory birthing room [20]. Possible explanations for this disparity include midwives' active participation in the implementation process and comprehensive staff training before start using the birthing rooms.

The midwives in our study found that the multisensory birthing rooms support key elements of their work. The calm atmosphere invites the birthing couple to create their own space and the midwife can retract herself to a more auxiliary and peripheral role in the birth process. The satisfaction reported by the midwives corroborates previous research highlighting the benefits of sensory birthing rooms [21–23]. The midwives expressed that a plausible explanation is that actively using the room's moods gives a potential reduction in oxytocin consumption and obstetric complications. This finding is consistent with previous research describing how the use of oxytocin infusion was reduced when giving birth in a sensory room versus a standard birthing room [24].

The inviting environment signals professionalism and gives the midwives a sense of pride, which played a crucial role in the transformation process. This sense of ownership could translate into an increased job satisfaction, as demonstrated by previous research in various workplace settings [25].

Strengths and limitations

A crucial strength of this study was that the multidisciplinary research group, comprising doctors, anthropologists, sound researchers, and an occupational therapy research. This diverse composition provided different angles to the research process and strengthen the study [26]. Another strength was that the interview questions were supplemented with photos of the delivery rooms before and after to facilitate parts of the conversation and help reduce recall bias. The knowledge

from the present study may be transferable to other hospital contexts. A limitation of the study could be if the midwives were reluctant to give negative evaluations of the birthing rooms since they were part of the process with planning and implementing the changes. Also, they could have hesitated to give negative feedback on the new environment if this would affect their relationship with the department management. These limitations were sought to be eliminated by using an external interviewer and anonymising the identity of the midwives.

Conclusion

The transformation of the physical environment from traditional to multisensory birthing rooms has led to a cultural transformation that is perceived to support the midwives' professionalism and their working environment. The interviews suggested that the audio-visual content from the local surroundings played an important role in how the midwives established a connection with the couples.

Contribution to authorship

All authors contributed to the study. LSM performed the interviews. The initial data were processed by MH, SL, LSM and AE, and all authors contributed to the data analysis. AE drafted the manuscript and all authors revised and approved the final version.

Details of ethics approval

The regional ethics committee of Northern Denmark waived the need for approval. The study was registered at the Danish Data Protection Authority (2020–113). Participants were informed verbally and in writing about the project, and informed consent was obtained prior to participation in the interview. Participation was voluntary and consent could be withdrawn at any time. All participants were anonymized.

Data availability statement

Data are available from the authors on request.

CRediT authorship contribution statement

Anya Eidhammer: Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Dorte Melgaard:** Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Louise Sofia Madsen:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Data curation, Conceptualization. **Julie Glavind:** Writing – review & editing, Conceptualization. **Sissel Raahede Lundgaard:** Writing – original draft, Formal analysis. **Marie Koldkjær Højlund:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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