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ESTONIAN ACADEMY OF ARTS
FACULTY OF DESIGN

MSc. Design and Technology Futures

**Improving Neonatal Intensive Care Parent-Infant
Bonding Through Supportive Design: A Case Study of the
Open-Bay Setting in Tallinn Children's Hospital**

LAPSEVANEMATE JA NENDE IMIKUTE VAHELISE SIDEME TUGEVDAMINE
VASTSÜNDINUTE INTENSIIVRAVIS LÄBI TOETAVA DISAINI: TALLINNA
LASTEHAIGLA AVATUD PALATISÜSTEEMI JUHTUMIUURING

MASTER THESIS

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Improving Neonatal Intensive Care Parent-Infant Bonding Through Supportive Design: A Case Study of Open-Bay Rooms in Tallinn Children's Hospital

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THESIS TASK

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Improving Neonatal Intensive Care Parent-Infant Bonding through Supportive Design: A Case Study of Open Bay Setting in Tallinn Children's Hospital (in English)

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Thesis main objectives:

1. Investigate emotional and practical challenges faced by parents in neonatal care.
2. Analyze and compare the impact of open-bay and single-family Neonatal Care environments on family-centred care at Tallinn Children's Hospital.
3. Evaluate healthcare design theories, focusing on Ulrich's Theory of Supportive Design, to inform improvements in NICU settings.

Thesis tasks and time schedule:

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ABSTRACT

This thesis investigates how supportive design can enhance parent–infant bonding in Neonatal Intensive Care Units (NICUs), with a focus on the open-bay setting at Tallinn Children's Hospital. The experience of premature birth or a critically ill infant requiring prolonged hospitalisation often leads to emotional strain, stress, and disrupted bonding for parents, especially mothers. For these families, the clinical environment becomes a formative space where early bonding, emotional well-being, and caregiving roles take shape. Despite advancements in family-centred Care (FCC), gaps in implementation persist, particularly in high-intensity open-bay settings where privacy, autonomy, and emotional support may be limited.

Drawing on Ulrich's Theory of Supportive Design, this study explores how environmental and service design touchpoints, such as sense of control, social support, and positive distraction, shape the NICU experience. Using a qualitative, human-centred design approach, the research integrates interviews, autoethnographic reflections, observations, and participatory methods to gather insights from parents (especially mothers) and healthcare professionals.

By comparing level III open-bay and level II single-family room settings, the thesis identifies key spatial and systemic barriers to FCC and proposes design interventions to help bridge the gap between clinical priorities and emotional care. The findings offer practical strategies to support not only infant recovery but also parental resilience and engagement. At its heart, this research calls for a more compassionate, holistic NICU environment — one that cares for the emotional well-being of families just as much as it delivers medical excellence.

Keywords: NICU, family-centred care, human-centred design, supportive design, parent-infant bonding, open-bay unit, single-family room, maternal well-being

TABLE OF CONTENTS

ABSTRACT.....	5
TABLE OF CONTENTS.....	6
1 INTRODUCTION.....	7
1.2 Chapter overview.....	12
1.3 Research Goals and Objectives.....	13
1.4 Limitations of the Study.....	13
2. RESEARCH.....	14
2.1 Background Information and Problem Space.....	14
2.1.1 Defining Prematurity and High-Risk Newborns.....	14
2.1.2 Introduction to Family-Centred Care.....	16
2.1.3 Tallinn Children's Hospital and the Context of Family-Centred Care.....	17
2.2 Field Research.....	21
2.2.1 Autoethnographic Study in Personal Context.....	21
2.2.2 Conducted Interviews Verbally.....	21
2.2.3 Observations.....	26
2.2.4 Mapping and Photo Documentation.....	27
2.2.5 HCD in Healthcare: NICU Applications.....	28
2.2.6 Design Process and Phases.....	29
3 SYNTHESIS.....	32
3.1 Supportive Design in Healthcare.....	32
3.1.1 Component of Perceived Parental Control.....	34
3.1.2 Component of Social Support Opportunities.....	39
3.1.3 Component of Positive Distraction.....	42
3.2 Conclusion and Discussion of Opportunities.....	46
4 DESIGN CONCEPT.....	49
4.1 Design Proposal 1.....	49
4.2 Design Proposal 2.....	53
4.3 Conclusion and Future opportunities.....	58
5. SUMMARY.....	60
ACKNOWLEDGMENTS.....	64
LIST OF REFERENCES.....	65
LIST OF FIGURES.....	73
APPENDICES.....	75

1 INTRODUCTION

Globally, approximately one in ten babies is born prematurely, before 37 weeks of gestation, and requires intensive care (Kaju, 2023; WHO, 2023). For these families, the birth experience is far from typical. Instead of returning home, they face prolonged hospital stays and an uncertain future for their infant. This unexpected journey is often marked by emotional and psychological challenges, including stress, helplessness, and uncertainty, which makes the NICU experience deeply emotional (WHO, 2019; Franck et al., 2017; DiBari et al., 2023; Orr et al., 2023; Roque et al., 2017).

Neonatal intensive care is essential for the smallest, premature, and critically ill newborns whose needs overreach the capacity of lower-level care units. (WHO, 2018, p. 61). This experience often leaves a lasting emotional impact and creates lifelong memories that persist well beyond discharge (Janvier et al., 2014; Bernardo et al., 2021). For many, it is not merely a medical event but a life-altering experience that deeply influences emotional well-being, perceptions of parenthood, and long-term family dynamics (Orr et al., 2023).

Regardless of nation or ethnocultural background, parents of newborns in the NICU often struggle with mental health issues (Roque et al., 2017). This psychological impact can significantly affect their ability to bond with their infant (Dubber et al., 2015). Furthermore, when parents have limited opportunities to engage in their infant's care, it can heighten feelings of anxiety and stress, often leading to coping behaviours such as emotional withdrawal or avoidance of caregiving activities (Heinemann et al., 2013).

This emotional distance can be further compounded by the intimidating environment of the NICU itself, where prematurely born babies, fragile in both developmental maturity and appearance, are surrounded by unfamiliar and often overwhelming medical equipment (Kaju, 2023). Additionally, these days, external factors such as political instability, global crises, and war can intensify maternal stress and anxiety (Pillai et al., 2023). These broader societal issues add another layer of psychological stress, emphasising the need to prioritise maternal well-being.

Supporting parental well-being is thus essential, not only for the parents themselves but also for their infants' recovery (Armstrong et al. 2005, WHO 2018, p 68). Evidence-based research shows that strong family bonds in the hospital setting facilitate faster recovery for NICU babies (Ortenstrand et al., 2010; Toetusfond; WHO, 2018), leading to reduced

infection rates, shorter hospital stays, improved cognitive and language development, and increased rates of breastfeeding (Toetusfond; Aedma, 2019; Toome et al., 2022).

The hospitalisation coincides with a critical period of brain development, especially for preterm which unfolds in NICU. During this time, early bonding, sensory exposure, and emotional support can significantly impact long-term cognitive and emotional development (Lehtonen & White, 2020; Ettenberger et al., 2021; Ravijuhend, 2017). The presence of parents is not only emotionally beneficial but also biologically essential. Factors such as skin-to-skin contact, mother familiar voices and scents help regulate stress levels and promote physiological stability in newborns (Altimier & Phillips, 2016). By fostering a supportive environment that encourages parental involvement and well-being (Ferreira et al., 2021; Väliaho et al., 2023), hospitals can contribute to improved recovery outcomes for infants. This not only enhances the efficiency of care but also leads to more cost-effective management, as newborn care is notably expensive (Ravijuhend, 2017).

Today, family-centred care (FCC) is widely regarded as the optimal approach in pediatric healthcare, recognising parents as active participants in their child's care (Jolley & Shields, 2009; WHO, 2019). This model has significantly improved care quality for hospitalised children (Jolley & Shields, 2009; Lam, Chang, & Morrissey, 2006; WHO, 2018). However, despite this paradigm shift, in neonatal intensive care units, parental input and perspectives are often underrepresented in practice (Ferreira et al., 2021). Furthermore, effective implementation still requires adaptation across diverse healthcare systems, institutional cultures, and resource contexts (Jolley & Shields, 2009; Kuo et al., 2012). Healthcare professionals must empathise with the unique challenges faced by parents, especially mothers (Obeidat et al., 2009; Yu et al., 2020). There is a need for insights to develop interventions that address parental needs, encourage active participation in infant care, and offer emotional support throughout the hospitalisation journey (Yu et al., 2020).

This thesis explores how these dynamics unfold in Estonia's highest-level neonatal care at Tallinn Children's Hospital in Northern Estonia. Since the 1980s, this hospital has uniquely allowed mothers to stay with their sick or premature infants in neonatal units, a practice that differed significantly from approaches in Western countries and the rest of the world (WHO, 2019). Initially, strict regulations limited accessibility with hospital doors remaining locked and no visits permitted. Over time, policies shifted toward greater accessibility.

At Tallinn Children's Hospital, the philosophy emphasises the family as the primary caretaker. As Liis Toome, Head of the Department of Neonatal and Infant Medicine, states, "*The parent and family are the primary caregivers, and we are part of the same team.*" While the hospitals recognise the family as the primary caretaker, a gap remains between this ideal and everyday practice. In neonatal care, the infant's survival and health are rightly the primary focus. Nevertheless, the well-being of parents, who play a critical role in the infant's recovery, may be overlooked. Despite strong intentions, limited resources make it challenging to provide the level of support families genuinely need.

According to the *International Closeness Survey*, which compared departments across six European countries, parents in Estonia spend significant time with their hospitalised children. However, their active participation in care and overall assessment of FCC were lower than average (Toome et al., 2022). This highlights the need to strengthen parental participation in NICU care. This thesis examines the family-centred approach at Tallinn Children's Hospital and identifies interventions to enhance it.

While family-centred care typically emphasises supportive environments and interventions aimed at parents and infants (Coyne et al., 2018), incorporating design as a broader practice of care allows for a more holistic perspective. One that takes into account the contextual, cultural, and environmental factors that influence overall well-being. As Vaughan (2018, p. 12) articulates, practising care is a complex, value-laden process shaped not only by the relationship between caregiver and recipient but also by broader sociocultural norms and expectations that evolve.

By incorporating a human-centred design approach (Norman, 2013; Melles et al., 2021) and participatory methods that actively engage both parents and neonatal staff (Bate & Robert, 2006), this research aims to foster a greater sense of parental empowerment and well-being, in turn, supporting the parent–infant bond. The goal is to explore how design can contribute to a broader culture of care (Vaughan, 2018), and more compassionate, holistic NICU environment — one that cares for the emotional well-being of families just as much as it delivers medical excellence.

This thesis analyses the relationship between environmental and service-related experience touchpoints within Level III open-bay and Level II single-family room settings, affecting families. It aims to identify design features that contribute to improved outcomes. The theoretical foundation draws on Ulrich's Theory of Supportive Design

(1997), which emphasises how healthcare environments can reduce stress and promote well-being. Key components of the theory are sense of control, social support, and positive distraction. These are explored to better understand how space and design features influence emotional and practical challenges in clinical settings.

Thoughtfully designed spaces can play a crucial role in the healing process (Shepley, 2024), supporting emotional connection, reducing stress, and enhancing the overall experience of neonatal care. The findings of this study will inform the possible design interventions that are both emotionally supportive and practically feasible within the constraints of a medical environment. Rather than viewing design solely as a tool for problem-solving, it should be understood as a practice of care, one that fosters relational, meaningful, and sustainable outcomes (Vaughan, 2018). This perspective also supports future advancements in NICU design by generating new insights that enhance the overall experience of both parents and infants in neonatal care settings.

Research questions:

How can supportive design in the Neonatal Intensive Care at Tallinn Children Hospital enhance maternal comfort and strengthen the emotional connection between mothers and their newborns?

Sub questions:

How do spatial and service-related aspects of NICU design impact parental experience with parent-infant bonding?

List of abbreviations

ECMO - Extra Corporeal Membrane Oxygenation

FCC - Family-Centred care

HCD - Human-Centred design

ICU - Intensive Care Unit

NICU - Neonatal Intensive Care Unit

PICU - Pediatric Intensive Care Unit

1.2 Chapter overview

Chapter one introduces the research topic, providing background and motivation while situating the study within the broader discourse on NICUs and their implications for family well-being and caregiving practices. It also outlines the research questions, aims, and scope of the study.

Chapter Two is divided into two parts: the first provides a literature review and background on preterm infant care, family-centred care principles, and the Tallinn Children's Hospital case study; the second outlines the fieldwork methods and research techniques used in the study.

Chapter three explores Ulrich's Supportive design components in healthcare settings. It synthesises the qualitative findings with the theoretical framework, examining how design elements in Tallinn Children's Hospital either support or hinder personal control, social support, and positive distraction.

Chapter four presents the proposed design concepts, detailing their key features and the value they provide to users and stakeholders. Includes a discussion of the findings and concludes the study.

Chapter five summarises the thesis by providing an overview of the study, revisiting the research questions, reviewing the data, and reflecting on the theoretical framework.

1.3 Research Goals and Objectives

This thesis outlines research goals and objectives, guiding the inquiry from exploration to design proposals, aiming to contribute to more supportive NICU environments.

Goals:

- To explore the relationship between the NICU environment of physical spaces and parental well-being in the NICU.
- Gather comprehensive insights from parents and healthcare staff to uncover underlying beliefs, motivations, and key challenges in NICU environments.
- Develop testable design concepts that integrate supportive design principles.

Objectives:

- Investigate emotional and practical challenges faced by parents in neonatal care.
- Analyze and compare the impact of open-bay and single-family Neonatal Care environments on family-centred care at Tallinn Children's Hospital.
- Evaluate healthcare design theories, focusing on Ulrich's Theory of Supportive Design, to inform improvements in NICU settings.

1.4 Limitations of the Study

The study on low birth rates in Estonia faces several limitations that may affect the interpretation and generalisability of its findings. Firstly, the relatively small number of cases, combined with the reluctance of some mothers to revisit traumatic experiences, may result in underreporting and incomplete qualitative data, thereby limiting the depth and power of the analysis. Since this thesis primarily focuses on mothers, the perspectives of fathers have only been examined on a small scale. Furthermore, potential confounding variables, such as maternal socioeconomic status, may not be fully accounted for, which could influence the accuracy of the results.

Access to all hospital spaces was also limited, and the constraints imposed by the scope of the thesis and available research time may have hindered both the comprehensiveness of data collection and the depth of the analysis. In addition, the limited availability of staff due to their heavy workloads and time constraints posed challenges for scheduling interviews and gathering in-depth insights from clinical professionals.

2. RESEARCH

2.1 Background Information and Problem Space

This chapter explains the challenges faced by preterm infants and their families, introduces family-centred care, and presents Tallinn Children's Hospital as a case study site, providing insight into the local neonatal care environment.

2.1.1 Defining Prematurity and High-Risk Newborns

According to the World Health Organisation, preterm birth is defined as delivery before 37 completed weeks of gestation. These newborns represent some of the most medically fragile individuals in hospital setting (WHO 2018 p 5; Platt, 2014) The earlier a baby is born, the more vulnerable its brain is, making effective and consistent neuroprotective care from birth crucial for optimal brain development (Altimier & Phillips, 2016; Platt, 2014; Lehtonen & White, 2020; WHO, 2018).

Neurobehavioral and Neurosensory Development of the Infant in the NICU

The third trimester, crucial for neurological and sensory development, typically occurs in the womb (Altimier & Phillips, 2016). For preterm infants, this development happens in the NICU, an environment that differs greatly from the womb's nurturing conditions and can profoundly impact brain development (Altimier & Phillips, 2013; Lehtonen & White, 2020).

While medical technologies such as ventilators and ECMO machines are central to neonatal care, findings have highlighted that research and clinical experience increasingly emphasise that technology alone is not enough. Hospitalised preterm or ill infants face harmful stressors like long separation from parents, inconsistent care, painful procedures without support, and overwhelming sensory environments (Sanders & Hall, 2017). Infants who lack early social interaction are more likely to face emotional and behavioural challenges as they grow (Boundy et al., 2016; Sanders & Hall, 2018). Parental presence is equally vital for optimal recovery and development (WHO, 2018). As a neonatologist from Tallinn Children's Hospital explains:

"It is essential to provide the most optimising environment possible, one that is similar to being with the mother, and this cannot be achieved without the presence of both the mother and the father."

Supporting healthy development requires both minimising negative sensory stimuli and introducing positive, age-appropriate experiences (Pineda *et al.*, 2025; Lehtonen & White, 2020,). Sensory-based care practices, such as skin-to-skin contact, exposure to the mother's scent, gentle touch, auditory recognition such as mother's voice, heartbeat, and therapeutic music are backed by strong evidence (Altimier & Phillips, 2016,; Ortenstrand *et al.* 2010) These interventions help reduce stress, ease procedural pain, and promote better neurological outcomes.

However, one of the biggest barriers to delivering this kind of care is parental stress. Research has shown that a newborn's well-being is closely tied to the well-being of their family, and the mother makes it essential to provide continuous, compassionate care that supports them both together (Sanders & Hall, 2018; WHO, 2018, p 18). This is where family-centred care becomes critical. The hospital should be a place that cares not just for the baby's medical needs, but also for the emotional and mental well-being of both the baby and their parents. (He *et al.*, 2021). Creating optimal environmental conditions, whether the infant is critically ill or stable, can foster stronger parent-child bonding and support healthier long-term outcomes (WHO, 2017, p 5).

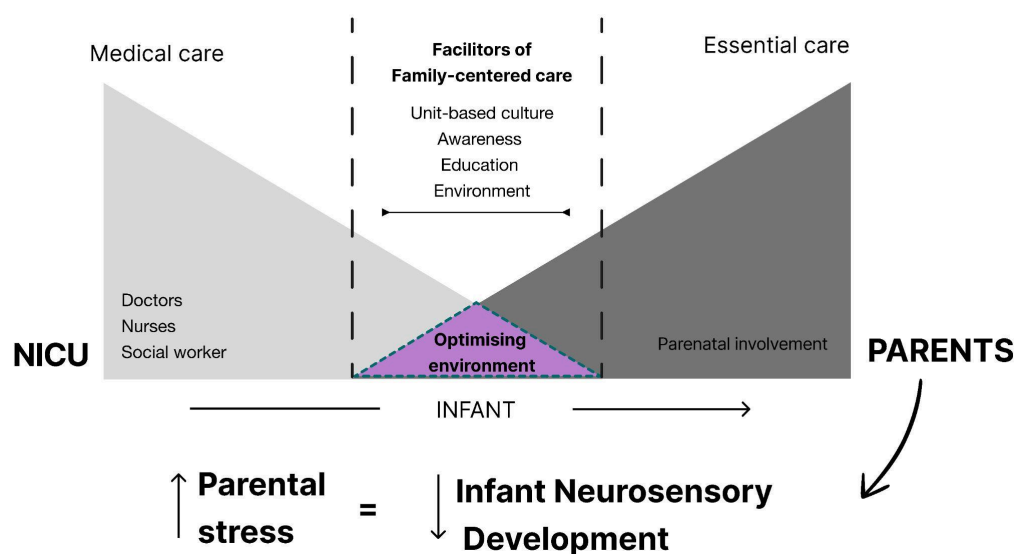


Figure 1. This model illustrates how both medical care and essential parental involvement contribute to creating an optimal care environment. However, elevated parental stress can negatively impact the infant's neuro-sensory development. Figure created by the author.

2.1.2 Introduction to Family-Centred Care

In recent decades, healthcare has undergone a meaningful transformation, from focusing solely on the individual patient to recognising the essential role of the family in care, particularly in pediatric and neonatal settings (Ramezani *et al.*, 2014; Moradian, 2018). This evolution has led to the development and widespread acceptance of family-centred Care (FCC), a philosophy that places families at the heart of the healthcare experience (Moradian, 2018; Jolley & Shields, 2009).

FCC is built on the principle that parents and families are not just visitors, but central figures in a child's life and care (Jolley & Shields, 2009; Obeidat *et al.*, 2009; WHO 2018). Within this model, nurses and healthcare professionals serve as key facilitators, with their ability to advocate for families, promote open communication, and cultivate inclusive care environments playing a vital role in translating FCC in everyday practice (Jolley & Shields, 2009; Stefana *et al.*, 2024). Empowering parents as active members of the care team has been shown to improve outcomes for hospitalised children (Jolley & Shields, 2009; Lam, Chang, & Morrissey, 2006), such as weight gain and neurodevelopmental progress (WHO, 2018 p 19).

However, despite this paradigm shift in theory, the voices and lived experiences of parents are still often underrepresented in the practical implementation of FCC, particularly in neonatal intensive care units (Ferreira *et al.*, 2021). While the benefits of FCC in NICU settings are well recognised, such as improved parent-infant bonding, enhanced parental confidence, and more compassionate, coordinated care. There remains a lack of clarity around how to implement FCC meaningfully across varying healthcare systems, institutional cultures, and resource settings (Jolley & Shields, 2009; Kuo *et al.*, 2012).

To strengthen family-centred Care practices, each NICU must develop a more holistic and integrated understanding that addresses the emotional, physical, and psychological needs of both infants and their families (Coyne, 2013). As Ferreira (2021) notes, these care models must also be sensitive to suit parents' needs within the specific context of local culture, resources, and staff experience. Achieving this level of integration is not without challenges. It requires not only changes in clinical practice, but also a broader cultural and organisational transformation, demanding shifts in mindset at both the caregiver and administrative levels (Itoshima *et al.*, 2025; NICU Design – ESCNH).

2.1.3 Tallinn Children's Hospital and the Context of Family-Centred Care



Figure 2. The Neonatal and Infant Unit at Tallinn Children's Hospital in Mustamäe. Photo: https://media.voog.com/0000/0038/9993/photos/IMG_3942_block.jpg

Tallinn Children's Hospital specialises in the treatment of critically ill premature infants and full-term newborns with various diseases or congenital abnormalities requiring prolonged hospital care (Lastehaigla). Each year, approximately 600 children are treated in the Neonatal and Infant Department at Tallinn Children's Hospital. Of these, an estimated 250 are admitted directly from the maternity hospital to the intensive care unit or the neonatal and infant department. About 75 are extremely premature newborns, that is, with a birth weight under 1500 grams (Toetusfond).

Given that extremely premature infants often require long stays in hospital, the institution prioritises creating an environment that ensures both comfort and safety for infants and their families (Toetusfond). The hospital operates a Level III intensive care for the most critical cases, situated in the pediatric intensive care department. Despite its advanced medical capabilities, this unit lacks the dedicated spatial infrastructure, such as privacy, required to fully implement a family-centred care (FCC) model (Toetusfond). Level II intensive care and follow-up services are delivered in the neonatal and infant unit.

Tallinn Children's Hospital's main goal in transitioning to family-centred neonatal intensive care is to achieve better treatment outcomes and ensure the well-being of the family (Toetusfond). Significant progress was made in 2018 with the renovation of the Level II neonatal care, where five single-family rooms and a parent restroom were

introduced, each equipped to support both clinical needs and family involvement. Rooms include incubators, respiratory support, feeding pumps, parental beds, “kangaroo chairs” for skin-to-skin contact, private bathrooms, and partition walls for privacy. Central monitoring systems ensure continuous, 24/7 oversight of the newborn by medical staff, balancing clinical excellence with parental presence.

These family rooms offer a more homelike and private environment, allowing parents to remain with their child around the clock. Previously, a mother could stay in the hospital with her infant, but not in the same room. Now, this barrier has been removed, reinforcing the hospital's commitment to integrated, family-oriented care (Toetusfond).

Estonia's emphasis on FCC is not new. As early as the 1980s, the country was advancing parental involvement in neonatal care at a time when such practices were still rare globally (Toetusfond; Antson 2019). As hospital recalls, “*The doors were locked, you were either in or out. Once inside, you stayed until the end. No visits.*” Over time, these rigid rules evolved. By the 2000s, fathers could stay in family rooms, and by 2017, in intensive care rooms (Toome et al., 2022). This progression reflects Estonia's long-standing values of closeness and emotional support in neonatal care.



Figure 3. Photo: Peeter Vendelin. Tallinn City Clinical Children's Hospital rooms for children and mothers. <https://ajapaik.ee/photo/993585/tallinna-linna-kliinilise-lastehaigla-boksid-lastele/>

This pioneering approach was strongly shaped by Dr. Adik Levin, who led the neonatal and infant department at Tallinn Children's Hospital from 1979 to 2004. Levin's "Humane Neonatal Care Initiative" advocated for active maternal involvement in infant care, supported by healthcare professionals (EWR Online, 2017; Toetusfond). His 1991 doctoral

dissertation, *The Mother-Infant Unit at Tallinn Children's Hospital, Estonia: A Truly Baby-Friendly Unit* (Levin, 1994), underscored the rights of both mother and infant in hospital settings. Many of the practices he championed were globally ahead of their time, further positioning Estonia as a leader in neonatal care (EWR Online, 2017). Therefore, Estonia also led the way in encouraging and advancing the use of skin-to-skin contact in neonatal care around the world (WHO, 2018 p 24).

The hospital's philosophy emphasises the family as the primary caregiver, yet field research indicates a gap between this ideal and the practical realities of daily care. According to the International Closeness Survey (Toome et al., 2022), while Estonian parents spend significant time physically present with their hospitalised infants, their active involvement in care and their overall experience of family-centred care (FCC) is below the European average (Toome et al., 2022, p. 620). This highlights the importance of finding ways to strengthen parental involvement in NICU settings, ensuring that parents are not only physically present but also meaningfully engaged in their infant's care.

To address this, Estonian neonatal departments adopted the "Close Collaboration with Parents" training program developed in Turku University Hospital, Finland (He et al., 2021; cited in Toome et al., 2022, pg 620). This four-module educational system aimed to actively involve parents in the care and treatment process of their child (He et al., 2021, Soomets, 2024). In the NICUs of Estonia, personnel indicated a more significant enhancement in FCC practices compared to parents following the intervention (Itoshima et al., 2025). Positive changes in behavior and structure were noted, such as, a head nurse observing increased empathy and moral sensitivity among older staff. The overall impact fell short of expectations. The reasons behind this ranging from implementation challenges, warrant further investigation. Conducting large-scale training sessions among heavily burdened healthcare workers is quite a challenge (Soomets, 2024).

Another important challenge is parental well-being. In field research highlighted in interviews, while the primary focus in neonatal care naturally centers on the infant, supporting the emotional and psychological well-being of parents is equally vital. However, due to limited resources, fully addressing the needs of families can be difficult, even with the best intentions. This highlights the continued need to identify and explore the gap between the principles of family-centred care and their practical implementation.

Ultimately, the outcomes of neonatal care are shaped not only by medical technology or national resources, but also by how care systems are organised and delivered (Toome et

al., 2022). In Tallinn Children's Hospital, the author's findings highlight several ongoing challenges:

Financial and Socioeconomic Barriers

- Neonatal intensive care is resource-intensive in terms of technology, expertise, and personnel.
- The weakness of the national healthcare system.
- Limited state or hospital funding for FCC-related infrastructure
- Parental financial strain during hospitalisation
- Caregivers face challenges like frequent hospital transfers of infants postnatally and difficulties in providing consistent family-centred care.
- A significant shortage of nursing and care staff, and high turnover among existing nursing personnel.

Physical Environment Constraints

- The separate locations of third level maternity and children's hospitals leads disrupts continuity of care
- Outdated and deteriorating buildings limit the functionality and comfort needed for modern neonatal care
- Physical space constraints make it difficult to implement ideal care practices to all clinical settings.

Socio-Cultural and Communication Barriers

- **Lack of training in FCC principles for all staff** - even if the philosophy exists, without ongoing specific training, staff may default to traditional, hierarchical caregiver-patient dynamics.
- **Language and communication gaps** - in multilingual or multicultural contexts, communication (mainly Estonian-Russian speaking) barriers between families and healthcare providers can lead to misunderstandings or limited involvement in care decisions.
- **Parents' confusion about their role and the care of their newborn** - some families may be hesitant to participate actively due to cultural norms about medical authority, care roles, or emotional expression.

2.2 Field Research

In this chapter, an outline of the fieldwork research methods, methodologies, and selected research techniques, including ethnography, utilized in the study is provided. To achieve its objectives, the study employs qualitative research methods, which are well-aligned with the principles of human-centred design (HCD).

2.2.1 Autoethnographic Study in Personal Context

This thesis adopts an autoethnographic approach, rooted in the author's 20-day experience in Karolinska University Hospital in Sweden in the ECMO unit at the highest levels of intensive care. This personal journey served as a foundation for developing a deeper understanding of the NICU experience from a parental perspective. The reflective engagement with this experience highlights the emotional and practical challenges faced by families with hospitalised newborns and informs the study's focus on family-centred care. It also shaped the research questions and provided critical insights into how neonatal environments, particularly in Estonia, can better support families, while underscoring the need for greater societal awareness, empathy, and systemic support.

2.2.2 Conducted Interviews Verbally

To gather in-depth qualitative data, semi-structured interviews were conducted with two key participant groups: parents of NICU infants and neonatal care professionals. Semi-structured interviews are widely recognized for their ability to yield rich, context-specific insights while allowing flexibility in exploring individual experiences (Dempsey et al., 2016).

1. First Target Group: Infant Parents

12 parents of intensive care whose infants had been admitted to the Neonatal Intensive Care

- Tallinn Children's Hospital - Department of Neonatology, Estonia
- Faculty of Medicine, University of Tartu, Children's Clinic, Department of Neonatology, Estonia

This study's first participant group included parents whose infants had been admitted to the NICU, with hospital stays ranging from 10 days to nine months. Participants were recruited via the Facebook group *Beebid 2024* and a public call for volunteers. Interviews were conducted remotely with parents already discharged and in person with one mother

still in hospital. In-person interviews enabled observation of non-verbal cues, essential for discussing emotionally sensitive topics (Corbin & Morse, 2013), and helped build trust for deeper insight into their lived experiences.

In many cases, the emotional weight of the neonatal intensive care experience made it difficult for parents. Especially mothers who had lengthy hospital stays, to engage in structured discussions. As a result, initial conversations were often unstructured, giving participants the space to share their stories in their own way. These open dialogues helped establish trust and created a foundation for deeper engagement. To further explore thesis-specific topics, some follow-up interviews were conducted, often in shorter sessions to ensure participants' comfort while enhancing the depth and quality of the data collected.

The interview process was structured around a guide informed by core themes by family-centred care principles (see Appendices 1), which ensured consistency across participants while still allowing space for spontaneous and open-ended responses. Trust and empathy grew as my personal experiences resonated with those of the parents, making them more open to sharing.

Respect for participants' emotional well-being, audio recordings were not used. Several parents expressed a desire for privacy and emotional safety, preferring to share their stories in a setting free from judgment or documentation. To ensure the accuracy of the data, comprehensive notes were taken during and immediately after each interview, allowing for faithful representation of participants' experiences without compromising their comfort or trust (Cowles, 1988).

2. Second Target Group: Neonatal Staff

The second group of participants consisted of neonatal care professionals. These participants provided insights into institutional practices, family-centred care implementation, and organisational dynamics within NICUs. Their perspectives were crucial in understanding the dynamics of family-centred care and the practical, organisational, and emotional aspects of neonatal care from a professional standpoint. To guide the meetings, I prepared key thematic areas to structure the discussions and ensure comprehensive coverage of relevant topics (see Appendices 2).

I Session in Tartu: Interview + Observation (duration: 45 min)

An introductory session was conducted with **Dr. Heili Varendi**, University of Tartu, Faculty of Medicine, Institute of Clinical Medicine, Associate Professor in Paediatric Illnesses. This meeting provided a contextual background of neonatal care, offering an overview of the current implementation of family-centred care practices at Tartu.

II session in Tallinn: Group Interview (duration: 45 min)

At Tallinn Children's Hospital, the following professionals participated in the interview and observation session:

- **Liis Toome** - Head of the Department of Neonatal and Infant Medicine, Tallinn Children's Hospital
- **Reelika Part** - Head of the Neonatal and Infant Department, Tallinn Children's Hospital
- **Merle Paluste** - Doctor at Neonatal and Infant Department, Tallinn Children's Hospital

As Tallinn Children's Hospital served as the main field research, this session included both interviews and direct observational engagement (see also the Observation chapter). The perspectives of these professionals were crucial for understanding the daily operations, institutional challenges, and emotional and practical dimensions of delivering neonatal care within a family-centred framework.

The primary objectives of these group interview were to:

- To introduce the researcher's background and the scope of the study, including the application of a human-centred design approach.
- To gain an understanding of the historical development and current organisational structure of neonatal care at Tallinn Children's Hospital.
- To evaluate the extent and characteristics of family-centred care implementation within the institution.
- To understand what supports the effective integration of family-centred care practices and identify factors that enable these practices to work well or present barriers in the clinical setting.

Additionally, stakeholder mapping was conducted using a preliminary draft developed by the researcher, which was subsequently reviewed and refined in an interview session. The

aim was to identify the roles and influence of various actors within the NICU ecosystem, distinguishing between internal stakeholders (e.g., healthcare providers, hospital staff, parents) and external stakeholders (e.g., non-profit organizations, support groups) who may impact the NICU experience. This mapping process helped to clarify the relationships, responsibilities, and potential areas of influence among stakeholders in neonatal care.

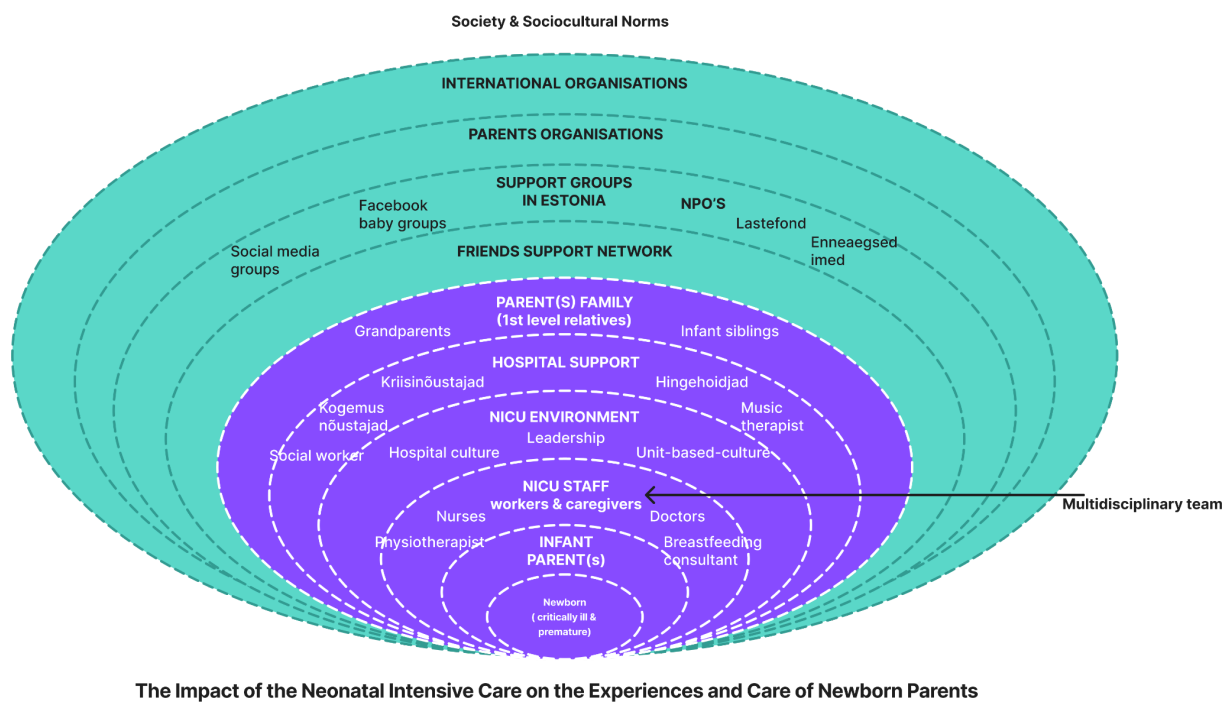


Figure 4: Stakeholder map illustrating the impact of Neonatal Intensive Care on the experience and care of parents of newborns. Created by the author.

3. Third Target Group of Neonatal Staff Participated in Scheduled Meetings.

To deepen the understanding of family-centred care (FCC) implementation and to identify practical challenges within Tallinn Children's Hospital. A series of interviews were conducted with various neonatal staff members. These interviews provide a grounded, multidisciplinary perspective on the institutional, spatial, and interpersonal dynamics influencing care delivery.

Interviewee: Annika Laats, Caregiver and Counsellor

Duration: 45 min

The goal of the caregiver and counsellor is to provide emotional and psychological support to patients and their families during times of crisis. She helps individuals navigate these emotionally intense periods by fostering a sense of balance through conversation.

The purpose of the meeting was to gain a deeper understanding of the caregiving and counselling work, including the settings in which parent meetings are held, how these environments affect the quality of interaction, and the challenges encountered in providing support.

Interviewee: Vera Nikolejeva, Head Nurse

Duration: 50 min

Vera offered insights into the everyday realities of nursing within the neonatal intensive care unit. She shared her perspective on the practical challenges of the "Close Collaboration with Parents" training program. She also highlighted issues affecting existing workflow demands, limited staffing, political aspects, and other challenges.

Interviewee: Anette Aija, Neonatologist and Doctoral Researcher (University of Turku)

Duration: 40 min

Dr. Anette Aija shared key insights from her academic research on neonatal care and parent-infant closeness, underscoring its critical importance. Drawing on her expertise with the LENA (Language Environment Analysis) system, which provides automated measurements in neonatal intensive care units to support parent-infant closeness and assess language environments, she contributed evidence-based recommendations to the discussion. Her perspective highlighted the essential role of parents as active participants in care and emphasised the developmental benefits of sustained closeness in NICU settings.

Interviewee: Birgit Kiilaspää, Head Nurse

Duration: 45 min

The purpose of the meeting was to discuss my experience in intensive care in Sweden. Secondly, the initiative aimed to shed light on intensive care interventions that have been

considered and attempted to be implemented in an open-bay setting, as well as to understand the emotional impact of care from the nurses' perspective.

2.2.3 Observations

To gain a comprehensive understanding of the care environment at Tallinn Children's Hospital, a non-participant observational method was used. This approach involves observing people from a distance without interaction, allowing behaviours to unfold naturally without examining internal thoughts or feelings (Gobo, 2008). As a qualitative method, it offers in-depth insights into lived experiences (Norman, 2013, p. 222), helping to identify real-world challenges and contextual concerns within the hospital setting.

The observations were conducted alongside the first round of interviews, enabling meaningful triangulation and strengthening the validity of the findings. This combination provided a richer understanding of the emotional and practical dimensions of neonatal care, informing more responsive, human-centred design interventions. Observing multiple levels of intensive care and the physical spaces where daily routines take place also revealed subtle yet important dynamics that might not surface through interviews alone (Lofland et al., 2005).

Primary Objectives of the Observations:



1. Validating Findings from Initial Interviews

The observations helped to corroborate the insights gathered during the first round of interviews, ensuring consistency and reliability in the data.

2. Understanding Service-Related Aspects Across Different Departments and Rooms

Understanding the purpose and functionality of various departments and physical rooms within the hospital, including caregiving and lodging areas, involves recognising their distinct design features, interiors, visuals, equipment, and roles in delivering care.

The table below outlines the key focus areas, providing a descriptive background of the observational research central to this thesis. Conducted across both Level II and Level III care, the observations, supported by staff guidance, emphasise the role of various spaces within the neonatal environment.

<p>III session: Interview along with non-direct observation with Merle Paluste (duration: 45 min)</p>	<p>IV session: Interview along with non-direct observation with Reelika Part (duration: 45 min)</p>
<p>Tallinn Children's Hospital, Intensive Care Unit (ICU) with PICU and Neonatal Care</p> <p>Main architectural setting: SINGLE-FAMILY ROOMS (Level II)</p> <ul style="list-style-type: none"> - To accommodate parents to be present continuously for 24/7 with their infant. - Private rooms for families designed to decrease noxious stimuli as well as to provide a foundation for family-centred care.  <p><i>Photo:</i> https://www.postimees.ee/6499860/galerii-tallinna-lastehaigla-sai-vastsundinute-intensiivravi-perepalatid?gallery=266384&image=11716949</p>	<p>Tallinn Children's Hospital, Neonatal and Infant Department</p> <p>Main architectural setting: TRADITIONAL OPEN-BAY (Level III)</p> <ul style="list-style-type: none"> - Families can visit their newborn during the daytime. - Traditional settings are generally large rooms with clusters of infants on the same ward.  <p><i>Photo:</i> https://www.lastehaigla.ee/sites/default/files/2024-01/anestesioloogia-1.png</p>

*Observations were also conducted in the follow-up care setting; however, this environment falls outside the primary scope of the thesis and was therefore not included in the core research objectives.

2.2.4 Mapping and Photo Documentation

In spatial research, mapping is a well-established strategy for collecting primary data on the physical location and characteristics of spaces under investigation (Fülling et al., 2024). In this study, mapping was complemented by systematic photo documentation, which served as a method for interpreting visual information that cannot be captured through spatial data alone. As Fülling et al. (2024) suggest, photo-based observations offer unique insights into environmental conditions, usage patterns, and spatial functions that enrich the analytical process.

This phase involved clustering visual data and mapping spatial zones (see figure 5) to highlight the physical attributes and intended functions of each room. These combined methods supported the early stages of analysis by providing a tangible overview of the environment. Together, they formed a foundational layer for deeper exploration of how design elements and room layouts influence parent-infant interaction and overall experiences within the NICU setting.

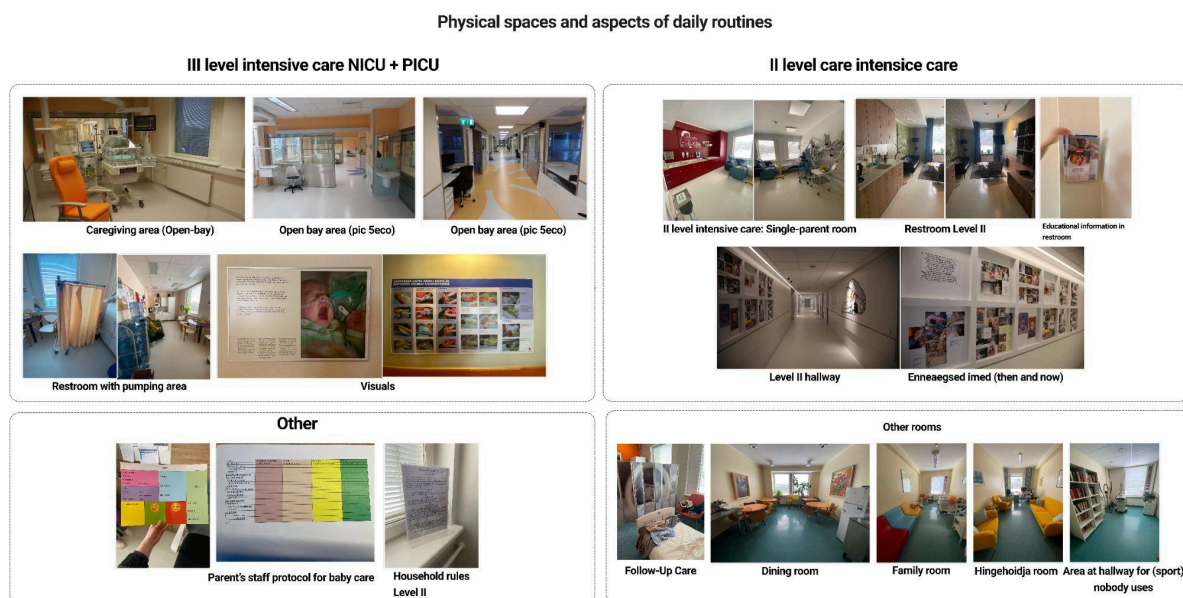


Figure 5. Photos clustered after observation, highlighting different rooms and their functions within the neonatal care environment. Created by the author.

2.2.5 HCD in Healthcare: NICU Applications

Human-Centred Design (HCD) places human needs, behaviours, and experiences at the core of the design process, offering a systemic and empathetic framework particularly suited to complex fields like healthcare (Melles et al., 2021; Groeneveld et al., 2018). Rooted in humanistic values, HCD emphasises empathic understanding, co-creation with users, and iterative refinement to make different stakeholders' voices and perspectives heard (Bird et al., 2020; Steen, 2011; Pfannstiel & Rasche, 2019). It ensures solutions are both effective and responsive to evolving needs.

In the NICU, HCD offers valuable potential to shape environments that support emotional comfort, connection, and family involvement. Unlike traditional approaches that prioritise procedural efficiency, HCD centres on the lived experiences of parents, caregivers, and staff by integrating emotional, cognitive, and sociocultural dimensions of care (Institute of Medicine, 2001; Pfannstiel & Rasche, 2019). This perspective is particularly relevant in

NICUs, where challenges such as maternal stress, disrupted bonding, and limited privacy require more nuanced, human-responsive solutions (Mohammed et al., 2023).

However, integrating HCD into clinical practice remains complex. Many healthcare professionals are unfamiliar with design methodologies that prioritise experiential, qualitative research (Melles et al., 2021). This tension is compounded by the sector's reliance on evidence-based, quantitative approaches, which may seem at odds with HCD's iterative, small-scale nature (Göttgens & Oertelt-Prigione, 2021). To bridge this gap, this study engages healthcare professionals as co-researchers, building trust and demonstrating how human-centred methods can meaningfully address both the practical and emotional dimensions of neonatal care.

2.2.6 Design Process and Phases

This chapter presents and briefly discusses the basic theoretical framework that underpins the research study and its various phases.

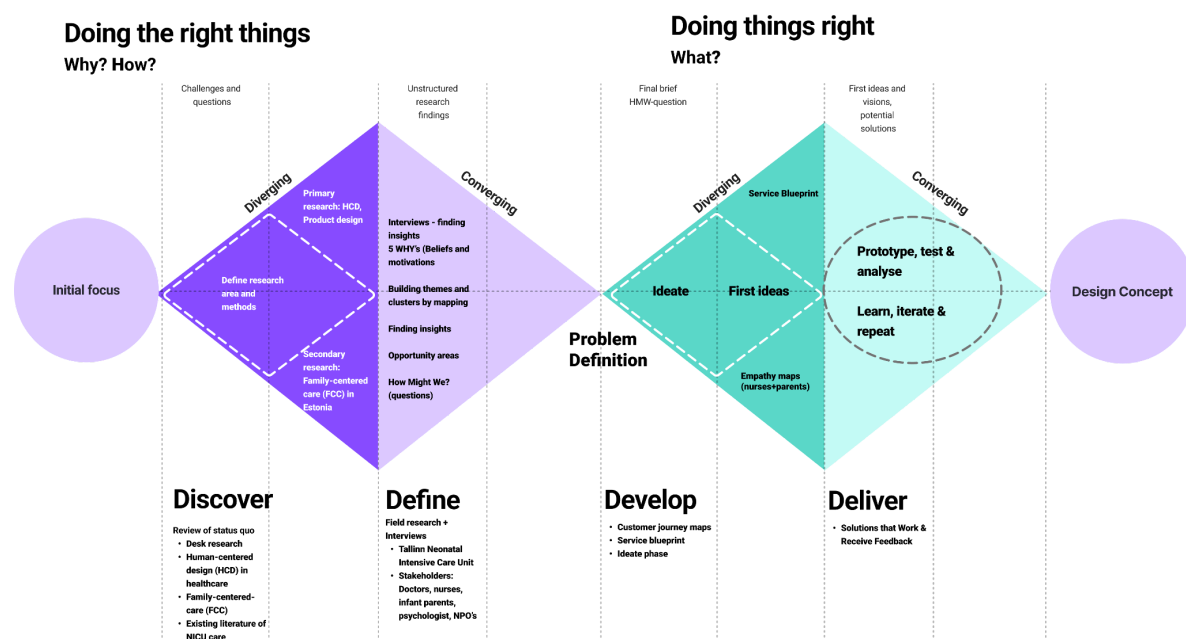


Figure 6: Combined framework adapted from the Design Council's Double Diamond model and inspired by Dan Nessler's revamped version. Additional methods have been integrated to better align with the context and aims of this thesis. Created by author.

The research process utilised the **Double Diamond framework** (Norman, 2013; Designcouncil), which structures the design process into two key phases: finding the

right problem and fulfilling human needs (Norman, 2013, pg 221). The iterative diverge-converge methodology allows designers to explore a broad range of possibilities before refining solutions, ensuring that both the problem and its resolution are thoroughly examined (Designcouncil; UNICEF).

Phase 1 - Discover - Research Phase

During the discovery phase, the first half of the double diamond — the focus lies in identifying the problem space (Design Council), uncovering opportunities or unmet needs, and beginning to define the initial parameters and constraints of the potential solution space.

To comprehensively explore the Neonatal Intensive care experience, the discover phase was divided into two primary areas:

- **Primary Research (Field Research):**

This phase involved research methods such as interviews, observations, and direct engagement with key stakeholders, including parents and neonatal staff, as described in previous chapters.

- **Secondary Research (Desk Research):**

A systematic review of existing literature was undertaken to examine the current state of challenges in NICU healthcare, with a particular focus on parental well-being and comfort in healthcare setting and active participation. The review included an analysis of family-centred care models, their historical evolution, and evidence-based improvements in NICU environments.

Phase 2 - Define - Synthesis

Synthesising insights from both primary (interviews, observations) and secondary (literature) research helped reframe the design challenge, following the guidelines of the Design Council.

The analysis was organised around two key focus areas: physical spaces and service-related touchpoints. Physical spaces include layout, visual design and sensory elements of the environment — all of which significantly influence emotional well-being and user experience (Canoa). Service-related touchpoints, informed by service design theory, refer to specific moments of interaction within neonatal care that shape parental experience and satisfaction (David & Singer, 2015).

Organising insights into these categories allowed for the development of thematic clusters, forming a clearer framework to address NICU-specific challenges. This phase culminated in a patient journey map, which takes the user's point of view and explains their experience of the service (Design Council). Visually outlining the stages, emotions, and opportunities parents encounter throughout their NICU experience (see Appendices 3).

Phase 3 - Develop - Ideation

The insights gained during the journey map were translated into actionable design directions through the lens of Ulrich's *Supportive Design Theory*. The components of this theory provided a structured framework for narrowing the research focus and formulating a clearly defined problem statement.

The process transitioned into the ideation phase, evaluating various approaches to address core challenges. The "*How Might We?*" (HMW) question is a design tool that reframes the challenge as an opportunity for ideation and creative problem-solving (Interaction Design Foundation).

Phase 4 - Deliver - Solutions

The main focus of the delivery phase was to generate potential solutions, with a particular emphasis on evaluating and refining the most promising concepts for implementation. This process, known as idea generation or ideation, follows an agile, iterative approach (Norman, 2013, p. 226). The process is structured into three key stages: prototyping, testing, and refining — allowing for continuous improvement and adaptation.

3 SYNTHESIS

The chapter explores the impact of environmental and service design elements on the experiences of parents and staff in the Neonatal Intensive Care at Tallinn Children's Hospital, integrating findings from field research with Ulrich's Supportive Design Theory.

3.1 Supportive Design in Healthcare

Historically, noise, light and infection control have been the primary focus of healthcare environmental design research (Shepley, 2006). While hospitals are primarily designed to provide top-tier medical care, the impact of design on patient recovery and overall well-being is often overlooked (Relling, et al. 2008). However, growing recognition of the environment's role in the healing process has brought it to the forefront of concern among healthcare providers, environmental psychologists, consultants, and architects (Devlin & Arneill, 2003). Here, I wanna highlight the groundbreaking contributions of Roger Ulrich, PhD, a leading figure in evidence-based healthcare design research.

A pivotal moment in healthcare design came in 1984 with Ulrich's study, *"View Through a Window May Influence Recovery from Surgery,"* which introduced the concept of *"healing architecture"* (Rainey, 2019; Ulrich et al., 2008). This concept emphasises how the architectural and design features of healthcare facilities can enhance patient experiences and outcomes (Jaušovec & Gabrovec, 2023). Originally applied to acute care and intensive care units (ICUs), these principles were later adapted for neonatal intensive care units (NICUs) in the mid-1990s, focusing on developmental care for infants and integrating parents as active participants in care (Vogel, 2022). This shift has led to the exploration of interventions for NICU designs that emphasise family-centred care, creating more inviting and supportive spaces for families.

For the thesis, for the help of exploring design interventions, I analyse Ulrich's (1991) theory of supportive design. For Ulrich, stress is a significant barrier to recovery and his theory is grounded in the well-established fact that most patients experience stress during their hospital stay. This means healthcare environments should be designed to avoid introducing additional stressors and instead facilitate access to elements that reduce stress (Ulrich, 2000; Ulrich, 1979; Ulrich et al., 2006; Ulrich et al., 2008). Hence, these design considerations may increase parental well-being and benefit parents-infant bonding, visitors, and healthcare staff alike.

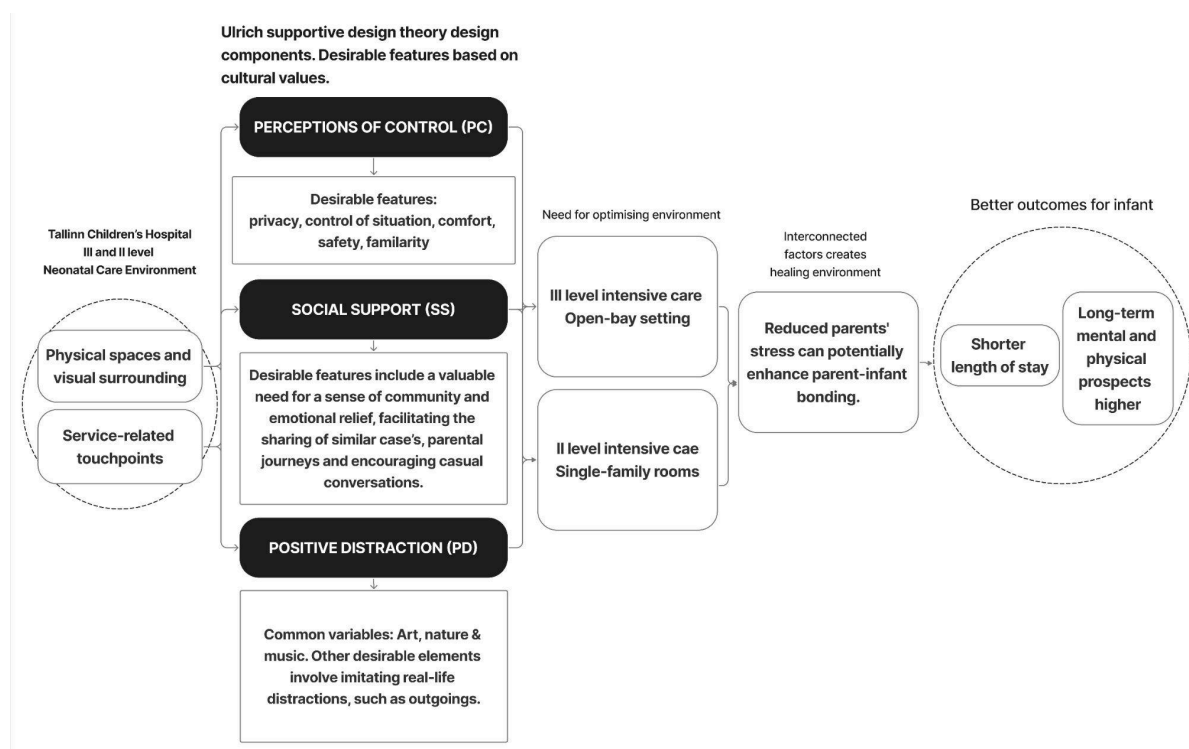


Figure 7. Illustrating the mapping of the interconnected impact of Ulrich's Supportive Design Theory, as viewed by the author, and how it can create a healing environment for both parents and their infant. Created by author.

Ulrich suggests that hospital environments can mitigate stress if these three components are used in healthcare setting:

- **sense of control**
- **social support**
- **positive distraction**

This theory was selected for the thesis because it strongly resonates with my personal experience of being with my infant in a high-level intensive care unit at Karolinska University Hospital. During this emotionally intense period, I became acutely aware of how environmental and service-related touchpoints, beyond clinical care, profoundly shaped my emotional well-being and sense of control. This experience sparked a more in-depth interest in healthcare design and healing environments, ultimately leading me to the foundational work of Roger Ulrich and his Supportive Design Theory.

A related theme in neonatal care is explored in the research article "Transforming the NICU Environment for Parent and Staff Wellbeing: A Holistic and Transdisciplinary Supportive Design Approach," which demonstrates how the thoughtful redesign of non-clinical NICU spaces can enhance the well-being of both staff and parents. While that study centres on shared environments and general well-being, this thesis adopts a more personal and layered perspective, shifting the focus toward how these spaces affect the parent-infant relationship, particularly in high-intensity care contexts. It investigates how design and care practices can more effectively foster bonding, emotional resilience, and, ultimately, improved infant outcomes.

3.1.1 Component of Perceived Parental Control

Personal control refers to an individual's ability to influence and manage aspects of their environment and life circumstances (Fisher, 1990; Kopec, 2018, p.15). According to Shepley (2017, p.29), personal control is "*offering choices increases an individual's sense of control and thereby reduces stress*," underscoring the psychological benefits of environments that support autonomy. Research consistently shows that individuals who perceive a greater sense of control in stressful situations are coping better, report lower stress levels, and experience improved overall health compared to those who feel powerless (Ulrich, 2000; as cited in Evans & Cohen, 1987; Ulrich, 1999). Kopec (2018, p.271), in *Environmental Psychology for Design*, further highlights that much of the stress experienced in healthcare environments arises from a loss of privacy, disruption of familiar routines, and separation from the home environment — all of which increase vulnerability and lessen a person's sense of control. Control can often shift, with healthcare providers having authority over patients. (Kopec, 2018).

According to James Averill (1973), there are three types of control we have over our surroundings:

- **Behavioural control** – The ability to take action and influence what happens. Good design supports this by offering different ways to reach a goal.
- **Cognitive control** – The ability to change how we think about a situation. Flexible design helps people see things from different perspectives and better understand their environment.
- **Decisional control** – The ability to choose how to respond. Design that offers options gives users a sense of choice and control.

In the highest intensive care, strict routines and safety procedures are essential for protecting vulnerable infants. However, these protocols unintentionally limit parental involvement, leaving many parents feeling powerless.

During my time in the ECMO unit, which was an open-bay setting at Karolinska University Hospital, I often felt helpless, unsure how to participate meaningfully in my infant's care. Gradually, small opportunities to engage began to emerge, such as cleaning, providing gentle touch, and practising kangaroo care, all of which helped restore a sense of agency. One nurse introduced the idea of exchanging scents between the infant and parents. Although this was a one-time gesture and not a sustained practice, it offered a brief but meaningful sense of connection. Over time, I began to initiate my routines, such as reading fairy tales — something the nurses noted had a calming effect on my infant's saturation levels.



Figure 8. Karolinska University Hospital, ECMO Unit – Open-Bay Setting. Illustrates the nature of high-intensity care. Photo by the author.

These experiences resonate with interviews from Estonian parents, particularly first-time mothers, who echoed similar emotions. Many expressed anxiety about how to participate, whether their presence was helpful, and how to navigate the clinical environment, especially within open-bay settings. Stress and fatigue are often intensified when fundamental needs such as emotional support, privacy, and autonomy are unmet or inconsistently provided.

The experiences for parents of preterm infants can vary significantly throughout the entire care journey — from the perinatal period to post-discharge home care (Frank et al., 2017). At Tallinn Children's Hospital, the sense of control parents experience depends largely on the level of care needed and the physical design of the NICU, whether it's Level III open-bay settings or Level II single-family rooms.

Level II single-family rooms provide a private, continuous caregiving environment, allowing mothers to stay full-time with their infant. They also offer a nurturing sensory environment, shield preterm infants from harmful stimuli, and foster healthy parent-infant bonding by promoting privacy, intimacy, calmness, and security (Lehtonen & White, 2020).

In contrast, Level III highest intensive care, where infants need intensive support, allows parents to visit during daytime hours and provides a space with a chair close to the infant's bed. In the context of preterm infants requiring the highest level of medical attention and being placed in incubators, opportunities for parental caregiving are limited, particularly during the first few weeks when physical contact is limited. This limited interaction can leave parents feeling helpless.(Heinemann et al., 2013)

One seemingly minor yet impactful element in open-bay is the presence or absence of a chair next to the infant's bed. Although easily overlooked, this chair is symbolic of belonging and parental involvement, as it serves as the primary place for parents to spend extended periods of time. Some occasions, the chair may be missing upon arrival, requiring parents to retrieve one from elsewhere. This simple inconvenience can amplify a sense of displacement.

This small act, ensuring a chair is in place, carries significant emotional weight. As supported by interviews with parents, the presence of the chair is seen as a signal of welcome and readiness for parental involvement. It communicates, in a non-verbal way, that parents were not only allowed but expected to be present. This highlights how small environmental details influence perceptions of inclusion and support in the service-related touchpoint.

This experience was echoed in my own experience: on multiple occasions, the chair was not initially present, which led as parents to hesitation and concern about potentially disrupting medical routines. However, the nursing staff responded promptly, always bringing a chair. In most cases, the absence was due to medical interventions or

necessary spatial adjustments.



Figure 9. Illustrative photos of the Level III open-bay room, taken from <https://ehitus5eco.ee/portfolio/sa-tallinna-lastehaigla-intensiivosakonna-rekonstrueerimine-tervise-28-tallinn/> during its reconstruction, as the author was unable to capture images from the real-life setting.

Another inevitable challenge in caregiving area, Level III intensive care open-bay rooms is the lack of privacy, as open layout means multiple infants and families share the same space, which can inhibit bonding behaviors such as speaking or reading to one's baby. This need for privacy is especially important in Estonia, where cultural values emphasize personal space (Settle Estonia, 2021). Ethnographic insights suggest that shared environments can feel uncomfortable for many Estonian parents, making it more difficult to relax or feel emotionally safe. Mother described the experience in an open-bay rooms:

"The experience in an open-bay room can vary greatly depending on who you share it with. There were no wall separations, so I had no privacy and often worried about the exposure to other patients and their neonates"

"There were many times when I wanted to cry, but I didn't want to express my feelings openly, especially near my ill child. I had no place to cry and be alone for a moment"

For some parents, the lack of privacy in the NICU can quickly become normalised. They adapt, suppress discomfort, and come to accept it as an inherent part of the experience. However, for others who struggle to adjust, the absence of privacy remains a persistent emotional barrier. It can heighten stress, disrupt bonding moments, and create feelings of vulnerability or exposure. What becomes routine for some may still feel deeply

intrusive for others, highlighting the need for more adaptable and inclusive environmental solutions.

The resting room can offer a temporary escape in terms of privacy, as it may be occupied. However, it does not meet the needs of all parents, particularly those seeking solitude or emotional retreat. For some, stepping outside is not a viable option either. As one mother explained,

“There are still people outside, and when you're already emotionally burned out and vulnerable, you don't want to see anyone. Home remains the only true place of emotional refuge, yet the hospital day is long. I was there for months, everyday.”

Some parents seek solitude in their cars to find a quiet moment to decompress. While not ideal, this shows how critical private spaces or semi-private areas are during intensive care. The same need applies to daily activities like breast milk pumping, which adds another layer of stress. Although a designated area is meant to be near the infant, as the nurse explains, and is intended to stimulate milk production. Yet, this setup is not suitable for all parents. Given that pumping is typically required every 3-4 hours, some parents feel vulnerable and find the process more stressful.

Having a private and quiet space is essential for many parents, as some believe it can significantly influence both their milk supply and stress levels during their time in the NICU. While there is a designated area for pumping located within the restroom, it is small and separated only by a clinical curtain. Feedback from mothers indicates that this space is rarely used, primarily because it lacks true privacy. Since it is located in a shared restroom, many parents feel uncomfortable using it when others are present.

Recognising these diverse needs is key to improving the overall experience of families in intensive care. Providing more flexible environments can ease parental stress, promote bonding, and support mental well-being. Even simple additions like self-care options or a quiet corner can offer parents micro-moments of autonomy and comfort.

For many families, care either begins in or transitions to Level II, where single-family rooms enable round-the-clock cohabitation. Parents in these rooms reported a stronger sense of bonding, comfort, and emotional security. Some even described the space as “hotel-like” due to its privacy. However, this increased autonomy also poses challenges.

Spending long periods indoors with limited social interaction can lead to feelings of isolation.



Figure 10. *Illustrative photos of the Level II Single-family room at Tallinn Children's Hospital. Taken by the author.*

This shows the need for an optimised environment — II level care that offers privacy for bonding, but it needs spaces or routines that can promote light social contact, time outdoors or distraction from the healthcare setting. As mothers remain with their infants, fathers often juggle work and family responsibilities at home, creating a fragmented care dynamic. Hence, isolation is difficult, especially for parents who lack a strong support network or live far from the hospital. Further discussed in the chapter, Components of Social Support Opportunities.

Although many aspects of NICU life are unchangeable due to clinical necessity, thoughtful design can help restore a sense of control. Interviews and observations highlight the importance of designing with cultural norms and daily needs in mind.

3.1.2 Component of Social Support Opportunities

Social support is a well-known psychosocial factor that influences health outcomes. Research has shown that hospitalized patients often experience high levels of stress (Ulrich et al., 2006), and this is especially true for parents with babies in NICU. In these settings, social support plays a critical role in helping parents cope with emotional challenges (Coppola, et. al 2013).

As described in the previous chapter on Level III and Level II care, a parent's sense of control is shaped not only by medical routines but also by the physical environment. Social support is not just an emotional need but also a spatial opportunity, as certain physical spaces can either encourage or hinder interaction with others.

In Level III intensive care, the resting room serves an important function. It is more than just a space for a quick coffee or snack- It becomes a hub for social interaction. Parents often gather there to talk with others going through similar experiences. This shared space provides a valuable sense of community and emotional relief. For many parents, the ability to talk with others who understand their situation becomes a key coping mechanism.



Figure 11. *Illustrative photos of the Level III Open-bay room at Tallinn Children's Hospital. Taken by the author.*

By contrast, the Level II care environment offers a different experience. The resting room is designed with a home-like atmosphere that contrasts with the clinical setting. While this space is appreciated in theory, it is significantly underused by mothers. Mothers, who are typically the primary caregivers, often choose to stay in the single-family rooms to remain close to their infants. Two main reasons contribute to this: first, the emotional difficulty of leaving their baby, and second, a limited sense of trust toward the nursing staff. This trust is often built selectively through individual interactions, and when it is lacking, mothers feel uncomfortable stepping away, even briefly. As a result, their

engagement with communal areas like the resting room is reduced, further limiting opportunities for social connection and emotional relief.

Fathers, by contrast, are more likely to use the resting room for short breaks or work-related activities. This distinction highlights how the spatial needs and routines of parents are shaped not only by the NICU's physical environment but also by interpersonal dynamics and caregiving roles.



Figure 12. Illustrative photo of the renovated Level II restroom. Taken by the author.

While single-family rooms in Level II provide privacy and comfort, they limit opportunities for organic, informal interactions. Many parents express a need for social contact during their stay in a single-family room, to have someone to visit them daily for brief conversations or emotional check-ins. As some mother have expressed,

"I really needed face-to-face or parent-to-parent contact with another mother or person, but it was difficult, because I didn't want to invade someone's personal space. One surprising moment was when I walked down the corridor, saw another mother, and gathered the courage to speak. I asked her to join me in the resting room for a short break."

"Women in the single-family rooms should be encouraged to spend at least 15 minutes outside each day. I stayed indoors for three consecutive days without going outside, and it didn't feel healthy."

This highlights that even within private care settings, the fundamental human need for social connection remains. Informal encounters, such as passing another parent in a hallway, can offer unexpected moments of support. However, there is a need for purposeful design strategies that encourage parents to gather together or gently nudge them towards brief informal interactions, such as light activities, short conversations, or simple support groups, which can be beneficial.

A good example of an environment that fosters informal connections is the “Neonatal Village” at Oklahoma Children's Hospital. There, private rooms are arranged around the perimeter, while a shared central area serves as a welcoming space where families and staff can meet, rest, eat, or talk (BabyFirstChannel, 2014). This central co-mingling zone supports spontaneous social interaction and illustrates how thoughtful architectural planning can support both privacy and community.

The current layout of the Level II private rooms at Tallinn Children's Hospital places them along a long, narrow corridor with a single nurse station and a restroom at the end of the hallway. This design offers physical separation but contributes to emotional isolation, particularly for mothers who spend long hours alone with their baby.

Unlike the Level III open-bay care, the restroom naturally encourages interaction among families, the spatial configuration of Level II reduces opportunities for informal support. Paradoxically, although single-family rooms are designed to strengthen family-centred care, they can feel more mentally taxing than traditional open-bay settings. Some parents find the emotional weight of isolation heavier than the lack of privacy in a shared space. This comparison underscores the importance of designing environments that balance the need for privacy with intentional opportunities for connection and peer support. These small interventions can make a significant impact on daily coping, as the NICU environment plays a crucial role in how such support is accessed.

3.1.3 Component of Positive Distraction

In the high-pressure atmosphere of a neonatal intensive care unit (NICU), parents are entirely focused on their infant's survival and medical progress. Yet to maintain emotional resilience and avoid psychological burnout, it is important to create moments for mental rest and self-care. By identifying the right positive distraction strategies, healthcare providers can redirect attention from distress and promote a sense of control,

contributing to better psychological outcomes for both patients and their families (Ulrich, 1997; Mohammed et al., 2023; Shepley, 2006).

Traditionally, elements such as natural views, soothing music, and artwork have been used effectively to reduce stress in healthcare settings, as these components help create spaces that foster calm, comfort, and healing (Shepley, 2016; Mohammed et al., 2023; Kopec, 2018, p.58) This aligns with Ulrich's concept of positive distraction, stimuli that evoke uplifting emotions, effortlessly capture attention, and help reduce distressing thoughts (Devlin & Arneill, 2003).

For example, at Karolinska University Hospital in Sweden, the author observed a thoughtful implementation of positive distraction within the ECMO unit. Staff actively encouraged parents to take breaks, offering free tickets to the Haga Ocean Butterfly House, which provided a peaceful, immersive environment for families to recharge. Additionally, nearby parks or museums were recommended, emphasising the importance of self-care during emotionally challenging times. These initiatives reflect a holistic understanding of family-centred care, recognising that supporting parental well-being indirectly enhances the care and recovery of their child.

Although the close area around Tallinn Children's Hospital lacks a strong connection to parks — which does not mean that creating a calming environment is impossible. If the hospital's design or geographic location makes it impractical to offer beautiful garden views, nature-inspired design can still provide a similar sense of tranquillity and peace of mind. Through carefully selected visuals and design choices, it can offer valuable moments of respite for parents, helping them manage the stress and emotional challenges they face.

This approach aligns with the well-documented restorative effects of nature in healthcare settings. Ulrich's early research has shown that patients recovering from surgery healed faster and required less medication when they had views of greenery instead of a brick wall (Ulrich, 1979; Ulrich et al., 1993). Further supporting this, a study conducted at a university hospital in Sweden found that patients responded more positively to realistic nature scenes than to abstract artwork, which was often perceived as less comforting (Ulrich et al., 1993, Devlin & Arneill, 2003). This foundational work helps solidify exposure to nature as a core principle in healing design.

Positive distraction can take simpler forms, such as photographs, reading materials, or nature-based imagery. These static elements provide moments of calm and familiarity, especially in otherwise sterile or clinical spaces (Rivera & Karsh, 2010; Jiang, 2020).

At Tallinn Children's Hospital, I observed the current setting of the role of positive distraction through visuals in different rooms. The most common visual elements were pictures of infants, often showing the progression of children from illness to health, then and now. The purpose of pictures of preterm infants is to foster emotional attachment or to provide a sense of progress and reassurance. Hence, parental feedback on these pictures varied. One parent shared,

"I saw how sick children grew beautifully, and it gave me hope during difficult moments."

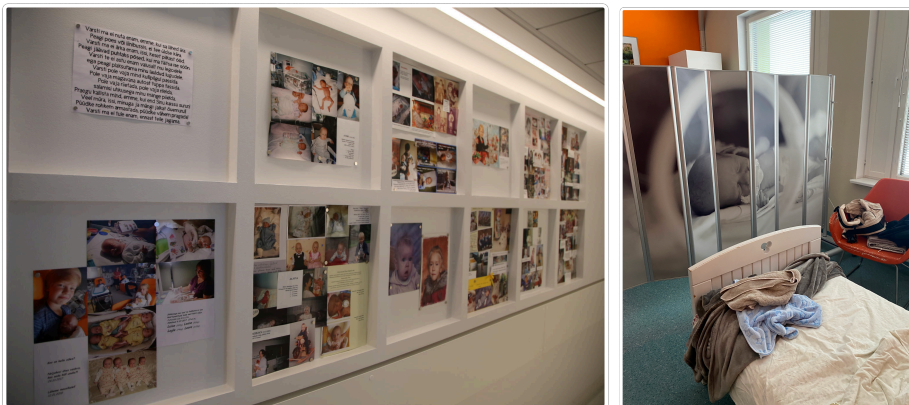


Figure 13. Illustrative photos of visuals observed at Tallinn Children's Hospital. Taken by the author.

However, other parents found the images distressing, particularly those depicting critically ill infants or reminding them of disrupted bonding experiences. This underscores the importance of personalising positive distraction strategies, as not all visual stimuli have the same emotional effect on every parent. In some parts of the hospital, images of preterm babies were also used on private walls. While this can be uplifting, using more neutral and universally calming imagery, like nature scenes, might better accommodate diverse emotional responses.

While visuals are intended to enhance the environment, as Piatkowski (2017) argues, adding pleasant features to a room can help reduce stress, there is a limit. Beyond a

certain point, too many stimulating elements may overwhelm the senses and create a sense of chaos rather than comfort.

Positive distraction is gaining increasing attention as an effective strategy for enhancing the NICU environment. This principle has also been central to a workshop titled "Reimagining the NICU: A Human-Centred Design Approach to Healthcare Innovation" which emphasises the integration of nature, art, and music into NICU design. Recommendations included incorporating outdoor views, nature-themed murals, and individually tailored music for soothing stimulation.

Music therapy is a growing field (Ettenberger et al., 2021), reflecting this more holistic approach to care. Tallinn Children's Hospital is at the beginning of introducing music therapy, demonstrating a commitment to supporting both infants and their families. Music has been shown to reduce stress, reduce unwanted environmental noise (Devlin & Arneill, 2003), and offer a form of distraction, mainly valuable in the typically noisy NICU setting, where it can serve as "white noise" to mask disturbing sounds (Shepley, 2006).

The *Reimagining the NICU* workshop also highlighted the potential of immersive technologies, such as virtual and augmented reality, as promising tools for enhancing emotional support in clinical settings (Mohammed et al., 2023). These technologies enable multisensory engagement, offering both distraction and sensory stimulation, which can alleviate distress and better meet the needs of young patients (Jiang, 2020), and are well-suited in pediatric care. In Estonia, Pärnu Hospital has successfully implemented an augmented reality device that projects animated film characters to reduce children's anxiety before anaesthesia, effectively diverting their attention from the medical procedure (Vilgas, 2020).

To summarise, elements such as art, nature, and music are well known for providing beneficial diversion in hospital settings, delivering periods of peace, emotional release, and connection, particularly in high-stress conditions such as NICUs. Their effectiveness, however, is determined not only by general psychological benefits, but also by cultural context and individual sensitivity. This underscores the need of creating emotionally and culturally responsive surroundings. In both Level II and Level III intensive care, incorporating positive diversions can improve emotional well-being, assist parental control or promote social connection.

3.2 Conclusion and Discussion of Opportunities

This research highlights the nuanced interplay between NICU design and the lived experiences of parents. While both open-bay (Level III) and single-family room (Level II) NICU settings aim to support vulnerable infants, each environment presents distinct challenges and affordances in terms of family-centred, supportive design.

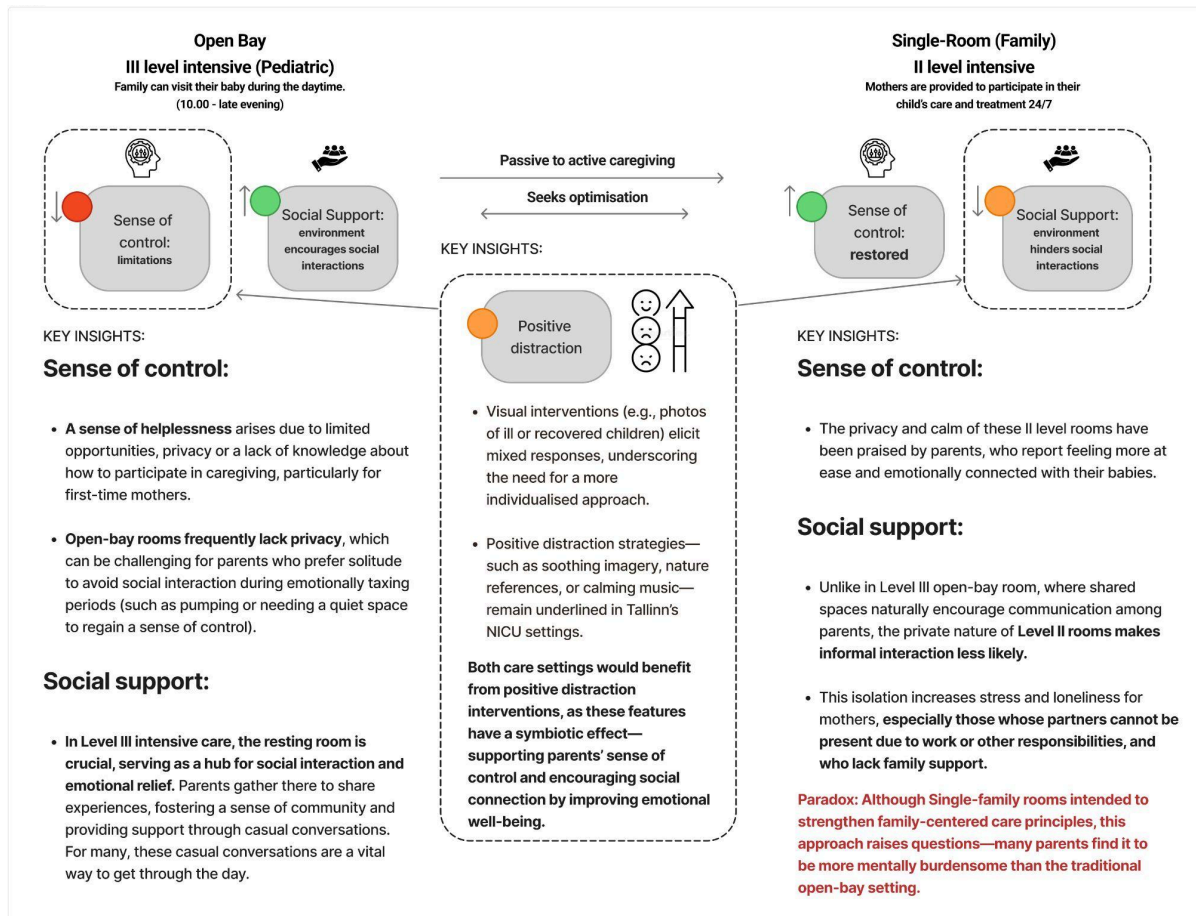


Figure 14. Comparison of Open-Bay Level III and Single-Family Level II key insights and recurring themes identified through Ulrich's Supportive Design components, based on data analysis. Created by the author.

1. Personal Control: Limitations and Possibilities

In Level III, rigid clinical routines, spatial openness, and the absence of privacy contribute to a sense of helplessness, particularly in the early weeks when physical contact with the infant may be restricted by preterm. Many expressed anxiety about how to participate, whether their presence was helpful, and how to navigate the clinical environment within open-bay settings.

Compared to Level III, Level II care allows for greater parental autonomy. However, taking on a full-time, continuous caregiving role can become overwhelming. The lack of a sense of community may lead to isolation and emotional fatigue. This experience resonates particularly with mothers who have spent extended periods in the hospital, often feeling alone in their caregiving journey.

How might we...

restore a sense of autonomy in open-bay settings by enabling small, meaningful caregiving choices?

leverage transitional spaces to support moments of decompression and emotional reset?

2. Social Support: Fragmented Access

Social support is vital but unevenly accessible. In open-bay settings, incidental parent-to-parent interactions offer a spontaneous emotional connection. In contrast, the single-family room model prioritises privacy but may isolate mothers, particularly those without close social support. This contrast highlights the need for purposeful design strategies that encourage parents to gather together or gently nudge them towards brief informal interactions, such as light activities, short conversations, or peer support. It can enhance emotional support and reduce feelings of isolation.

How might we...

design for informal social interactions in II level from full-time caregiving, through spatial nudges in semi-open areas like hallways, lounges, or shared thresholds?

3. Positive Distraction: Inconsistently Applied, Yet Deeply Impactful

Positive distraction strategies, such as soothing imagery and references to nature, remain underutilised in Tallinn's NICU settings. Visual interventions, like photos of recovering children, tend to elicit mixed reactions, highlighting the importance of a more individualised and sensitive approach. Although the hospital lacks direct access to nature or nearby parks are too distant, integrating nature-inspired or abstract design elements indoors can help create a calming atmosphere and provide moments of emotional relief.

How might we...

integrate sensory-friendly, culturally responsive forms of positive distraction into both private and shared NICU spaces?

4. Overall synthesis: The Need for Layered and Flexible Design

The analysis adopted a holistic perspective by exploring the interaction between spatial and service-related elements of the NICU environment and evaluating their combined impact on parental experience and emotional bonding. The findings enhance our understanding of how various factors can either hinder or support optimal clinical practices.

People respond differently to unexpected and distressing events, while some cope with them more easily, others may find them particularly challenging. Based on this, the analysis suggests that no single spatial solution is universally optimal for all NICU families. Instead, layered environments, which offer an optimisation and continuum between privacy, interaction, and retreat, can help meet the diverse needs of parents throughout the NICU journey. Addressing these evolving needs, the emotional experiences of caregivers(family) are not additional but essential to family-centred care, with the physical environment playing a critical role.

4 DESIGN CONCEPT

Based on the synthesis of conclusions, the design proposals focus on the Level III Open-Bay NICU setting, which demonstrates more complex challenges, such as limited privacy, disrupted opportunities for bonding, and fewer supportive design interventions, compared to the single-family room environment.

To improve the parental experience in this high-acuity care context, a service blueprint was developed to map the care journey from both parental and staff perspective (see Appendices 4). This visualisation tool allowed for a comprehensive overview of the service delivery process from admission onward, helping to specify touchpoints where targeted interventions could improve the family experience.

These insights advised the development of interventions with design features within two key areas of the open-bay environment: the restroom and caregiving area. Proposed interventions aim to enrich both functionality and bonding, while being supportive and practically feasible within the constraints of a medical setting. By embedding small-scale but meaningful proposals seeks to create a more emotionally responsive and inclusive care environment without disrupting core clinical workflows.

4.1 Design Proposal 1

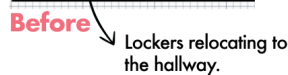
Reimagining the Parent Restroom Experience

This initiative aimed to reimagine the parent hub space, recognising its vital role in fostering social support. However, interviews highlighted a significant gap: the absence of a dedicated area for privacy and emotional respite, which many parents identified as an essential need.

To address this, one key proposal suggests removing the current curtained pumping area, which feels stark and overly clinical, especially given that it also functions as a restroom. In its place, the vision is to create a separate, dedicated area designed with soft, home-like décor and natural design elements, such as plants. Such a space would offer a cocoon-like atmosphere, supporting the emotional rhythms of caregiving by providing parents with a comforting environment for rest, reflection, or breast pumping.

Furthermore, the plan includes relocating the lockers to the hallway to free up valuable space within the parent hub. This change also allows for improvements in locker

Another proposed feature is a children's bookshelf, which contributes to a more homely atmosphere and offers subtle, comforting cues that may support parent-infant bonding during difficult times. Importantly, this bookshelf also serves the needs of other young children, since the Level III unit accommodates pediatric care beyond neonates.



A. Privacy room

50

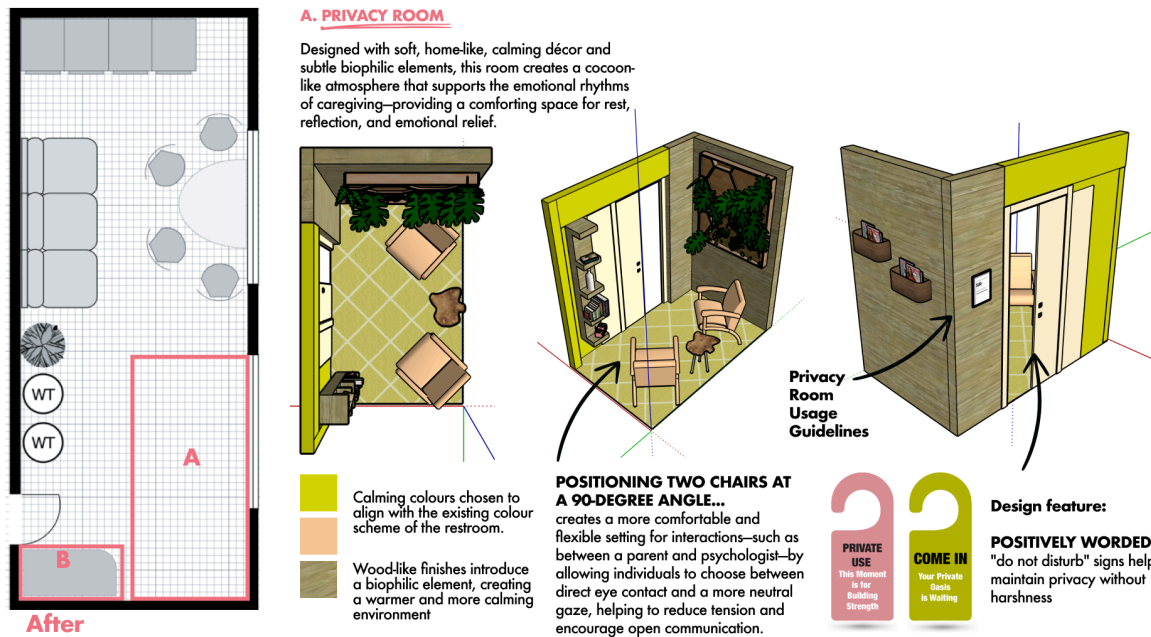


Figure 16. Visualisation of the redesigned private room area (A), highlighting key spatial features and supportive elements, rendered using SketchUp to illustrate the proposed design intentions. Created by author.

Value offer

This small room is designed to support a range of layered needs, offering a flexible, private space that enhances the overall family-centred care environment. It serves as:

- a private retreat for parents seeking a moment of solitude or emotional regulation,
- a dedicated area for mothers who feel uncomfortable pumping breast milk near their child or in shared spaces - an activity typically needed every 3–4 hours.
- a discreet and supportive setting for sensitive conversations, such as parent-psychologist interactions - who currently lack an appropriate space for such interactions.

Design Considerations

This concept extends beyond the physical room itself. Attention to small design details is crucial in shaping a more respectful and humane experience:

- **Usage Guidelines:** Clear, empathetic guidelines can help ensure equitable use of the room while respecting the needs of all families.

- **Door Signage:** A positively worded, easy-to-read sign can indicate whether the room is occupied, promoting privacy with warmth rather than formality.

These elements together support a more validating and user-centred approach to care, illustrating how even modest interventions can contribute to a more emotionally supportive hospital environment.

Other Future Consideration

- **Acoustic panels/materials:** To absorb outside noise, creating a sound-insulated, tranquil atmosphere.
- **Headphone dock:** Wireless headphones or a docking station for personal or guided relaxation audio sessions.
- **Occupancy sytem/detection:** Implementing a discreet occupancy system to indicate when the room is in use, helping to prevent unintentional disturbances and ensuring privacy without intruding on the space.

* Although the design proposal is intended for the restroom, this concept acts as inspiration for future spatial improvements across the hospital. Rooted in human-centred, design-led thinking, it reflects insights drawn from real experiences and evolving family needs within the NICU setting.

B. Bookshelf of Children Books

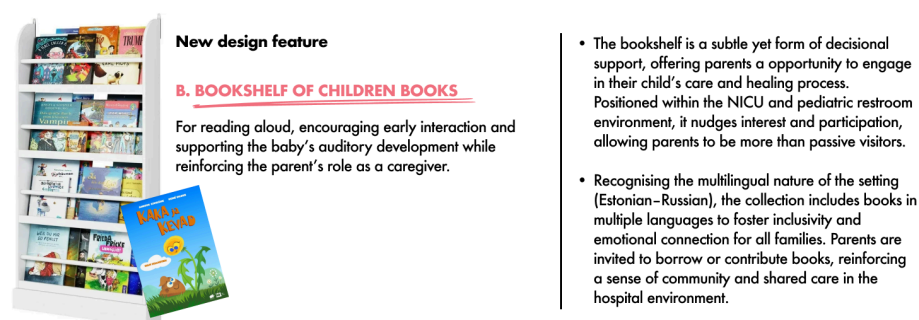


Figure 17. Visualisation of the proposed children's bookshelf as an integrated object suitable for placement in the parent restroom; design concept informed by inspirational imagery sourced from Google Images.

Preterm infants are at increased risk of delayed language development due to both neurological vulnerability and limited exposure to the natural soundscapes of the womb

(Barre et al., 2011; Ståhlberg-Forsén et al., 2021; Caskey et al., 2014). Yet, their developing brains possess remarkable plasticity, allowing them to respond and adapt to environmental stimuli (Ståhlberg-Forsén et al., 2021). Emerging research shows that exposure to a mother's live voice in the NICU not only enhances physiological stability and nutritional intake in preterm infants but also reduces maternal anxiety, benefiting both infant and parent (Filippa et al., 2017; Filippa et al., 2025).

"At Tallinn Children's Hospital, one mother shared how she brought a book from home and quietly read to her baby at the bedside. This simple, spontaneous gesture became both a source of emotional comfort to me and a way to bond during a highly stressful time."

However, another mother expressed uncertainty about whether such an action would be meaningful, and as a result, did not engage in it. Such moments highlight how small environmental cues, like the availability of reading materials, can gently encourage parent-infant interaction.

The European Foundation for the Care of Newborn Infants (EFCNI, Moen A, Hallberg B et al., 2018) have recommended that NICUs provide supportive acoustic environments, not only to reduce harmful noise but also to ensure speech privacy for families. In response, a small but intentional design intervention has been proposed for the parent restroom: a children's bookshelf stocked with simple, multilingual storybooks. This addition acts as a cue for bonding through language, while also fostering a shared caregiving culture by inviting families to borrow or contribute books.

To ensure speech privacy for parents, it is important to consider how the caregiving area in open-bay NICUs can be designed to better support confidential communication and encourage emotionally meaningful, developmentally supportive parent-infant interactions.

4.2 Design Proposal 2

Enhancing Emotional Closeness in Caregiving Area

This design proposal for the caregiving area focuses on two key elements: enhancing spatial dignity and privacy, and introducing a curated bonding-box that fosters emotional connection through small, meaningful objects.

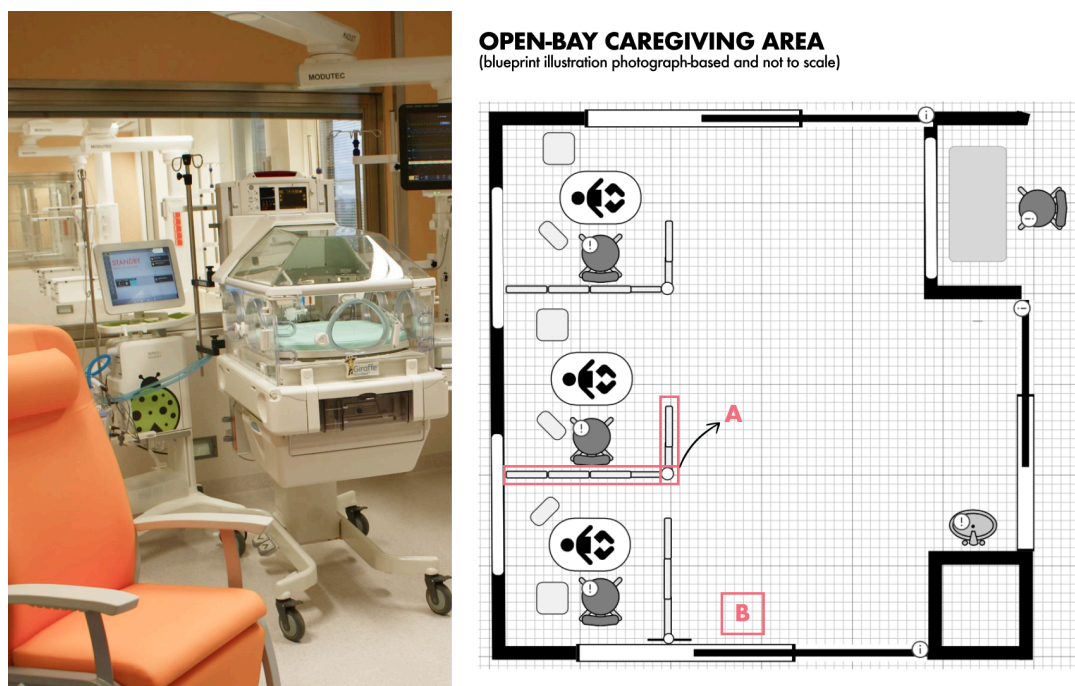


Figure 18. Blueprint illustration of an open-bay NICU room (photograph-based and not to scale), used to conceptually demonstrate the room layout and highlight proposed new design features.

New design feature

A. PORTABLE PRIVACY WALL WITH BIOPHILIC DESIGN

- A flexible, movable privacy wall offers parents the ability to create a more private and comfortable space when needed. Easily adjustable, the wall can be quickly positioned or retracted –ideal for moments when privacy is desired, yet rapid clinical access remains essential. Its practical design supports both family presence and medical responsiveness.
- Incorporating biophilic elements such as natural textures and calming visual patterns helps foster a more soothing environment –not only for parents, but also for staff working in high-stress situations.



New design feature

B. CURATED BONDING BOX - LITTLE STEPS, BIG BOND KIT

- In an environment where bonding can feel out of reach the Bonding Basket **reframes waiting time into bonding time** –helping parents feel more involved, grounded, and connected.
- This thoughtfully assembled kit empowers parents by supporting decisional control—the ability to choose how and when to engage with their infant in the NICU.
- The kits are stored on shelving units with wheels, allowing for easy transport and flexibility. When not in use, the box can be returned to its place without disrupting staff workflows, keeping the environment organized and responsive to everyone’s needs.



Figure 19. Introduction of new design features: (A) Portable privacy wall, created by the "Design Your Screen" product from Silentia, illustrated with descriptive annotations; (B) "Little Steps, Big Bond Kit"—a curated bonding box designed to support parent-infant interaction and promote continuity of care. Visualisation created by the author.

A. New design feature: Portable Privacy Wall with Biophilic Design

As discussed in the synthesis, ensuring privacy within the spatial constraints of open-bay NICU settings remains a challenge. Traditional privacy curtain walls are often too bulky for such limited areas. However, advancements in modular design have introduced systems, such as mobile and foldable privacy screens, that are both safe and user-friendly. These systems offer a balance between flexibility and functionality: they can be quickly deployed when needed and just as easily folded away to allow for urgent medical access. Companies like Silentia have focused specifically on such solutions that respect both clinical workflow and parental comfort.

In conclusion, incorporating neutral, discreet design elements that align with the existing environment helps to create a calming atmosphere, an important balance in a setting that is already emotionally and clinically intense.

B. New design feature: Little Steps, Big Bond Kit

The Little Steps, Big Bond Kit, referred to as the parent-infant bonding, is designed to empower parents in the neonatal care by enhancing decisional control, as discussed in the chapter "Components of Perceived Parental Control." This portable, **parent-centred kit** provides both educational materials and sensory tools, helping parents recognise bonding opportunities and make informed, personalised choices about how and when to engage with their infant.

In interviews, many parents expressed a desire for more accessible, relatable information about preterm care and bonding practices. Others noted a need for tools that could support their emotional journey, such as a diary to mark milestones or reflect on their experience.

Drawing on these insights, the kit could include:

- Educational brochures tailored to first-time NICU parents
- A children's book, which parents can select from the communal bookshelf, encourages early interaction through reading aloud
- A soft cloth scent pack to facilitate scent exchange between parent and infant
- An intensive care diary, designed for documenting emotions, milestones, and daily reflections

- Reserved space for future additions, to explore evolving parental needs

For example, interviews revealed that fathers often take a special interest in understanding the medical side of care. To address this, future designs of the kit could include illustrated cards or a simple booklet. These materials would explain the function of common NICU machines and staff roles in approachable, non-technical language.

By combining education, emotional support, and sensory connection, the Little Steps, Big Bond Kit's purpose is to help parents take an active role in their infant's care, fostering confidence, reducing stress, and reinforcing the parent-infant bond, one small step at a time.

How does the bonding-box work?

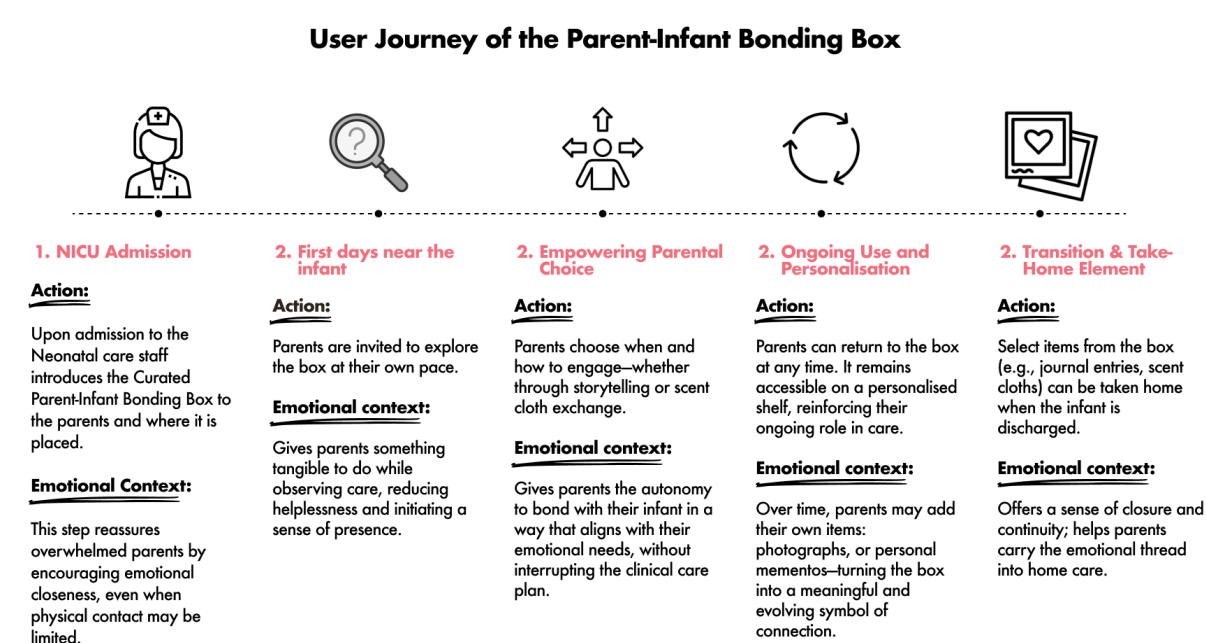


Figure 20. Overview of the user journey for the Parent-Infant Bonding Box, illustrating key interaction points from introduction to continued use. Created by the author.

Value offer

- Empowering Parental Choice

The Little Steps, Big Bond Kit provides parents with gentle, non-intrusive ways to connect with their infant, on their terms and in a manner that respects both their emotional readiness and the clinical realities of intensive care.

In an environment where bonding can feel out of reach, it reframes waiting time into bonding time, helping parents feel more involved, grounded, or connected. In such cases where direct contact, such as skin-to-skin care, may feel overwhelming or physically challenging, especially for mothers who are not mentally ready or are afraid, items like the scent cloth offer an alternative yet empathetic tool for bonding. A 2013 study by Lundström et al. found that a mother's brain responds differently to the scent of her own baby compared to others, suggesting that newborn scent can enhance emotional connection and maternal bonding.

Some parents are ready to engage in their baby's care right away, while others need more time to process the situation and adjust to their new reality. Enabling small but meaningful gestures may help nudge moments of helplessness into moments of connection. It can foster a sense of agency and emotional presence, reminding parents that even when touch is limited, they remain an essential part of their child's care journey. As a feasible and low-cost intervention, it offers high emotional value and contributes meaningfully to family-centred service design.

- Placemaking in care-giving area

To integrate seamlessly into clinical settings, the bonding boxes are stored on mobile shelving units (see Figure 18). This mobility ensures that the kits can be easily accessed and returned without disrupting staff routines, supporting both organisation and responsiveness.

Scent Cloth Service Implementation Scenario

At Tallinn Children's Hospital, an initial trial of cloth scent exchange has been conducted before but not sustained, largely due to the lack of a clearly defined system. This highlights how even a seemingly simple intervention can face challenges in integration without careful planning. Issues such as material selection, hygiene protocols, storage solutions, and clarity over responsibilities (e.g., who washes and manages the cloths) must be thoroughly addressed for successful implementation.

Scent cloth exchange

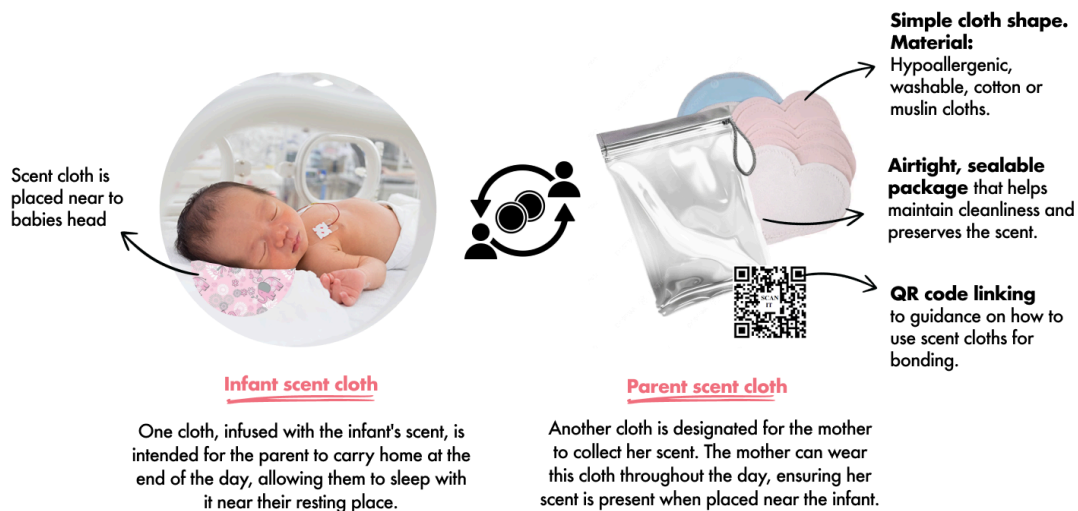


Figure 21. Descriptive image of the scent cloth exchange process. Created by the author.

Designing a Parent Scent Cloth service in the NICU setting requires a system that is hygienic, emotionally supportive, and seamlessly integrated into clinical routines. I propose a next-step concept using soft, hypoallergenic muslin cloths, simple in shape (e.g., square or heart), packaged as a scent kit. Each infant would have 4–6 clothes in rotation to allow for wearing, use, washing, and drying cycles. A scent cloth package would include a QR code providing clear guidance on how to use, wash, and understand the purpose of the cloths, supporting both parents and staff. Further research is needed to determine the most practical cleaning process and designate who is responsible for maintaining hygiene standards: parents, staff, or outsourced laundry services.

In conclusion, developing a sustainable and well-integrated scent cloth system can enhance the dynamic experience of NICU care by promoting bonding in a way that fits seamlessly into staff routines.

4.3 Conclusion and Future opportunities

Investing in research and development is essential for advancing the design, testing, and scaling of innovative approaches to neonatal care (WHO, 2018). Small-scale, context-specific studies are particularly valuable, as they offer insights into the true needs of families and the environmental nuances that shape their experiences in the NICU. Even modest, low-cost design interventions can have a significant impact when they are grounded in real user needs and thoughtfully integrated into care environments.

This thesis has aimed to reflect more deeply on the lived experiences, motivations, and emotional needs of parents, especially mothers, within the NICU context. The thesis insights and proposed design proposals are intended to serve as a foundation for future procurement or spatial planning decisions, demonstrating how seemingly small interventions can support family-centred care in meaningful ways.

However, one important gap remains: the limited inclusion of fathers' perspectives in both research and design. Fathers are vital members of the caregiving team, not only as co-parents but also as emotional support for mothers. There is a clear opportunity to explore design interventions that specifically address fathers' emotional needs and help them feel more grounded, confident, and included in the NICU experience.

Going forward, it is essential that healthcare professionals are actively involved in decision-making processes, particularly in areas such as environmental design, which directly affects staff workload and plays a vital role in long-term sustainability. Equally important is a deeper understanding of, and a deliberate effort to include, the voices of parents. Future design initiatives should be iterative, inclusive, and responsive, driven by a continuous commitment to testing and refining solutions that uphold dignity, provide emotional support, and promote the holistic well-being of all family members.

At its heart, this research calls for a more compassionate, holistic NICU environment — one that cares for the emotional well-being of families just as much as it delivers medical excellence.

5. SUMMARY

This research investigates how spatial and service-related aspects of environmental design support parental well-being and, in turn, foster parent–infant bonding and family-centred care (FCC) — in Neonatal Intensive Care Units (NICUs), with a particular focus on Tallinn Children’s Hospital in Estonia. The study is motivated by both professional interest and personal experience, drawing on an autoethnographic lens to highlight the emotional and psychological complexities faced by families navigating the neonatal care journey.

Globally, approximately one in ten infants is born prematurely, requiring extended hospitalisation in NICUs. For these families, the clinical environment becomes a formative space where early bonding, emotional well-being, and caregiving roles begin to take shape. Despite the increasing adoption of FCC principles in pediatric care, their implementation in everyday neonatal practice remains inconsistent and often constrained by spatial, cultural, and institutional factors.

This thesis compares two levels of care within Tallinn Children's Hospital: the Level III open-bay NICU and the Level II single-family room setting. Using a mixed-methods approach, including semi-structured interviews, field observations, and literature review, the research applied Roger Ulrich's Theory of Supportive Design as a guiding theoretical framework. The theory's core components: sense of control, social support, and positive distraction — serve as lenses to evaluate how the environment influences parental experiences, well-being and opportunities for meaningful involvement in care.

Key findings reveal that while Tallinn Children's Hospital strongly advocates FCC in principle, practical barriers remain, particularly in the open-bay setting. These include limited privacy, as spatial configurations hinder and constrain parental autonomy. In contrast, Level II single-family rooms offer a more emotionally secure environment, enabling continuous presence, enhanced bonding, and reduced parental stress. However, they also present new challenges, such as social isolation and the need for improved social support.

The study culminated in two design proposals for level III open-bay setting: rethinking the parent restroom as a multi-purpose space, and reimagining the caregiving area with flexible, human-centred features such as a portable privacy wall and a curated bonding box. These interventions are designed to be both emotionally supportive and practically feasible within the constraints of clinical care. Emphasis is placed on small-scale, testable solutions that respect the realities of medical workflows while enhancing parental

well-being. Ultimately, this thesis explores how design can contribute to fostering a culture of care within neonatal settings. By integrating the lived experiences of parents with the insights of healthcare professionals, it underscores the value of co-designed, human-centred environments that support not only the survival of newborns but also the well-being and flourishing of families. This work contributes to a growing body of interdisciplinary research supporting for more empathetic, responsive, and inclusive approaches to healthcare design.

KOKKUVÕTE

Käesolevas magistritöös uuritakse, kuidas ümbritseva keskkonna ruumilised ja teenustega seotud aspektid toetavad vanemate heaolu ja soodustavad omakorda vanemate ja imiku vahelist sidet ning perekeskse hoolduse (FCC) loomist vastsündinute intensiivraviüksustes, keskendudes eelkõige Tallinna Lastehaiglale Eestis. Uurimus on ajendatud nii professionaalsest huvist kui ka isiklikust kogemusest, kasutades autoetnograafilist vaatenurka, et tuua esile emotsionaalsed ja psühholoogilised keerukused, millega pered vastsündinute intensiivravi ja hoolduse teekonnal silmitsi seisavad.

Kogu maailmas sünnib umbes iga kümnes laps enneaegselt, mis nõuab pikemat haiglaravi intensiiviosakonnas. Nende perede jaoks muutub kliiniline keskkond kujunemisruumiks, kus hakkavad arenema varajased sidemed, emotsionaalne heaolu ja hooldaja rollid. Hoolimata sellest, et perekeskse lähenemise põhimõtteid võetakse üha enam kasutusele lastehoolduses, on nende rakendamine igapäevases vastsündinute praktikas endiselt ebaregulaarne ja sageli piiratud ruumiliste, kultuuriliste ja institutsionaalsete tegurite tõttu.

Käesolevas töös võrreldakse Tallinna Lastehaigla kahte hooldustaset: III astme intensiivravi avatud palatisüsteemi ja II astme peretubade keskkonda. Kasutades segameetodil põhinevat lähenemisviisi sealhulgas poolstruktureeritud intervjuud, välivaatlused ja kirjanduse ülevaade - kasutatakse uurimuses teoreetilise raamistikuna Roger Ulrichi toetava kujunduse teooriat (Theory of Supportive Design). Teooria põhikomponendid on kontrollitunne, sotsiaalne toetus ja positiivne tähelepanu kõrvalejuhtimine. Need on viisid, mille abil hinnata, kuidas keskkond mõjutab vanemate kogemusi, heaolu ja võimalusi osalemiseks lapse hoolduses.

Peamised järeldused näitavad, et kuigi Tallinna Lastehaigla toetab põhimõtteliselt tugevalt FCC-d, on praktilised takistused endiselt olemas, eriti avatud palatites. Nende hulka kuulub piiratud privaatsus, mida ruumiline konfiguratsioon takistab ning vanemate kontrollitunne. Seevastu II astme perepalatid pakuvad emotsionaalselt turvalisemat keskkonda, mis võimaldab pidevat kohalolekut, paremat sidet imikuga ja vähendab vanemate stressi. Siiski, tekitavad need ka uusi probleeme, nagu sotsiaalne isolatsioon ja vajadus parema sotsiaalse toetuse järele.

Uuring kulmineerub kahe disaini ettepanekuga III astme palatisüsteemides: vanemate puhkeruumi ümbermõtestamine mitmeotstarbelise ruumina ja hooldusalade uute

objektide ettepanek paindlike, inimkeskse funktsioonidega, nagu teisaldatav privaatsussein ja kureeritud kast objektidega, mis aitavad kaasa vanemate ja imiku vaheliste sideme loomisele. Need sekkumised on emotsionaalselt toetavad kui ka praktiliselt teostatavad kliinilise hoolduse piirangute raames. Tähelepanu pööratakse väikesemahulistele, testitavatele lahendustele, mis arvestavad meditsiiniliste töövoogude tegelikkust, suurendades samal ajal vanemate heaolu.

Lõppkokkuvõttes uuritakse käesolevas töös, kuidas disain võib aidata kaasa hoolduskultuuri edendamisele vastsündinute keskkonnas. Integreerides vanemate elatud kogemusi tervishoiutöötajate arusaamadega, rõhutatakse ühiselt kujundatud, inimkeskse keskkonna väärtust, mis toetab mitte ainult vastsündinute ellujäämist, vaid ka perekondade heaolu ja õitsengut. See töö aitab kaasa interdistsiplinaarsete uuringute kasvavale kogumile, mis propageerib empaatilisemat, tundlikumat ja kaasavamat lähenemist tervishoiu kujundamisele.

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LIST OF FIGURES

Figure 1. This model illustrates how both medical care and essential parental involvement contribute to creating an optimal care environment. However, elevated parental stress can negatively impact the infant's neuro-sensory development. Figure created by the author.

Figure 2. The Neonatal and Infant Unit at Tallinn Children's Hospital in Mustamäe. Photo: https://media.voog.com/0000/0038/9993/photos/IMG_3942_block.jpg

Figure 3. Photo: Peeter Vendelin. Tallinn City Clinical Children's Hospital rooms for children and mothers. <https://ajapaik.ee/photo/993585/tallinna-linna-kliinilise-lastehaigla-boksid-lastele/>

Figure 4: Stakeholder map illustrating the impact of Neonatal Intensive Care on the experience and care of parents of newborns. Created by the author.

Figure 5. Photos clustered after observation, highlighting different rooms and their functions within the neonatal care environment. Created by the author.

Figure 6: Combined framework adapted from the Design Council's Double Diamond model and inspired by Dan Nessler's revamped version. An additional methods has been integrated to better align with the context and aims of this thesis. Created by author.

Figure 7. Illustrating the mapping of the interconnected impact of Ulrich's Supportive Design Theory, as viewed by the author, and how it can create a healing environment for both parents and their infant. Created by author.

Figure 8. *Karolinska University Hospital, ECMO Unit – Open-Bay Setting. Illustrates the nature of high-intensity care. Photo by the author.*

Figure 8. Illustrative photos of the Level III open-bay room, taken from <https://ehitus5eco.ee/portfolio/sa-tallinna-lastehaigla-intensiivosakonna-rekonstrueerimine-tervise-28-tallinn/> during its reconstruction, as the author was unable to capture images from the real-life setting.

Figure 10. Illustrative photos of the Level II Single-family room at Tallinn Children's Hospital. Taken by the author.

Figure 11. Illustrative photos of the Level III Open-bay room at Tallinn Children's Hospital. Taken by the author.

Figure 12. Illustrative photo of the renovated Level II restroom. Taken by the author.

Figure 13. Illustrative photos of visuals observed at Tallinn Children's Hospital. Taken by the author.

Figure 14. Comparison of Open-Bay Level III and Single-Family Level II key insights and recurring themes identified through Ulrich's Supportive Design components, based on data analysis. Created by the author.

Figure 15. Photographs and floorplan comparison of the parent restroom before and after spatial improvements, featuring proposed design elements: (A) a dedicated privacy room to support emotional relief and comfort, and (B) a children's bookshelf introduced as a subtle bonding cue, with descriptive annotations. Created by author.

Figure 16. Visualisation of the redesigned private room area (A), highlighting key spatial features and supportive elements, rendered using SketchUp to illustrate the proposed design intentions. Created by author.

Figure 17. Visualisation of the proposed children's bookshelf as an integrated object suitable for placement in the parent restroom; design concept informed by inspirational imagery sourced from Google Images.

Figure 18. Blueprint illustration of an open-bay NICU room (photograph-based and not to scale), used to conceptually demonstrate the room layout and highlight proposed new design features.

Figure 19. Introduction of new design features: (A) Portable privacy wall, created by the "Design Your Screen" product from Silentia, illustrated with descriptive annotations; (B) "Little Steps, Big Bond Kit"—a curated bonding box designed to support parent-infant interaction and promote continuity of care. Visualisation created by the author.

Figure 20. Overview of the user journey for the Parent-Infant Bonding Box, illustrating key interaction points from introduction to continued use. Created by the author.

Figure 21. Descriptive image of the scent cloth exchange process. Created by the author.

APPENDICES

Appendix 1	Interview Guide for Parent Interviews
Appendix 2	Interview Themes for Neonatal Staff
Appendix 3	User Journey Map (with detailed zoom-in sections)
Appendix 4	Service Blueprint

All mappings [Online] Available at:

<https://www.figma.com/board/1KCyEwzvagiSkTrRCpYszc/MastherThesis-mappings?node-id=2203-300&t=QRFNU6Ck16YW6K2Q-1>

Appendix 1 Interview Guide for Parent Interviews

Interview Guide for Parent Interviews

Key Themes

General Information

- Hospital (Which hospital was the stay in?)
- Birth Order (Is this the first child, or do you have other children?)
- Length of Stay (How long did you and your baby stay in the hospital?)

Hospital Environment and Physical Space

- Impact on parental and infant well-being
- Positive vs. negative aspects of the environment
- Comfort and facilities for parents (sleeping, eating, privacy, resting, pumping)

Involvement in Baby's Care

- Collaboration with doctors and nurses
- Parental inclusion in care
- Activities baby-infant bonding

Emotional Support

- Availability and adequacy of emotional/psychological support
- Social support
- Most challenging vs. most supportive moments

Role of Family and Loved Ones

- Hospital's support for family involvement

Coping and Recovery

- Impact of the hospital stay on parental experience
- Areas for improvement in hospital support for parents and newborns

Appendix 2 Interview Themes for Neonatal Staff

Interview Themes for Neonatal Staff

Family-Centred Care (FCC) Implementation

- Perceptions of FCC principles in daily practice
- Challenges in implementing FCC in different care levels (Level II vs. III)
- Staff roles in facilitating or hindering parent engagement

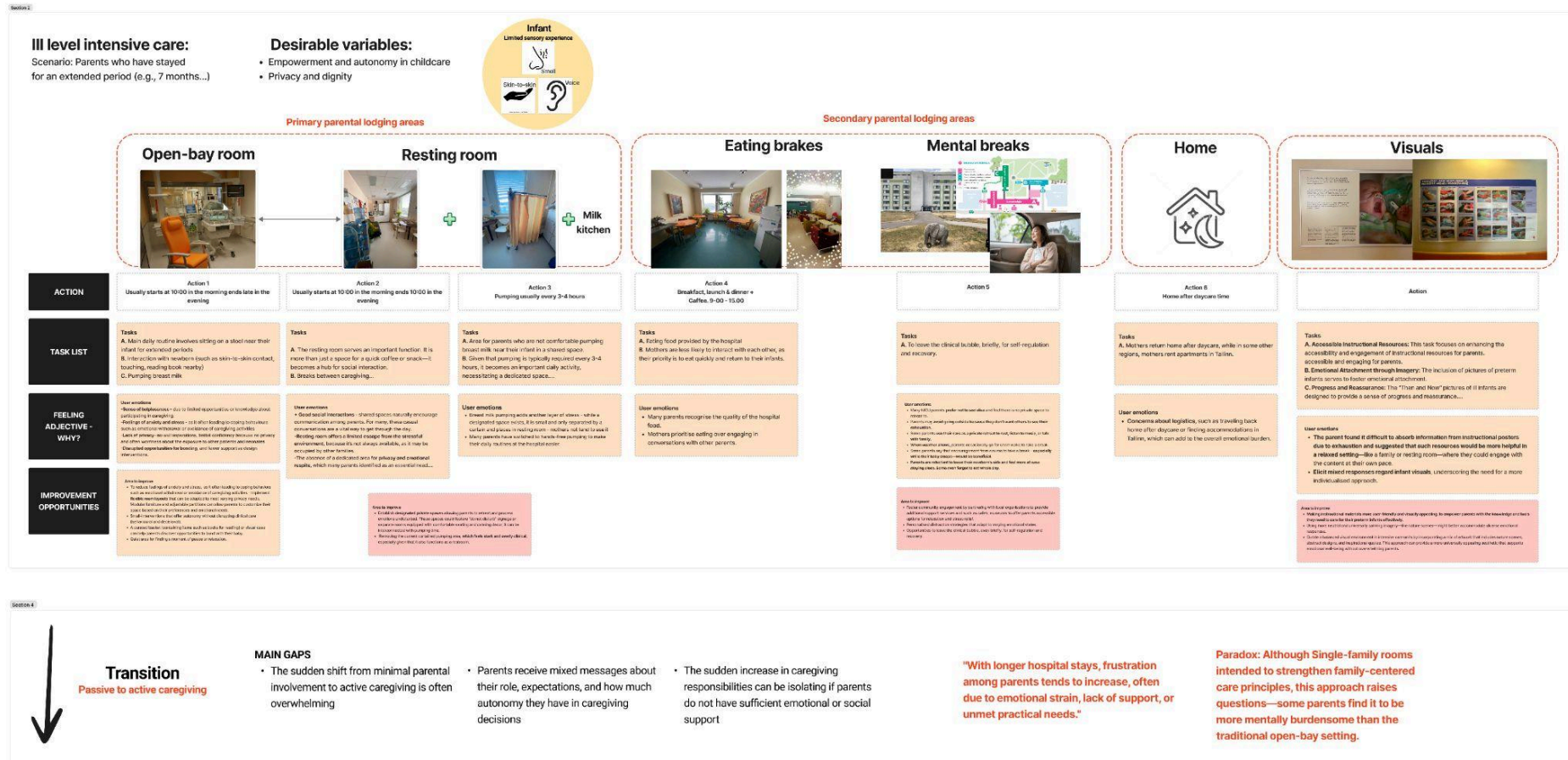
Spatial and Environmental Conditions

- Perceptions of current NICU layout and design
- Impact of physical space on staff workflows and family interactions
- Comparisons between open-bay and single-family room setups
- Suggestions for environmental improvements

Emotional and Psychosocial Aspects of Care

- Staff observations of parental stress and coping
- Support systems available for parents (and staff)
- Emotional challenges staff face when working in high-intensity NICU environments

Appendix 3: User Journey Map (with detailed zoom-in sections)

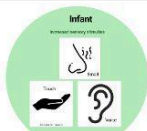
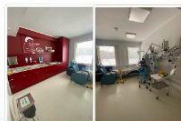
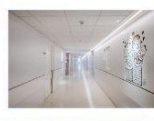


II level intensive care:

Scenario: Parents who have stayed for an extended period (e.g., 7 months...)

Desirable variables:

- Increased need for social support, as mothers tend to stay close to their infants, leading to increased isolation.
- A longing for social interaction and support, which may be challenging to fulfill in a hospital setting.

**Primary parental lodging area****Single family room****Restroom****Eating brakes****Corridor****Secondary parental lodging areas****Mental breaks****Hingehoidja****Visuals****Other visuals**

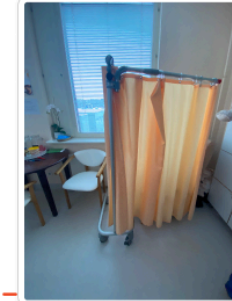
ACTION	Action 1 Covers 4 rooms: 8:30 AM – 12:00 PM Visiting hours on weekdays: 8:00 PM – 10:00 PM Visiting hours on weekends: 9:00 AM – 6:00 PM...		Action 2 Available all the time		Action 3 Breakfast, lunch & dinner + Café, 9:00 – 15:00		Action 4		Action 5		Action 6		Action 5	
TASK LIST	Tasks A. Mothers spend almost all of their time with their child to gain the knowledge and confidence needed to care for them. B. Main accessories such toilet and shower		Tasks A. The resting room serves as function for family gathering, parent-to-parent interaction, for different activities as it serves a function of isolation. B. The lounge allows for strong personal feel and preparing light meals. C. Under used – particularly by mothers.		Tasks: A. Eating food provided by the hospital. B. Mothers' interaction with each other		Tasks: A. Corridor areas are used for movement during breaks instead of outdoor environments (especially if weather is bad). B. Mothers tend to stay in their single-family rooms to remain close to their infants. No activities outside rooms.		Tasks: A. Corridor areas are used for movement during breaks instead of outdoor environments (especially if weather is bad). B. Parents don't want to be away from their child for long.		Tasks: A. Although these spaces were intended for private conversations between parents and the support (Hingehoidja), they are rarely used for that purpose, as such discussions typically take place in the designated parent room instead.		Tasks: A. To provide emotional support and instill hope by showcasing real life recovery stories of former ICU patients. These visuals aim to normalize the clinical environment and reassure parents during moments of uncertainty.	
FEELING ADJECTIVE - WHY?	"The privacy and calmness of single-family rooms are appreciated by parents, who report feeling more in control and directionally connected with their babies. However, the close-together arrangement also contributes to increased feelings of emotional stress and isolation. Many parents have expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families. A lack of appropriate curtains or activity tables creates practical challenges. One parent mentioned avoiding the room due to the lack of privacy, feeling isolated or worse, as the room does not support their privacy needs. Comments about fairness in room allocation were raised, with one parent feeling frustrated for being placed in a smaller room despite believing she needed more space than another family in a larger one.		Mothers often use the space as a quiet area for work or short breaks. "Mothers, however, also reported feeling that the room is not quite as well as might be given their long stay for personal, more intimate work. "Mothers, who are often in the room, often find it hard to sleep in the room as they need to be awake to look after their babies. They also find it hard to sleep in the room as they need to be awake to look after their babies. They also find it hard to sleep in the room as they need to be awake to look after their babies.		One mother: "I noticed that the room was not really a place for mothers to interact with each other. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		One mother: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		One mother: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		One mother: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		One mother: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.	
IMPROVEMENT OPPORTUNITIES	Area to improve: "Budget should be taken into account to gather together or partly outside from the rooming arrangement – such as light tables, and connect the rooming support groups.				Area to improve: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		Area to improve: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		Area to improve: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		Area to improve: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.		Area to improve: "The rooming arrangement does not allow me to stay in the room as I need to be awake to look after my babies. "Many parents expressed the need for a dedicated professional, such as a nurse, to visit and provide support or intervention – highlighting that the role of the Hingehoidja support system may not meet the needs of all families.	

Primary parental lodging areas

Open-bay room (caregiving area)



Resting room



Milk
kitchen

ACTION

Action 1

The day usually starts at 10:00 a.m. and finishes in the late evening

Action 2

The day usually starts at 10:00 a.m. and finishes in the late evening

Action 3

Pumping usually every 3-4 hours

TASK LIST

Tasks

- A. Main daily routine involves sitting on a stool near their infant for extended periods
- B. Interaction with newborn (such as skin-to-skin contact, touching, reading book nearby)
- C. Pumping breast milk

Tasks

- A. The resting room serves an important function. It is more than just a space for a quick coffee or snack—it becomes a hub for social interaction.
- B. Breaks between caregiving...

Tasks

- A. Area for parents who are not comfortable pumping breast milk near their infant in a shared space.
- B. Given that pumping is typically required every 3-4 hours, it becomes an important daily activity, necessitating a dedicated space....

FEELING ADJECTIVE - WHY?

User emotions

- Sense of **helplessness** - due to limited opportunities or knowledge about participating in caregiving.
- Feelings of **anxiety and stress** - as it often leading to coping behaviours such as emotional withdrawal or avoidance of caregiving activities
- Lack of **privacy**- no wall separations, limited confidentiality because no privacy and often worry about the exposure to other patients and neonates
- Disrupted **opportunities for bonding**, and fewer supportive design interventions.

User emotions

- + **Good social interactions** - shared spaces naturally encourage communication among parents. For many, these casual conversations are a vital way to get through the day.
- Resting room offers a **limited escape from the stressful environment**, because it's not always available, as it may be occupied by other families.
- The absence of a dedicated area for **privacy and emotional respite**, which many parents identified as an essential need....

User emotions

- Breast milk pumping adds another layer of stress - while a designated space exists, it is small and only separated by a curtain and places in resting room - mothers not tend to use it
- Many parents have switched to hands-free pumping to make their daily routines at the hospital easier.

IMPROVEMENT OPPORTUNITIES

Area to improve

- **Flexible Privacy Solutions:** Modular furniture and adjustable partitions or privacy walls could empower parents to personalise their space, creating a sense of semi-privacy without compromising clinical access.
- **Autonomy-Supportive Interventions:** Small, thoughtful interventions—such as offering choices in care routines or room settings—can support parents' behavioural and decisional autonomy, helping them feel more in control during their stay.
- **Curated Bonding Tools:** Providing a curated basket with simple items like books, or bonding prompts can gently guide parents toward meaningful interactions with their baby and encourage emotional connection....

Area to improve

- Implement **flexible room layouts** that can be adapted to meet varying privacy needs - **designated private space** allowing parents to retreat and process emotions undisturbed. These spaces could feature "do not disturb" signage or separate rooms equipped with comfortable seating and calming decor, it can be interconnected with pumping time.
- Removing the current curtained pumping area, **which feels stark and overly clinical**, especially given that it also functions as a restroom.

Mental breaks



Action 5

Tasks

A. To leave the clinical bubble, briefly, for self-regulation and recovery.

User emotions

- Many NICU parents **prefer not to socialise** and feel there is no private space to retreat to.
- Parents may **avoid going outside** because they don't want others to see their exhaustion.
- Some parents **use their cars as a private retreat** to rest, listen to music, or talk with family.
- When weather allows**, parents occasionally go for short walks to take a break.
- Some parents say that encouragement from a nurse to take a break—**especially while their baby sleeps**—would be beneficial.
- Parents are reluctant to leave their newborn's side and feel more at ease staying close. Some even forgot to eat whole day.

Area to improve

- Foster community engagement** by partnering with local organisations to provide additional support services and such as cafe's, museums to offer parents accessible options for relaxation and stress relief.
- Opportunities to Step Outside the Clinical Bubble: **design strategies that encourage parents to gather together or gently nudge them towards brief informal interactions** intensive care environment—even for a short walk, fresh air, or a change of scenery—can support emotional recovery and self-regulation.

Home



Action 6 Home after daycare time

Tasks

A. Mothers return home after daycare, while in some other regions, mothers rent apartments in Tallinn.

User emotions

- Concerns about logistics**, such as traveling back home after daycare or finding accommodations in Tallinn, which can add to the overall emotional burden.

Visuals



Action

Tasks

A. Accessible Instructional Resources: This task focuses on enhancing the accessibility and engagement of instructional resources for parents.

B. Emotional Attachment through Imagery: The inclusion of pictures of preterm infants serves to foster emotional attachment.

C. Progress and Reassurance: The "Then and Now" pictures of ill infants are designed to provide a sense of progress and reassurance....

User emotions

- The parent found it difficult to absorb information from instructional posters due to exhaustion and suggested that such resources would be more helpful in a relaxed setting**—like a family or resting room—where they could engage with the content at their own pace.
- Elicit mixed responses regard infant visuals**, underscoring the need for a more individualised approach.

Area to improve:

- Making instructional materials more user-friendly and visually appealing**, to empower parents with the knowledge and tools they need to care for their preterm infants effectively.
- Using more neutral and universally calming imagery—like nature scenes—might better accommodate diverse emotional responses.
- Curate a balanced visual environment in intensive care units by incorporating a mix of artwork that includes nature scenes, abstract designs, and inspirational quotes. This approach can provide a more universally appealing aesthetic that supports emotional well-being without overwhelming parents.

Appendix 4: Service Blueprint

