



Nature and human health  
– Principles for providing healing and restorative  
environment around healthcare settings

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Swedish University of Agricultural Sciences, SLU  
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# Nature and human health- Principles for providing healing and restorative environment around healthcare settings

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## Abstract

Outdoor environment is one of the most important factors in a person's physical, mental and emotional development. This thesis concerns the opportunities within landscape architecture to promote the development of the outdoors as a resource for health and well-being in healthcare settings.

The overall aim is to describe the main principles of providing a restorative outdoor environment around healthcare settings. Natural environments (Natural elements in outdoor environments) meet these criteria for a successful restorative environment. As such, benefits of integrating natural elements within healthcare settings to improve user experience and promote patient well-being.

This is a theoretical review based on literature studies including research done by professionals in various fields, and interviews with persons, who have done research in these specific fields- restorative environments around healthcare settings.

The results reflect the patient contact with the outdoors and the activities and characteristics the outdoors can and should provide, reflecting a variety of universal needs and opportunities in relation to the outdoor environment in healthcare settings

This paper concludes with general quality principles as well as key qualities essential when successful restorative environments around healthcare settings are based on the user's actual needs and preferences.

*Keywords:* Well-being, Healing gardens, Case study, evidence-based, healthcare architecture, landscape architecture, person-environment fit, phenomenology, restorative, supportive environment, universal design

# Preface

Growing up as a kid with several health problems and spending most of the childhood in different city hospitals, gave a really big insight of how the healthcare environment can leave an impact on the patient, visitors and even workers.

20 years ago, while building and planning hospital territories, people were thinking only about medicine and did not really pay attention to the environmental impact on patient well-being and how well-designed environments can in fact help the restoration process. In result most of these hospitals were mostly similar to each other. White walls, peculiar hospital smell and quiet hallways were the typical description of all hospitals. This never-changing hospital environment created deficient places for patients and visitors and made patients and visitors feel negative emotions, mostly stress.

As a kid, I always felt like I was divided from my family and good life, and put in a prison, where I couldn't choose what to eat and where to spend my free time. I was not able to spend private time alone or with my family as I did not have my own hospital room. Most of the hospitals I have visited did not include places indoors or outdoors where visitors could spend time with patients or where patients could go to be alone. This lack of places where patients could be alone or away from other patients can lead to more stress and longer stay in the hospital. It also may lead to discomfort as you had to deal with not only your own personal emotions, but also with other people's emotions.

Hospital environment also leaves an impact on the workers, who spend the most time in the hospital. No outdoor breaks and unvarying indoor designs can result in worker burnout etc., mental health problems. Further it works like a chain reaction; unhappy workers put their negative emotions on the patients, which lead to more negative experience for the patients and more mental health problems or longer restoration process.

In modern days people start to realize how the environment is sometimes even more effective than the medicine. New researches on this topic- how the healthcare environment leaves an impact on people's well-being, has led to deeper understanding for people and designers. But there is still a lack of knowledge of specific principles of how to design restorative environments.

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# 1. Introduction

People often are afflicted by mental health problems, the most common diagnoses are stress related states (e.g., depression, anxiety and burnout disorders) and because of the nowadays situation in the world, these problems are becoming more common (Mcdaid et al. 2017, World Health Organization 2013). Also, there is new viruses and health problems that affect people's health more than before, because of the limitations in work-space and everyday routine, and at a time like this, it's very important for people of all ages and abilities to be as active as possible (World Health Organization 2020; NHS 2020).

As there are more health problems, countries are in need of new hospitals and rehabilitation centres. Building these buildings, we have to point out the importance of providing healing and restorative environment around them (Stevens 1921; Tenngart et al. 2008), as it has a positive impact on patients and their experience- there is a belief that view of vegetation, water and other nature, can relief stress (Roger 1979).

There are several healthcare institutions that are not well-kept and/or don't have clean and designed territories around them. That leads to a disagreement about what these institutions should provide to their patients and to make sure their experience is on a high level, and what they actually provide.

Researches has been done in regards of the importance of the outdoor environment to our health, and it has been proven that natural and well-designed environments can reduce stress and influence people physical and mental health in appositive way (Guitea et al. 2006; Evans 2003).

In the Taber's encyclopaedic medical dictionary, the definition of environment includes the surroundings, conditions or influences that affect an organism (Davis, 1989). Definition of environment includes physical, biological, social, cultural, etc. external factors that can influence population health and well-being (Pruss-Ustun et al. 2006).

There has been an increase in interest in human-nature relationships, revealing the link with natural environments (Seymour 2016; Betrabet 1996). Fields as horticultural therapy, environmental psychology, landscape architecture and healthcare pursue the research of what people need to be restored from and why this restoration is needed (Betrabet 1996).

Restoration can be understood in several ways and according to Hartig et al. (2011:148), “the term restoration covers processes through which people recover resources they have diminished in their efforts to meet the demands of everyday life”.

Researches on the human –nature relationship have shown the benefits of present natural environments such as parks, gardens, fields etc. These benefits include physical improvements, as green space can promote active lifestyle that can lead to physiological benefits, for example, children’s activities in green spaces can improve social development (Seymour 2016).

## 1.1. Aim and purpose

The aim of this project is to explore important aspects of design for a restorative environment around healthcare settings and how they reflect on user well-being and experience.

This paper will conclude with the benefits of a well-designed healthcare setting outdoor environment that corresponds to the principles of providing a restorative environment.

- What are the main principles for providing a healing and restorative environment around healthcare settings?

## 1.2. Methodology

This chapter is divided in four paragraphs of which the first one explains the search method, second paragraph explains the selection and process of the data collection, in the third, all steps and process of analysing all collected data were explained, in the last paragraph project structure is explained in several steps.

## 1.3. Search method

To increase the credibility and validity of the results, Triangulation (Methodological triangle) method was used, so in the end the research could lead to a deeper understanding of a phenomenon.

This research is based on published literature and research on restorative environments and principles for providing restoration and people well-being. Overall, through all projects researching processes the snowball sampling method was used to gather all information.

Snowball sampling or chain sampling (Goodman 1961), is a nonprobability sampling technique where existing study subjects recruit future subjects from among their acquaintances. Also it can be used in interviews whereby each person interviewed may be asked to suggest additional people for interviewing and further literature. This method is efficient to access people who would be difficult to access using different research methods, therefore giving researchers access to their target population (Naderifar et al. 2017). Snowball sampling may be considered to be effective research method, to find the suiting studies for theme-restorative environments around healthcare settings.

## 1.4. Data collection

The literature search was carried out in total of four steps. First, a search online on Epsilon Open Archive, Scope and Google Scholar databases were made. Data were gathered using English keywords, including „Environmental psychology”, „Environmental health”, and „Healing Garden”, “Horticultural therapy”, “Restorative environment”, “External environment”. Articles that contained the useful data and were in English languages were selected for further research.

Second step in collecting the data was interviews with two persons- Anna Bengsston (Professor at Work Science, Business Economics and Environmental Psychology) and Teresia Hazen (Employee in Legacy Health in Portland, Oregon); both of them have done research in this theme. The main idea for these interviews was to get a personal insight in this theme as well as deeper understanding about the topic.

Before the interview, personal background/ biography research was carried out for both persons. The interviews were semi-structured, as the overall main questions were prepared before both interviews and they include some key words relating to the theme. During the interview more questions were added to semi-structured ones, according to the answers both participants were giving.

Because of the meeting limitations, both interviews were conducted online, using a zoom application. As there were only two persons in the “zoom meeting”, there were no outsiders present, and the person’s confidentiality was protected. During the interview both persons were asked to suggest further literature, to use in the research (Fig.1.). Both interviews were recorded (visual and sound) and transcribed after the meeting was completed.

In order to gain a deeper insight on project theme, research includes on-site/field studies. Two hospital territories were visited (Malmö hospital area and Halland’s hospital, Halmstad) and also one rehabilitation garden- Alnarp Rehabilitation Garden, making it a total of 3 healthcare setting field studies. Field study method included notes and pictures that were used later in this paper. Study notes included site design description as well as possibilities for users, reflecting on the knowledge gained in the literature of restorative environment topics read before.

Total of thirty references were found in the first step of data collection. After reading the literature found in the first step, references were compared and analysed and thirteen references were rejected due to a lack of focus or due to overlap of found information. Further literature was found, using the snowball sampling method and using suggested literature during the interviews (Fig. 1.).

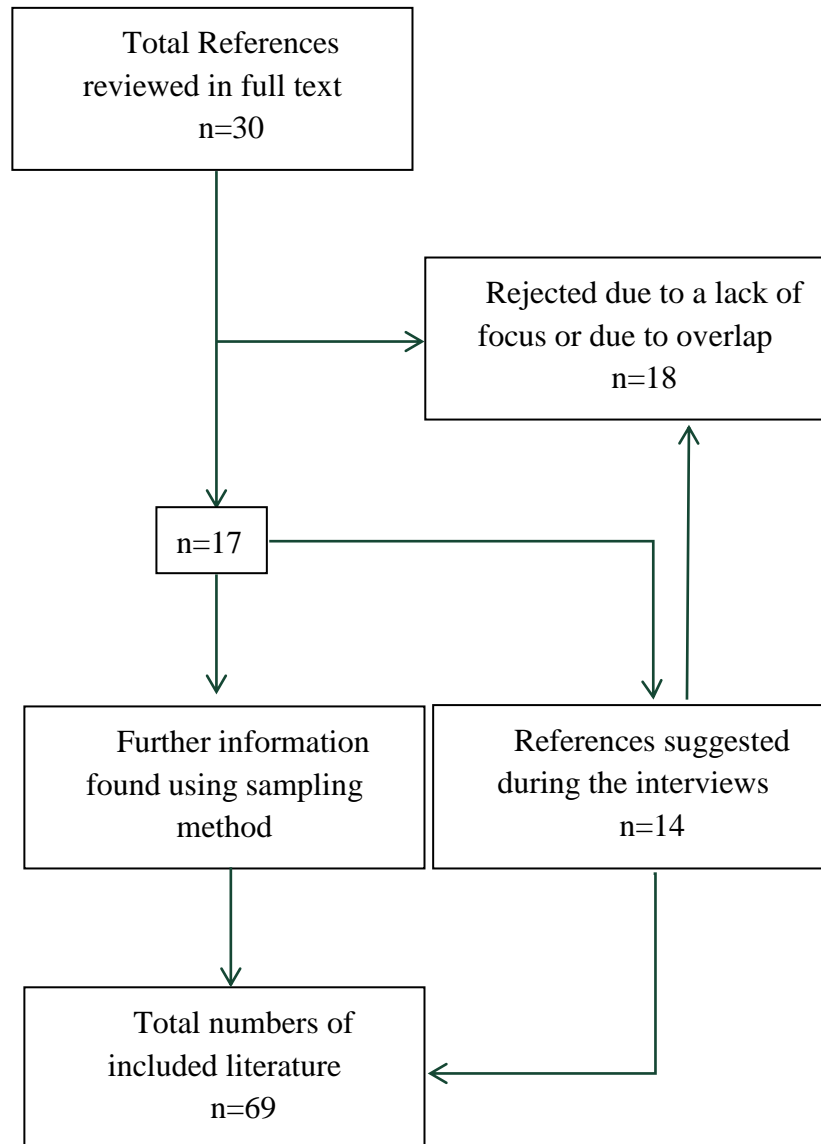


Figure 1. Illustration of the literature selection process representing the number of references gained in each method and number of rejected references

## 1.5. Data analysis

Data analysis was carried out in five steps according to the data collection type.

In the first step of the analysis, the author reviewed in full text a total of fifty references that were found using the first step in data collection, several times to understand the text as a whole phenomenon. After reading all gathered data were categorized by themes and ideas, in excel document (step 2).

The main starting themes were created by reading first articles, and the list of themes was supplemented during the reading process. In the theme table, all read literature was analysed and main quotes were written, according to the theme or

idea. In the third step a summary was done for the themes that were found in the literature that gave an overall insight about the main aim of the project.

After the summary, all themes were analysed repeatedly, creating graphical diagrams, containing main aspects and key words (step 4), using these diagrams and previously read information, the analysis was completed in narrative description about each theme.

The interview analysis was carried out in five steps. The first was interview transcription, using recorded materials. After re-watching and listening to both interviews, all information that was useful or answered the semi-structured questions, were written out in questioner papers. In the third step, interview manuscript and the questionnaires were read several times, while writing out the main ideas.

Using all information that was gained during the interview, all main aspects were categorized in themes. In the final fifth step information and the main ideas, that was gained in both interviews, were compared and sorted out in main themes.

## 1.6. Writing structure of the result part

Firstly, this paper discusses current design principles of providing healing and restorative environments and their impact on users.

Following it talks through the elements in the landscape that have an impact on people and their well-being and their effect in a restorative environment.

Further on the importance of sensory stimuli is discussed, placing examples of each sensory and stating their impact on human well-being.

This paper includes key qualities essential when providing successful restorative environments around healthcare settings based on user actual needs and preferences.

Following this paper discusses the results of interviews included in project data collection, positioning main themes gathered in interview analysis and discussing their importance in design.

## 1.7. Limitations

Healthcare setting design includes well-designed indoors, that meets all needs of all users and also a possible outdoor environment, to provide a more active and healthier lifestyle as well as positive experience. Considering the limited research time this paper primarily focuses only on the outdoor environment and its impact on user health, rather than the indoor effect and design, however some principles of healthcare setting indoor design are mentioned in this paper.

Given that there are many studies, literature and factors related to the design of restorative environments around healthcare settings and relatively short time given for this project, the amount of used literature had to be limited. Therefore, it was possible to sufficiently evaluate it. The reason for excluding an article would be because of the lack of focus on research aim or due to overlap of information as well as the reason that only materials in English could be evaluated. Regarding the limitations of search methods, this paper addresses only part of the designing factors, and doesn't include all possible information. As such, some factors are mentioned only marginally such as, view from indoors, gender difference etc.

This paper includes information gained from interviews of persons, who has done research or work in this field. Due to the strict meeting limitations, it was not possible to do face to face interviews, that could benefit in deeper conversations and insight of the person's individual view of the theme, and also it limited the number of persons interviewed.



## 2. Results and discussion

The purpose of this study was to define the main design principles providing a healing and restorative environment around healthcare settings, to improve existing territories, and to create possibilities for a better experience for patients, visitors and workers while being in the hospital.

In the literature analysis a total of twenty themes were found, during reviewing they were reduced to thirteen main themes that were divided in three main categories. First category consists of theories, design principles and nature activities that can be provided to design a restorative environment around healthcare settings. In the result discussion part these principles are described stating main findings. Second category includes outdoor and indoor elements as surface materials, art, water features and vegetation, and describes their impact in a restorative environment- how they impact user well-being and experience. Third category describes designing aspect influence on user well-being and experience regarding the emotions that have been provided in the restorative environment.

### 2.1. What are the current design principles in designing restorative environments for restorative environment around healthcare settings?

#### 2.1.1. Perceived sensory dimensions

Nowadays people have increased their knowledge of the impact that an external environment has on people's health and well-being (Skärbäck 2007), but there is still a need for more further studies about specific qualities that are required and most beneficial (van den Bosch et al. 2015).

In result of extensive research and more than 50 experiences described in a large number of interviews performed with people in urban green spaces between 1985 and 2012 (Grahn & Berggren-Bärring 2005). Researchers have defined eight recreational nature qualities, which represent people's perceived sensory dimensions of varied qualities of nature (van den Bosch et al. 2015), and are important for wellbeing - Serene, Wild, Lush, Space, the Common, the Pleasure Garden, Festive, and Culture (Grahn & Berggren-Bärring 2005; Skärbäck 2007).

External environment quality can leave an impact on the people's choice of place for living or visiting (Skärbäck 2007). Each patient requires different types of characteristics and depends on their well-being at the start of rehabilitation and these requirements might change during the healing process, so they have to create a design that suits all user needs (Fig. 2.).

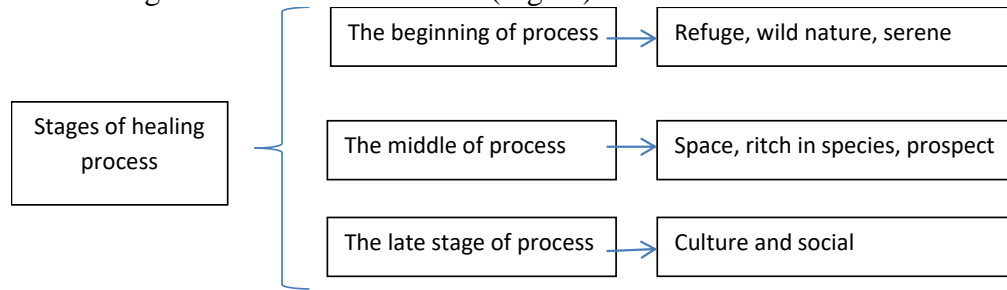


Figure 2. Characteristics according to people well-being in 3 stages of the healing process (Anna Bengtsson 2015)

### 2.1.2. Attention restoration theory (ART)

To make the environment restorative designs must include elements that awake fascination.

In his studies (Relf see Kaplan 1992) has developed an attention restoration theory, that explains two types of attention that people experience- 1) Directed attention that is used in tasks that require mental effort, focus and that inhibit distractions and 2) fascination, that is a combination of attracting soft fascination and limiting the need of directed attention (Fig. 3.). Fascination can be gained from art and elements in nature. This theory also explains how being in nature and using soft fascination can re-energize the directed attention (Kaplan 1995; Kaplan 2001).

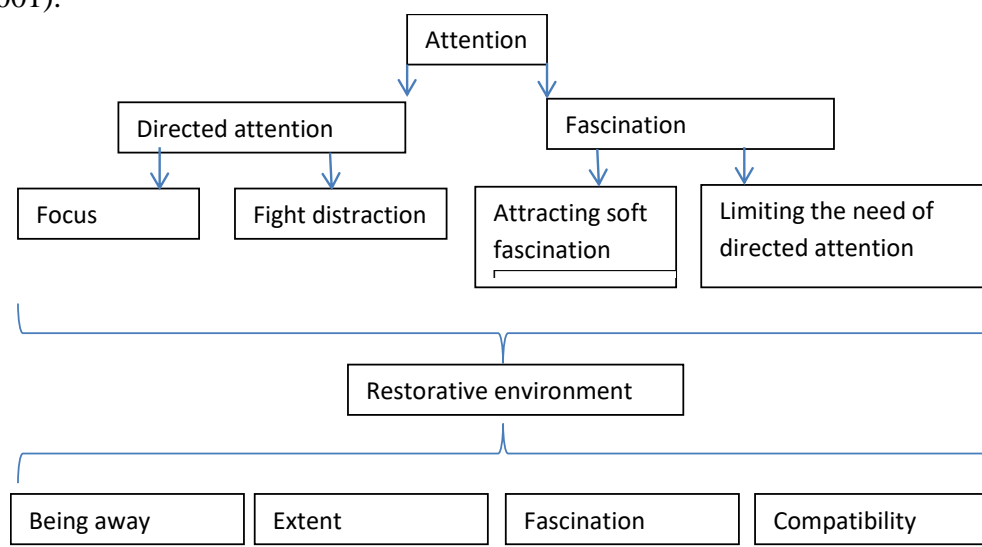


Figure 3. The scheme of how to create a good supportive environment using ART theory (Kaplan 1995, 2001; Kaplan et al. 1982)

To create good supportive environment (Fig. 2.), Attention restoration theory includes four hypothesized properties- Being away (change of everyday life), extent (feeling of being in totally different world), fascination (aspects of the environment that doesn't require direct attention and capture attention effortlessly) and compatibility (support the needs and inclination of the users, appreciation of nature) (Kaplan 2001; Kaplan et al. 1982).

Several illnesses, traumatic experiences and difficult life transitions set high pressure on directed attention (Relf see Kaplan 1992). As these mental and physical health problems are common in healthcare contexts, they promote the idea that people in such situations may benefit from restorative and/or natural environments (Bengtsson 2015).

Designers must embrace the fact that users experience different healthcare gardens differently restorative and that the experience of each of the four restorative qualities (being away, extent, fascination and compatibility) can vary depending on differences in the design and content of the physical environment (Tenngart et al. 2008). It is also important to take in consideration that each person has different personalities; therefore, they each can seek different values in the environment, meaning that environment design must include different elements that users can choose from. Elements in the environment should stimulate user senses as well as their direct attention and soft-fascination.

### 2.1.3. Horticultural therapy

Nowadays more landscape designers collaborate with horticultural therapists to create spaces that accommodate people with a wide range of abilities, and to provide them places to restore and improve their health. In these spaces' associations provide the possibility to attend horticultural therapy- it has been used for a long time and has been proven to be effective regarding people's well-being.

Horticultural therapy includes different kinds of tasks in the garden, starting from planting and growing flowers, vegetables, fruit, etc., to building bird boxes and fixing things in the garden (Cooper Marcus & Sachs 2013). These activities can stimulate and promote work skills and benefit aesthetically, spiritually and psychologically (Hewson 1994). Participating in gardening programs is beneficial for all and can help build self-confidence and self-esteem, take responsibility, learn compromise and sharing, as well as provide the sense of usefulness (Wagenfeld 2009).

People need to do physical activities every day to keep their well-being at a good level (Hewson 1994). Horticultural therapy is one of the ways to welcome people outdoors and combine physical activities with activities that stimulate the senses and improves mental health and also can reduce social isolation between patients (Wagenfeld 2009).

In several researches it has been mentioned that growing plants can stimulate past memories (Hewson 1994) as well as allow engaging with life and reflecting (Slavens 2007). For example, by watering plants people learn that plants need water to grow, and from this example they can reflect it to themselves, as they need time and care to grow mentally.

## 2.2. Elements and their impact in restorative environment

### 2.2.1. Surface

Surface choice in the healthcare setting outdoor and indoor design can affect people's health in several ways. Studies have indicated that using compliant surfaces as carpets and other anti-slip facilities can reduce falls and resulting injuries (Lachance et al. 2017; Drahota et al. 2007).

Choosing the surface in the design process, the designer must think also about the maintenance and cleaning. Hard flooring materials are easy for maintenance and cleaning, for example, copper surfaces can reduce bacterial concentration (Salgado et al. 2013) also natural surfaces as oak and pine without chemical finishing have antimicrobial effects and can also improve air quality (Kotradyova et al. 2019) If the surface is not easy to clean from all bacteria, it may impact people physical health as they could increase possibility of healthcare-associated Infections (HAI) (Salgado et al. 2013).

Surface has an effect on how users choose their resting places in the gardens. For example, walking on gravel or pavement surface makes louder sounds (Cerwén et al. 2016), people might choose resting places next to these pathways to avoid unwanted social interactions. Surface also has an impact on the way people walk, regarding the speed of the movement. In the research it shows that people tend to walk slower on wood surfaces as it produces a soft sound that confirms their presence in the space and movement, producing positive experience connecting participants and the garden (Cerwén et al. 2016).

<p><u>Effects of surface materials</u></p> <p><b>Carpets:</b></p> <p>Reduced:</p> <ul style="list-style-type: none"> <li>• Falls</li> <li>• Noise level</li> </ul> <p>Increased</p> <ul style="list-style-type: none"> <li>• Infection rates</li> </ul> <p><b>Hard flooring:</b></p> <ul style="list-style-type: none"> <li>• Easy maintained, cleaned</li> <li>• Impact on speed of movement</li> </ul>
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*Figure 4. The list of keywords of surface impact on health in a restorative environment*

### 2.2.2. Art intervention in healthcare

Engaging with the arts can improve physical and mental health and wellbeing. People may express creative impulse through, craft, creative writing, dance, design (including architecture), film- or music-making, and other types of art, and it can stimulate imagination and reflection, change perspectives, contribute to the construction of identity, provoke cathartic release, provide a place of safety and freedom from judgment, inspire change and growth etc. (Gordon-Nesbitt 2017).



*Figure 5. Art project in Malmö hospital area*

The application of the arts in healthcare has developed globally and more programs and practices use art in support of health in context of delivering

positive and creative experience (Crone et al. 2013). Enjoying and making art may distract user's attention from pain and allow using soft fascination and express nonphysical pain (Kim et al. 2018).

Design elements like temporary installations, fountains, sculptures, and other projects, can make existing environments more restorative. Using balanced designs without extreme content and shapes, to not give people a feeling of insecurity or being out of control can guarantee satisfaction and has a positive impact on health and well-being; they stimulate creativity, imagination and other senses. (Bengtsson 2015).

<u>Effects on emotions</u>
Stimulate creativity, imagination
Gratification
Satisfaction
Self-worth
Security, control

Figure 6. The list of keywords of art intervention impact on emotions in a restorative environment

### 2.2.3. Water features

The positive impact on human well-being from present water features has been mentioned in several researches.

Presence of water in a restorative environment has been mentioned in the psychophysiological stress recovery theory (Ulrich 1983) as it evokes restorative responses, because these landscapes resemble the primary environments of human evolution.

In the design the main idea is to visually or psychologically make an impression of water balancing or outweighing the built contents, to make the environment more restorative and likable from user point of view (Whyte 1980; Völker & Kistemann 2011). It can be achieved using plasticity and animistic qualities (movement, texture and sound of water). In an outdoor environment it is important to keep balance between natural and built elements. Too much built elements can make the place less natural and lose its restorative effect (Tenngart et.al. 2008).



*Figure 7. Water feature and walking space in Malmö hospital area*

The way water reflects the sky or its surroundings, how water moves in the wind and the uneven, natural shape of the water feature makes it natural and beautiful, therefore giving aesthetic value to the environment that includes water. The positive relation between human and water has been mentioned in Wagner (2003;2): “We value living near water, derive pleasure and even health benefits from viewing water scenes, and seek out water areas for recreation.”

People might gain inspiration from these reflections as well restore their direct attention as the water works as fascination.

Sound of running water can generate positive emotions and create a soothing experience for people (Cerwén et al. 2016). This can also be counted as a wanted, pleasant sound (described further in this paper).

#### Water feature effects on emotions

Soothing experience

Source of reflection

Feeling of well-being

Stress relief

*Figure 8. The list of keywords of design elements impact on emotions in a restorative environment*

## 2.2.4. Vegetation

The restorative benefits of natural environments and views of vegetation have been mentioned in several researches and experiments. By only viewing nature it is possible to reduce feelings of fear, and gain such positive effects as affection and elation. Exposure to the natural scenes where nature is dominated by trees and vegetation has more positive influence on a person’s emotional state, than exposure to urban settings without trees or vegetation ((Ulrich & Parsons 1990; Ulrich 1979).



*Figure 9. Pathway and sitting place in Alnarp's rehabilitation garden*

While designing these environments, landscape architects need to pay attention to aspects as vegetation materials, visual appearance, size and how all these things could stimulate most of the sensory in the right level without overstimulation or too low intensity to prevent people from human perceptual system fatigue and high levels of excitement (Psychological and physiological) (Baum, Singe & Valins see Cohen 1978).

Plant colour, scent and texture can be explored through multi-sensory channels, and can entice all the senses (Wagenfeld 2009).

Plants can also be used as a wind barrier that reduces the cold winds (temperature change) and also the sounds of wind or other unpleasant sounds. Presence of trees and other large vegetation can enhance aesthetic preference (Ulrich 1990). By providing this kind of natural environment enables its users to enjoy their time and relax.



## 2.3. Sensory input through restorative environment

Natural elements and natural environments can benefit in stress recovery and support sensory experiences (Sahlin 2014). The connection to nature through sensory impressions can help patients “open up” to treatment (Adevi & Lieberg 2012), as well as being involved with nature can stimulate senses.

There are several aspects, for example, trees and plants in different times of year produce fragrances, and stimulate a sense of smell. Also, the vegetation under the influence of the wind can make sounds stimulating the auditory system.

To make the environment restorative, design must include elements that stimulate the sensory. Information that is received via people’s senses, is processed subconsciously, and can play an important role in stress-related mental condition treatment (Sahlin 2014; Skärbäck 2007). All sensory stimuli can benefit in people restoration and well-being, but it is important to acknowledge the need of balance in the sensory input –to not over stimulate senses and keep the right balance in every sense (Zhang et al., 2018; Pálsdóttir et al. 2014)

### 2.3.1. Auditory system (sense of hearing)

People deal with sounds every day, as they are a part of the auditory system. Sounds influence people not only while they are using the sense of hearing-intentionally, but also at rest soundscapes can influence their physiological processes (Medvedev et al. 2015).

There are several sound sources that are divided in groups as wanted and unwanted sounds (Andringa & Lanser 2013). What is perceived as wanted or unwanted sounds depends on each person’s individual needs and preferences. Man-made sounds as industrial, technological sounds mostly are perceived as unpleasant and make people distracted; these sounds are counted as unwanted sounds. While otherwise natural sounds that include water, wind-induced sounds from vegetation, sounds from birds and other natural sounds are perceived as wanted sounds and may restore people from mental fatigue, reduce stress, clear mind and calm people (Cervén et al. 2016).

Sound effects on human well-being may depend also on the volume of the notice (Zhang et al. 2018). People may perceive industrial and technological sounds as disturbing if they are in high level, but if these sounds are somehow berried or isolated using sound absorbers indoors and suitable barriers outdoors as vegetation and architecture (Hagerman et al. 2005), these sounds doesn’t affect people as much as before (Zhang et al. 2018) Other example is, if natural sounds are going over normal limit they might make people feel uncomfortable, and increase stress level as they lose ability to concentrate, in these situations people might start feeling overstimulated.

One of the main sounds we deal with mostly every day is human sounds. These sounds as all others may be perceived differently on the level of the noise and the people's health situation. Some people seek to hear human sounds to feel present and in control, some try to avoid human sounds, because they feel stressed and want to „be away”.

It is possible to provide art (music) as a distraction in healthcare setting environments to provide better experience and improve user well-being (Drahota et al. 2012). There have been done several researches all over the world (Italy, South Korea, Canada, UK, USA, Iran, India etc.) on the music impact on human mental health, carrying out studies, exploring effect of arts activities on health-related outcomes in healthcare settings (Boyce et al. 2017).

These researches confirmed the positive impact of music on a user's health before, during and after health treatment and stated their findings regarding the patient's health. There are several positive effects of using music in healthcare, for example, lowered anxiety level (Angioli et al. 2014; Bae et al. 2014), lowered systolic blood pressure and heart rate (Angioli et al. 2014), less pain and fatigue before and post-surgery (Graversen & Sommer 2013; Angioli et al. 2014).

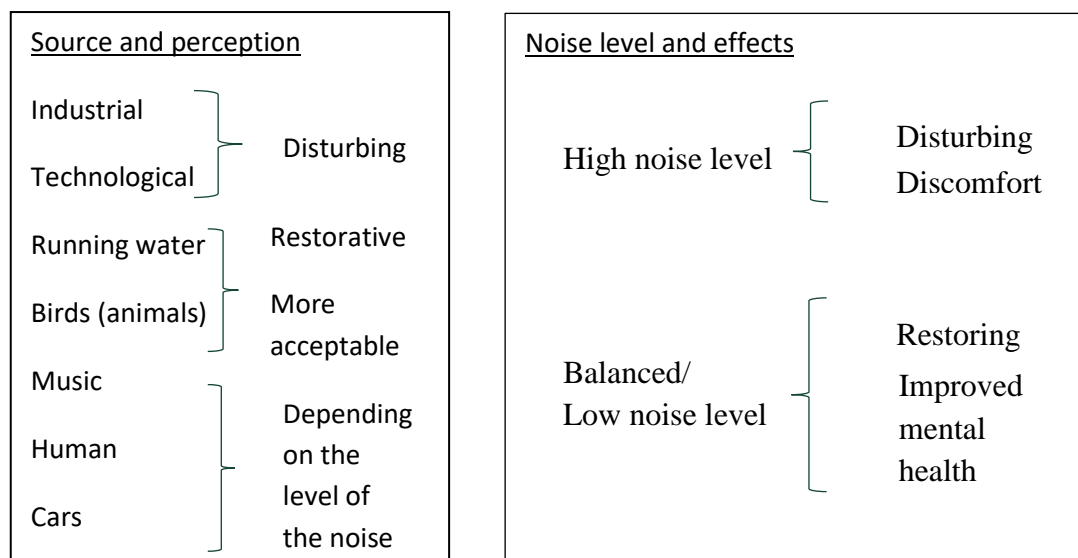


Figure 10. The scheme of keywords of sound -source and level of sound- impact on health in a restorative environment

### 2.3.2. Olfactory system (sense of smell)

Nowadays aromatherapy- the use of concentrated essential oils extracted from herbs, flowers, and other plant parts to treat various diseases (Segen 1998)- is becoming more popular. Aromatherapy can improve psychological or physical well-being and is offered as a form of alternative medicine.

There has been research that shows that if the environment has a pleasant smell, it can slightly lower the user level of anxiety (Fenko & Looek 2014).

Specific pleasant smell can be beneficial for symptom management for pain, nausea, vomiting, preoperative anxiety, critical care, well-being, anxiety, depression, stress, insomnia, respiratory, dementia, and oncology (Farrar & Farrar 2020).

To positively impact people's well-being and restoration, there must be a balance in the sensory input, for example, smells can't be too excessive, otherwise they could be excessive and make people feel uncomfortable or have a headache (Zhang et al. 2018).

Specific smells can remind people of their childhood, important moments of their life or trauma that may be connected to Post Traumatic Stress Disorder (PTSD) (Croy et al. 2010).

### 2.3.3. Visual system (sense of vision)

Human vision is considered to be the most important sense (Haupt 2008). People perceive form and colours through vision, in that way they can understand and study our surroundings (Gibson & Carmichael 1966).

As colours can stimulate sensory, they have an impact on people's well-being, and can regulate how they feel in specific environments- some colours can make people feel sad, depressed or opposite- happy, more alive. Mostly people perceive main colours similar, for example, calming and restoring colours (e.g., blues, greens and violet) and they may be recommended for high-stress areas and areas that require concentration (Zhang et al. 2018). There have also been explored links between colours and psychological arousal, for example, link between red and excitement/stimulation and blue and calmness/relaxation (Elliot 2018).

Two main colours that have been mentioned in many researches are green and blue. These colours together are said to provide people with positive emotions such as happiness, security, and tranquillity (Guilford & Smith 1959; Mahnke 1996). These emotions may be revoked because of how both of these colours are perceived as natural colours, found in many natural elements, for example, sky, water and vegetation.

While designing the environment it is important to keep a balance in colours in every element. Balanced colour schemes are a key-principle for an environment that can positively affect people's mental health and balance their sensory input (Pálsdóttir et al. 2014).



*Figure 11. Balanced colours between Architecture, vegetation and sculpture in the backyard in Halland's hospital area*

Colours may also stimulate memory (Dzulkifli & Mustafar 2013) as they can remind people of specific times when the colour was current, this may also be associated with Post Traumatic Stress Disorder (PTSD) (Croy et al. 2010).

There has been research done on the effect of the view from the window. In studies it has been mentioned that the window is really important in every room, so people, who are not able to go outdoors can still feel close to nature by looking out of the window, see daylight or sunlight shining through it (Pálsdóttir et al. 2014; Pearson et al. 2019) and also feel the wind if they open the window. The window in a patient room can also influence the recovery after surgery (Ulrich, 1984) or during and after rehabilitation (Raanaas et al. 2011; Jackson 2005), as one of the explanations is that it makes people feel less isolated from the outer world and more relaxed.



*Figure 12. Building with windows, that has a view of the park in Halland's hospital area*

View of nature can provide pleasant distractions and alleviate the stress. In the process of recovery, it may be really important to provide a view of the outside for patients who have to spend a long time in the same room (Ulrich 1984). Natural view can evoke positive emotions, reduce fear in stressed subjects, sustain interest and attention, and may reduce stress or even restore from stress and anxiety (Ulrich 1984).

Principal module of „four zones of contact with the outdoors” (Bengtsson 2015), describes in what way differences in site planning and content in relation to the different zones would result in different experiences of contact with the outdoors. The module also includes the view from the building and possibility of having contact with the outdoors from inside a building, that is, through the windows and transition zones between indoors and outdoors, for example, balconies, patios and entrance areas.

<u>View of nature effects on emotions</u>	<u>Health effects</u>
Pleasant distraction	Shorter recovery/hospitalization
Satisfying	Reduced pain-relief drug intake
Blocked worrisome thoughts	Lower incidence of delirium
Comfort	Revival of autobiographical memories
Relaxation	Alleviates from stress
Gives the person a certain level of choice	Reduced depression and pain
Feeling of being in control	

*Figure 13. The list of keywords of how view from the window impacts health in a restorative environment*

## 2.4. Designing aspect reflection on user well-being and experience- emotions

### 2.4.1. Safety and comfort

Mostly environments that don't feel safe are not welcoming and can make people feel stressed and increase their anxiety, and consequently people choose to not use/ be in them. It is therefore important for restorative natural environments to include elements and design principles such as light in the dark part of the day, safe surface material, borders like fences and safety margins, etc. These elements can make environments safer and can help people to feel at ease and enjoy their

time without being scared and disturbed by being alert (Høegmark 2020; Ulrich 1983).

To make these environments safe and comfortable designers need to design a balance between characteristics and balance in the sensory input, to not make people feel overstimulated and uncomfortable (Pálsdóttir et al. 2018). Sensory gardens can work as a perfect place for people to find their own place, explore and relax (Wagenfeld 2009). As for people with disabilities these gardens can support wayfinding and mobility, encourage behavioural changes and social interaction (Hussein 2011).

The working team is an important factor for making people feel at ease and secure. The way the staff work can make people feel comfortable in the environment and feel protected from threats (Pálsdóttir et al. 2018). Keeping the worksite safe, comfortable and uncluttered may help workers to have a feeling of well-being, and make them be a better help for patients (Hewson 1994).

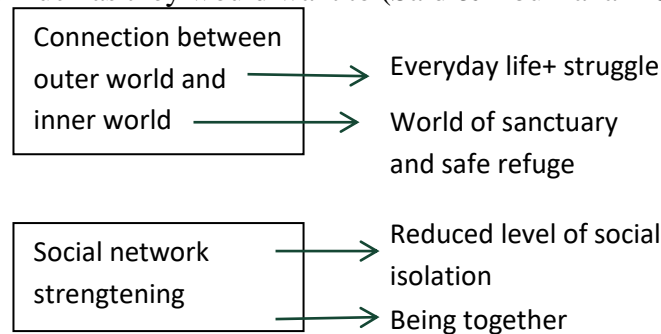
<u>Effects on emotions</u>	<u>Safe, comfortable design principles</u>
At ease	<b>Familiar, non-institutional setting</b>
Secure	<ul style="list-style-type: none"> <li>• Link to childhood landscape</li> <li>• Feel like at home</li> <li>• Moderate manner</li> </ul>
Relaxing	
Restfull	<b>Precautionary design</b>
Open-minded	<ul style="list-style-type: none"> <li>• Natural elements</li> <li>• Non-threatning views</li> <li>• Protected from disturbance</li> <li>• Unclutered, safe, comfortable worksite</li> <li>• Sensory stimuli</li> <li>• Place to explore</li> </ul>
Easier to let go	
Be present	
Calmness	
Comfort	

*Figure 14. The list of keywords of impact on people when restorative environments provide safety and comfort*

#### 2.4.2. Feeling of isolation and “being alone”

Isolation may be a positive aspect as it distinguishes between the patients every day outside the healthcare setting, their routine and struggles and their inner world- their feelings and emotions. Therefore, people may feel safer and more stable being isolated and spend their time in the healthcare setting (Pálsdóttir et al. 2018). And also, negative thing, regarding people who isolate themselves from outer world and other people (Jackson 2005), or like for children- who feel

controlled, not being able to come and go as they please and not being able to see their family as much as they would want to (Said & Abu Bakar 2007-2008).



*Figure 15. The scheme of keywords of impact on people when restorative environments provide feeling of isolation*

People seek places where they can be alone with their thoughts and emotions to think and reflect and to engage with nature, as it is hard to do that in a social environment, where there are more sounds and it is less peaceful (Pálsdóttir et al. 2018; Pálsdóttir et al. 2014). While being alone people can be their „truest themselves”, not pretending and hiding their true emotions. While being alone people don’t need to fear the judgment from other people. Therefore, it is important to include in the design of healthcare settings places where people could observe the surroundings without being noticed by other people. This design principle could help people to not feel anxiety and to enjoy the aesthetic value of the site (Bengtsson 2015).



*Figure 16. Sitting area in the garden that provides feeling of being alone in Alnarp rehabilitation garden*

Reasons why people seek to be alone can be different and depend on the person’s individual mental health. People can be divided in 3 groups regarding “being alone”. First group is people who want to be alone when they are angry, upset or feeling lost. Second group want to be alone because it helps them regarding creativity and imagination. The third group is people who may feel left out or

depressed when they are alone for too long, so they seek social interactions and avoid situations where they could be left alone.

### 2.4.3. Feeling of peacefulness

People may seek peaceful places like natural environments (parks, gardens), or places indoors where there are less man-made sounds and more quiet environments to find dimensions of quietness, calm, and tranquillity (Van den Bosch et al. 2015). Taking in consideration that a peaceful environment helps to reduce stress and other negative emotions that the user may be experiencing, peacefulness in the place is an important principle to include while designing a restorative environment.



*Figure 17. Greenhouse that provides feeling of peacefulness in Alnarp rehabilitation garden*

In order to restore direct attention, it is important for the environment to be peaceful; therefore, patients can focus only on their emotions, relax and not pay attention to other things that can make them alert (Kaplan 1995; Kaplan 2001). These environments provide its users to be able to enjoy time or even face the issues that they are going through and reflect on their feelings (Pálsdóttir et al. 2018).

<u>Effects on emotions</u>	<u>Peaceful design principles</u>
Peace and quiet	A possibility to think and consider
Calm/ tranquility	A chance to face issues and reflect
Restfull	A possibility for the body to release the sympathetic stress response
Permissive	Benefits of mental clarity
Clear mind	Permitted recovery of direct attention

*Figure 18. The list of keywords of impact on people when restorative environments provide peacefulness*



## 2.5. Results of interview

Interviews done in the data collection part were analysed and compared to each other and three main themes were gained- Human factors, nature and limitations.

### 2.5.1. Human factors

“Population health”, as described in Teresia’s Hazen interview, is important in public health approach and important in healthcare agencies. This “population health” targets all people, including healthcare workers and visitors. Anna Bengsston pointed out in her interview that it is important to not only think of outdoors as a resource for patients but for all users. As more workers have fewer opportunities to spend time outdoors and become more obese, it is important to provide outdoor spaces for workers, to improve their mental and physical health in their workspace. By improving their workspace, it would be possible to improve workers work performance and their results in patient healing process.

Both interviews indicated that one of the main aspects to design a restorative environment is to look at people generally and most importantly, at their individual needs and requirements. Patient health status in all parts of the healthcare process is important because it differs and changes in the healing process. Therefore, it is important to provide patients with individual plans for their recovery and better experience.

Interview results corresponded to literature study analysis and indicated that every person needs as much sensorial input as possible. Though, every patient needs and preferences differ in different parts of the healing process. Teresia’s Hazen stated an example that some environments for children with attention disorders need less stimulation- softer colours, greener areas and less sensorial input. Therefore, it is important to provide different parts of outdoor environment, where patients according to their health status can stimulate their senses and restore.

People need daily time outdoors, but for patients, who are not able to go out or even see the view from nature, it is effective to use distractions as headsets, visual nature, pictures and hobbies as art and reading books. Both interviewers found important to use these distractions not only in patient rooms, but also in doctor cabinets and, for example, surgery rooms, to make these spaces more comfortable and relieve stress for patients.

### 2.5.2. Nature

Daily time outdoors and physical activities in nature were mentioned as important aspects to provide active and healthy lifestyle. Therefore, a daily walk or just resting in the park or garden can improve person’s well-being and reduce health problems as well as create positive emotions and improve their mental health.

Anna Bengsston in her interview mentioned that nature can be understood as a resource- resource of mental health and place for activities. In both interviews, it was mentioned that even if there are possible distractions for people who are not able to go outdoors, these distractions will never be as good as real, natural environments. Natural views and sounds can create positive emotions for people and increase their well-being.

Teresa Hazen in her interview stated: “As a horticultural therapist, I am teaching people how to stop and look, feel, touch and listen.” It is important to include natural environments that provide these possibilities to stop and look and environments where it is allowed to touch, smell and some things they could eat, for example, berries or fruits. Using all sensory input makes the environment more valuable. Using different body senses stimulate patient’s brain and provide restoration.

### 2.5.3. Limitations

There are several limitations in the designing process. Regarding both interviewer working field and country, they are living their opinions differed regarding the limitation in providing healing gardens. In her interview, Teresia Hazen could not mention important limitations that she had come across as she had gained only good experience working in here workspace and country.

As one of the main limitations in design process Anna Bengsston stated Economics and finances. In several countries the budget for healthcare setting environment is small or non-existing. In result fewer city healthcare setting owners are interested in implementing these projects that require more money, thus cities lack well-designed restorative environments.

At the beginning of the designing process people start to think only in short terms and how the project would require fewer finances. Therefore, their projects may fail or request more finances, later in the implementation process or in maintenance part. This is a really important aspect to keep in mind to create more sustainable projects that are planned in long-term.

Other limitation for designing process is the healthcare setting placement-what kind of surroundings and vegetation it contains. The setting current situation also can impact the finances for implementing projects, as it depends on the size of the territory and the amount of the work that needs to be done.

In some of the healthcare settings it may be hard to follow some principles of what restorative environments include, because of their natural habitats and climate. Therefore, there a research of the site needs to be done before the designing process, to be able to implement the project and provide sustainable and restorative environment.

The main limitation is the lack of information available and knowledge about the environment impact on people well-being. As nowadays situation in world

health is decreasing it is important to inform people of ways to make choices that will result in less hospital and healthcare support but increase their health and well-being. Daily walks outdoor and healthy eating is a choice people can make and be in control of. In the interview Teresia Hazen mentioned: “As a landscape architects, we have to find ways to teach, with designed landscapes, how to stay healthy and active.”

### 3. Conclusions

The purpose of this study was to explore important aspects of design for a restorative environment around healthcare settings and how they reflect on user well-being and experience, and to discuss the benefits of a well-designed outdoor environment of a healthcare setting.

The interview and literature analysis results indicate that healing and restorative environments should be designed and provided for all users- patients, their family and workers, and they should offer well-being and equal opportunities for all, no matter of the age or gender. This may help to improve social connections between patients and families or between patients and their care-givers, and reduce feeling of not being able to get help regarding on age or gender.

To provide restoration for users, designers and the healthcare setting workers need to look at people generally and most importantly, at their individual needs and requirements. Patient health status in all parts of the healthcare process is an important aspect in the design process.

Nature can be understood as a resource- resource of mental health and place for activities. Many studies indicated that outdoor activities that provide active lifestyle can benefit physically and physiologically. For example, they can improve social interactions between people, provide positive emotions.

Every person needs daily time outdoors, for a walk, just resting in the park or working in the garden, as it creates positive emotions, makes your lifestyle healthier and more active and can reduce health problems (physical and mental). Outdoor activities can include therapies as horticultural therapy or wilderness therapy that can improve persons work skills and build self-confidence and self-esteem. Therefore, establishing human- nature relationship is important aspect in providing restoration.

Interview results indicated that healthcare settings which have green areas or gardens are more likely to provide better experience and a faster restoration process than those settings which don't have them. This corresponds to the results of the studies used in this research.

By providing green areas in the healthcare setting gives opportunity to be in nature and stimulate senses. To provide restoration people must have as much sensorial input as possible, therefore helping patients to "open up" to treatment,

stimulate them and help them to reflect on their emotions. Although it is important to keep all the sensorial input in balance, to not over stimulate a person. As all patients differ and their necessary sensorial input differs as well, designers and healthcare setting workers need to control the way and which patient senses are stimulated.

Restorative environments should include options to choose from, for example, places where people can be alone and different places for group gatherings. This will also help in the healthcare process when patients may be too under or over-stimulated to certain characteristics.

Sensorial stimuli can also help patients to stimulate soft-fascination and stimulate patient creativity and imagination. Places that include elements such as sculptures, water features, music or natural sounds as well as different types of vegetation, are a great way to stimulate person and to restore direct attention.

The balance of sensorial input, green and comfortable environment and a place where person can be without feeling of stress or danger, help them to feel safe. These safe environments could help them to feel peaceful, help to relax and in some cases can help to restore from mental fatigue.

It is important to look at the all the principles separately in the design process. But to provide a restorative environment designer must use all the principles together. From a landscape architect point of view, restorative environments should include options to choose from, for example, places where people can be alone and different places for group gatherings. This will also help in the healthcare process when patients may be too under or over-stimulated to certain characteristics.

An important aspect that was derived from the interview review was: limitations in the restorative environment designing process can be impacted by the country, where the project is implemented in, as each country has different budget and existing environments. This can also be connected to other studies and personal insight of the theme. The budged limit and existing environments also are a reason why only part of the world countries has increased their interest in other ways to provide restoration in healthcare settings than using medication. Therefore, it is mainly important to consider ways, in which healthcare settings could be developed and designed in the future to include more design principles to provide restoration and that could require less budget.

Both interviews and literature analysis developed a basic understanding and deeper insight of the connectivity between different people, experience and thoughts about the principles that are most important in providing healing and restorative environments around healthcare settings. This study can help as a guide for the design process and to understand how human well-being may be impacted by the design of the environment.

### 3.1. Suggestions on future research

Most of the research regarding this topic is concentrating on healthcare setting outdoor environments rather than indoor or both in general and therefore only one side of the environment have been researched more in these studies. Indoor environment has an impact on user well-being the same as outdoor environment does, but there is little research done on the indoor effect.

- How does the indoor environment in healthcare settings affect patient and other user health and well-being?

While doing the data collection, only few articles were found about the restorative environment (partially around healthcare settings) design principles regarding the aspects as gender or age difference. As in the interview gained information, there might be a difference how users experience the environment according to their age or gender, and how that affects the healing process. Future research might add new design principles to existing ones.

- Do people perceive the environment differently according to their age or gender?
- How the gender or age differences affect the principles of providing a restorative environment around healthcare settings?

In this research the main aspect was the principles to provide a restorative environment around healthcare settings and how to heal people. But we should research the principles of providing environments that improve healthier lifestyles and reduced usage of healthcare settings and medication.

- What are the bases of good health and healthier people with reduced healthcare expenditure according to the environment designers provide, to help companies and hospitals restore people health and well-being.
- How to provide healthier lifestyles and increased well-being without medication?

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