A structural approach for the redesign of a small-scale care facility as a guideline for decision-makers

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A structural approach for the redesign of a small-scale care facility as a guideline for decision-makers

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ABSTRACT
Long-term care facilities in the Netherlands try to implement new design approaches to enrich their environments and to cope with the changes and innovations in the Dutch healthcare sector. An enriched environment supports both quality of life of people with frail health and the well-being of the healthcare professionals who take care of them. Despite the increased attention devoted to built environments in relation to health, a gap in knowledge remains how to implement new design approaches. The aim of this study is to present a structural approach for a decision-making process to help to create enriched small-scale care facilities for older people with a frail health condition. A case study was conducted to understand how the structural approach contributes to implementing design features of an enriched environment. The structural approach identifies the key factors (such as shared language, collective understanding and involvement of stakeholders) that should be considered when developing such facilities and describes the critical steps for decision-makers for such environment. This case study provides a rich source of information from actual experiences for a better understanding of steering mechanisms for decision-making by the management of small-scale care facilities.

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KEYWORDS
Built environment; participatory design; age-friendly environments; care professionals

Introduction
In the Netherlands, 57% of the 811 healthcare facilities provide long-term care. Since 2009, the management of these facilities has been entirely accountable for the design of their buildings and the management of their real estate (van der Zwart, van der Voordt, and Jonge 2010, 70–86). In addition, technological innovations (like home automation), sustainability and the design of a healing environment have become increasingly important for Dutch healthcare building design (Appel-Meulenbroek, Gordon Brown, and Ramakers 2010). New design approaches have been implemented in some long-term care facilities to ameliorate their environments and to cope with these innovations and trends. These organizations want to present themselves as being focused on care with a physical environment that supports the quality of life of older people and the well-being of the healthcare professionals who take care of them (Davis et al. 2009, 185–203; Dellinger 2010, 45–80).

This growing attention for building design as a means to shape healthcare environments that promote healing is based on the healing environments concept and evidence-based design (Zimring and
The Center for Health Design (2016) defined evidence-based design as ‘the process of basing decisions about the built environment on credible research to achieve the best possible outcomes’. So far, this concept has been applied mainly with regard to hospital settings, wherein the effects of the physical environment on patient healing and staff well-being were also studied (Codinhoto et al. 2009, 138–151; Huisman et al. 2012, 70–80; Ulrich et al. 2008, 61–125). Many of the basic elements of healing or enriched hospital environments have thus been clearly identified (see for example Huisman et al. 2012; Salonen et al. 2013, 3–25; Ulrich et al. 2008), such as building physics aspects, layout and interior. Besides health, other proven benefits of enriched environments are enhancement of client satisfaction, promotion of healing and well-being, improvement in employees’ satisfaction and strengthening of competitive advantage (Oi-Zhen, Weng-Wai, and Yu-Tian 2015).

In this study, a long-term care facility, which is very different from a hospital setting, is examined. Designing long-term care facilities is a complex and dynamic process, especially when it involves stakeholder groups with complex demands, such as older people with psychogeriatric disorders (Van Hoof et al. 2015, 243–263). In addition, the organization and design team have to translate the evidence-based design findings from hospital studies into design solutions that are beneficial for this specific healthcare environment as there is scant research on long-term care environments. They must also realize that there will not be a ‘healing’ effect and therefore the aim is to try to design an environment that may enrich the lives of older people who have frail health conditions and which supports them in their daily activities and helps them led a meaningful life. Quality of life refers to the total living experience (Singh 2014) for which the living environment is only one of the contributing factor. An enriched environment refers to technology and architectural solutions that support the well-being and quality of life of the residents and optimize the work process of healthcare professionals (Huisman et al. 2012; van Hoof et al. 2014, 1–12; Elf et al. 2015).

However, before designing any building, it is vital to understand the values of the various stakeholders involved in the design process. Specifying the needs of stakeholders in integrated building design is a challenge for designers. Each stakeholder has a unique set of beliefs and requirements that are associated with the built environment (Tanja-Dijkstra and Pieterse 2011). Despite the increased attention devoted to built environments in relation to health, there is still a gap in knowledge as to how to integrate the values of diverse stakeholders into actual building design. A few studies have developed theoretical frameworks that are useful in categorizing various indoor environmental factors and relating them to health outcomes (e.g. Codinhoto et al. 2009). However, Durmisevic and Ciftcioegl (2010) concluded that none of the currently available methodologies can successfully integrate both indoor environmental factors and health outcomes.

This study aims to present a framework for a structural approach for a decision-making process to help create enriched small-scale care facilities for older people with a frail health condition. Small-scale care in the Netherlands is aimed at providing nursing care in small groups (6–10 residents per group) while emphasizing normalization of daily life and encouraging residents to participate in activities (Verbeek et al. 2010, 662–670). The focus of this study was placed on redesigning a common living room of a small-scale care facility by using the perspectives of the different stakeholders via a participatory design approach. Participatory design is an approach that actively involves all stakeholders in the design process to ensure that the end results are practical and meet each stakeholder’s needs (Kang, Choo, and Watters 2015, 830–833). Concepts are developed together with users so that they fit better with what users do and want to do. The aim of this study was to adapt, develop and evaluate a structural approach when planning and (re)designing long-term care facilities. The structural approach presented in this study focused on understanding both the residents’ and healthcare professionals’ perception. It provides support for communication and collaboration for the difficulties that may arise in the design process.

In the next section, we shall introduce the structural approach. First, the three steps for how to address the decisions of the design of an enriched environment will be described. Next, the steps will be applied in a case to illustrate and evaluate the approach in practice.
Methods

Towards a structural approach

The structural approach presented in this study consists of three steps: (a) exploration; (b) concreting and (c) evaluation (see Figure 1). These three basic steps are present in almost all participatory design research approaches and can be iterated several times (Spinuzzi 2005, 163–174). But whereas, in general, participatory design approach is applied in the early stages of concept design (e.g. Kang, Choo, and Watters 2015, 830–833), the structural approach introduced here will cover the entire building cycle. Another difference involves the setting. Participatory design often takes place in a laboratory environment (e.g. Schuler and Namioka 1993), whereas the structural approach is implemented in a real environment. The three steps of the structural approach are described below in more detail, which leads to a more elaborate version of the framework for the structural approach as shown in Figure 2.

Exploration step

The exploration step describes the activities that take place to answer and to inspire the exploration of open-ended questions such as, ‘What is an enriched environment?’ or ‘How can we improve the quality of life of older people who have a frail health condition?’ (Sanders and Stappers 2008, 5–18).

The aim of this step is to determine the basic principles (called output in Figure 1) for an enriched care facility for a particular organization. The exploration helps to obtain and define the needs and ideas regarding enriched care facilities of the participants who are representatives of the various stakeholders. All of the data are compiled in order to define the basic principles as an output factor and function as an input factor for the next step in the structural approach.

The exploration step includes measurements of the indoor environment (IE) and observations of residents in the facility (Figure 2). The following IE parameters should be included: light conditions,
acoustics conditions, accessibility, safety, color and contrast, interior, and the layout of the common living room (Ulrich et al. 2008; Huisman et al. 2012; Salonen et al. 2013). Observations of residents should be focused on the interactions between residents, staff and the IE as done by Aarts et al. (2014). They should take place in the natural surroundings of the participants and the researcher should not participate in any of the activities and the group (he or she should be a ‘complete observer’). Additionally, semi-structured interviews with stakeholders provide further insights into users’ needs in relation to the IE. Visits to other project sites gave participants (facility manager, staff and researchers) the same frame of reference.

All of this is followed by a workshop, which is designed to collect stakeholders’ wishes and preferences with regard to the indoor environmental factors of the small-scale care facility and is meant to discuss any other relevant contextual factors. The result of such a workshop is a list of basic principles for the facility. The workshop can be guided by a facilitator (a researcher of the team) to stimulate creativity and to obtain a maximum of variety in input for the list of basic principles.

**Concretizing step**

The purpose of the concretizing step is to translate the basic principles for an enriched care facility collected in step 1 into values and functions. Furthermore, these values and functions are translated into a design. It is an iterative process in which the researchers and the stakeholders interact frequently, and are involved in discussion meetings (Spinuzzi 2005, 163–174). Such an iterative process contributes to the co-creation of a design with all participants. The aim of the categorization of the values and functions is to determine and address all relevant design features and IE principles for the small-scale care facility. The discussion meetings increase the feasibility of design concepts that are chosen, because they help select the improvements for the environment based on the ambitions of the small-care facility and the basic principles of the various stakeholders (Vink, Imada, and Zink 2008, 519–526).

The concretizing step starts with categorizing the unstructured data on needs and preferences that are collected during the exploration step. Categorization should be conducted using the four eyes principle (Hiebl 2015, 264–282). This principle means that the categorization may not be made by individual actors alone but must be made by at least two actors. Based on the outcomes of the categorization process and possible expert meetings, one or more building design proposals can be developed. The design proposals visualize basic principles for the indoor environmental factors and design features of the facility based on the needs and input of the various stakeholders. In addition, meetings with stakeholders are useful for reflecting on the design proposals and for eliciting comments and feedback. The outcome of this step is that the design integrates the basic and functional values of the residents, their family members and the staff.

**Evaluation step**

The evaluation step follows the completion of the design. The aim of the evaluation step is to define recommendations and reconsiderations (called input in Figure 1) for a possible redesign and to measure the subjective and objective effects, to adjust improvements and to evaluate the process (Vink, Imada, and Zink 2008, 519–526). It is important to gather information in order to assess whether the redesign meets all the requirements of the stakeholders.

The evaluation step includes a series of activities, such as a second round of IE measurements, interviews with representatives of healthcare professionals, and observations. The IE measurements are useful in determining whether the new setting meets IE requirements. The interviews and observations provide additional information about stakeholders’ perceptions of IE in the new setting.
Case description

The structural approach that was developed is applied to a small-scale care facility in the western part of the Netherlands with the aim of creating an enriched care facility. In keeping with this goal, the board of the facility planned to renovate the common living rooms at one location. At this particular location, one common living room located in a low-rise building was selected for redesign. The other living rooms had the same layout, but were mirrored. Figure 3 shows the two common living rooms in a mirrored situation. Each common living room is used by six residents during the day under the supervision of four healthcare professionals. The residents spend the nights in their own bedrooms. The common living room to the left was used in this case study to apply the structural approach.

Figure 3. Case study situation of the two common mirrored living rooms.
The participants in this study were divided into four groups: (i) residents and members of the client council \((n = 27)\); (ii) healthcare professionals \((n = 19; 17 \text{ female and } 2 \text{ males; age range } 22–61)\), (iii) board and (facility) staff members \((n = 8)\), and (iv) researchers and experts \((n = 7)\). The first group participated in the exploration and evaluation step. The other three groups participated in all steps of the structural approach.

All residents that participated in this study suffer from psychogeriatric disorders. The selection of residents was based on informed consent and the willingness of the residents and/or their legal representatives to participate in this study. The healthcare professionals were invited by their team leaders to participate in this study. The participants of group three and four were selected by having regard to their function, expertise and their willingness to participate in this study.

**Procedure**

The period of the exploration step took one year from September 2012 until October 2013. IE features included light and acoustic measurements. The point light measurements included the horizontal and vertical illuminance at relevant positions for the residents and viewing directions. This was done in two situations: once with the electrical lighting switched off and once with the electrical lighting switched on, in combination with daylight. Illuminance was measured with a Konica Minolta Chroma meter (type CL-200). The light measurements took place during the summer period and winter period. The room acoustics were described according to the following parameters: reverberation time, background noise and speech intelligibility. The acoustic measurements were done according ISO 3382-2/3 and IEC 60268-16 and were measured with a sound-level meter RION (type NL-32 and serial number 0111084). The observations were conducted during the day from 0900 h up to and including 1700 h. The position of the observer was in consultation with the healthcare professionals on site.

The period of the concretizing step took eight months from October 2013 until June 2014. The data were structured and ordered over the course of four discussion meetings over a period of three months, where researchers and practitioners discussed the data with the goal to achieve alignment and to validate the content. The unstructured data were also discussed with an expert from the King’s Fund of the United Kingdom. This group has a specific program to help develop supportive designs for people with dementia (The King’s Fund 2016). The design proposals were developed over the course of four discussion meetings over a period of four months, where researchers and practitioners discussed the two proposals with the goal to choose one design.

The period of the evaluation step took eight months from June 2014 until January 2015. The design of the common living room was realized over a period of four months. The second round of measurements, the interviews and observations took place two months after the realization of the design.

**Results: application of the structural approach**

The following sections describe the structural approach in practice. The output factors, the basic principles and the design, as well as the input factors and the recommendations/reconsiderations for a new structural design process are described.

**Exploration: basic principles**

The site visit to a reference project (a new building of the long-term care facility) identified the following key factors: (a) identity; (b) feeling at home and (c) satisfaction. The indoor environmental measurements and the semi-structured interviews with healthcare professionals \((N = 19)\) supported the observation that the room’s layout, lighting \(<500 \text{ lux}\) and acoustics \(>100 \text{ dB(A)}\) did not
comply with the current standards. The needs and ideas were summarized using the words written on the posters and mentioned in the workshop and are shown in Table 1.

**Concretizing: design**

The translation of the values and function needs to be done in an accurate way with the mission and vision of the organization in mind, after which these were prioritize to the different basic principles in the proper order aligned with the ambitions of the organization and the various stakeholders.

Table 1 shows the translation of the unstructured data into the structured and ordered outcomes. For example, the terms experience, wall, aspects of lifestyle, feeling at home and identity were combined in the value ‘identity’. The value ‘identity’ led to the principle to create an environment in which the residents can identify themselves with. In addition, ‘to stimulate activity’ and ‘to stimulate to participate’ were combined in the function ‘mobility’. The function ‘mobility’ led to the guideline to create an environment with an accessible design for residents and healthcare professionals.

Based on the discussion meetings and expert meeting, two new items were added to the structured and ordered data – sustainability and hanging out the laundry – which represented value and function (see the black box in Table 1). The values and functions, deduced from the concretizing step, were the basic principles and guidelines which led to the two design proposals.

The design proposals took the floor plan layout, colours, acoustics and lighting plan into account. Figure 4 shows the two design proposals for the common living room. The aim of the first proposal (left) was to create a safe home environment with a focus on the privacy of the residents and to

**Table 1.** The translation of the unstructured data into structured and ordered outcomes.

<table>
<thead>
<tr>
<th>A. Exploration Step</th>
<th>B. Concretizing step</th>
<th>A. Exploration step</th>
<th>B. Concretizing step</th>
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<tbody>
<tr>
<td>Day light</td>
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<td>Day light</td>
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<td>Acoustics</td>
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<td>Sound / Noise</td>
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<td>Art (Acoustics arts)</td>
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<td>Privacy</td>
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<td>Feeling at home (care takers, family, husband or wife)</td>
<td>Sense of security</td>
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<td>Aspects of lifestyle</td>
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<td>To be aware of quality</td>
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<td>Experience [wall]</td>
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<td>Identity</td>
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<td>Several seats, chairs</td>
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<td>To stimulate activity</td>
<td>Spaciousness</td>
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<td>(Soft) materials</td>
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stimulate interactions between residents and healthcare professionals. Special attention was devoted to creating an identity through an experience wall on the right and left side of the common living room. Furthermore, a private seating area was created where the residents have been offered the possibility to receive visits from their family. The aim of the second proposal (right) was to create spaciousness, stimulate interaction and align the floor plan of the room with the aforementioned values and functions. To create spaciousness and to stimulate interaction between the healthcare professionals and residents, the kitchen was replaced to the left side of the common living room. Furthermore, replacing the kitchen created a better overview of the common living room and enhanced the safety and security of the residents.

The discussion meetings and interviews identified the key factors for examining the design proposals. These key factors were accessibility, technical feasibility, encouragement of mobility and social interaction, identity and safety. Based on these key factors, proposal 2 was thought to be more successful in creating more open space and in encouraging mobility and social interaction. Additionally, it provided a strategic value with respect to creating an enriched environment. Figure 5 shows the floor plan of the design and the common living room in the new situation. The main factors of the design were replacing the kitchen to encourage interaction, implementing a lighting plan

Figure 4. Two design proposals.

Figure 5. Common living room design and the new situation.
with equal distances to spread evenly over the space, improving the acoustics, color and contrast for visual functioning, creating sightlines to enhance safety and security, and creating a spacious floor plan to encourage mobility.

**Evaluation: recommendations and reconsiderations**

The evaluative interviews corroborated the view that the new layout of the room stimulated interactions between the staff and the residents. In addition, the new setting increased the spaciousness of the room. The indoor environmental measurements supported the view that the light and acoustic conditions were improved and did indeed meet the current standards. Observations also attested to the fact that residents from the reference living room were present daily in the redesigned living room instead of their own living room.

**Discussion**

The structural approach that was applied in this study contributes to design decision-making processes by including the perspective of multiple user groups on how to add value with healthcare real estate. In the following sections, the implications for theory as well as the implications for practices and future studies shall be discussed.

**Implications for theory**

The design outcomes in the long-term care setting of this study contribute to existing literature on the home environment. Research on the home environment showed that accessible and adaptable design can lead to reduction of emotional and physical demands and that it stimulates a sense of comfort and independence among residents (Olsen, Ehrenkrantz, and Lynn Hutchings 1996, 1–8; Soilemezi et al. 2017). Also, an open layout enhances the visibility and makes monitoring and interaction with the carers easier (Olsen, Ehrenkrantz, and Lynn Hutchings 1996, 1–8; Askham et al. 2007, 3–24; Soilemezi et al. 2017). In this study, we found that besides the layout of the floor plan, the indoor environmental factors, such as light and acoustics, also play an important role in the entire design process of long-term care facilities, especially for residents of long-term care facilities. This target group has different demands regarding the IE due to biological ageing and multiple diseases.

From the literature, it may be deduced that the initial phase in the design process is the most important one due to the critical decisions made during this phase. Additionally, this is the phase where the stakeholders share and discuss their ideas and space requirements and prepare for design decisions (Elf et al. 2015, 114). The aim of this phase is to identify the healthcare environment demands from multiple users’ perspective and relate this to the healthcare organization’s strategic plan. The exploration step and the concretizing step in the structural approach help to concretize and specify the ideas and space requirements of the multiple user groups in this phase. The evaluation step in the structural approach is important to evaluate the design and to learn lessons for a future design process. So the approach adds more depth to existing theory on design processes.

The involvement of multiple user groups as equal design partners through the participatory design approach offers a number of benefits. These include shared decision-making through using various methods in the structural approach, and it results in more ideas and solutions for the actual design process. This study shows the possibilities and challenges of participatory design approach when a more frail target group in a long-term care setting is included. The structural approach might in turn lead to optimizing the care environment, which contributes to residents’ quality of life and healthcare professionals’ well-being.
Implications for practice

Based on this case in which the structural approach is applied, the following recommendations and reconsiderations were identified to further strengthen the approach:

- Determine the various stakeholders of the small-scale care facility and ensure that representatives of the strategic, tactical and operational divisions are present to address basic principles;
- Stay involved during the realization phase and interact with the various stakeholders. Stakeholder feedback should be shared with the external suppliers and the management of the facility to ensure a quick response from the facility manager, if necessary;
- Involve external suppliers of the organization in this early stage of the structural approach; this will help to ensure that the basic principles that are set comply with the organization’s goals;
- Facility members can and should play a critical role in understanding the specific needs of various stakeholders regarding IE factors to improve the management of the IE.

Future studies

Further research is needed to optimize interventions in the IE of small-scale care institutions and to understand how these interventions contribute to the quality of life of older people who have a frail health condition and the well-being of healthcare professionals. For example, the results obtained for the basic principles and design development process can be used as a starting point for further studies aiming to optimize the interventions and to determine the main factors of the IE of small-scale care institutions from healthcare professionals’ and residents’ perspective.

Another relevant aspect for future research is to gain more insight into the decision-making by those responsible throughout the entire design process. This study focused on the development of the structural approach and the outcomes of such an approach, which resulted in the redesign of a common living room in a long-term care facility. But in general, the decision-making by managers during a design process, for example how they weigh different design solutions and make a choice that one is favourable over the other, remains a black box. Opening this black box with further research will be useful for more insight in decision-making by facility managers, staff and boards of long-term care facilities.

Conclusion

This study provided an example of how decision-makers can structurally address the creation of an enriched environment for older people who have a frail health condition. The structural approach that was developed gave valuable information to the healthcare organization about whether the basic principles actually met the user’s needs.

The structural approach also helped to create a shared language and collective understanding of the design features of an enriched environment and contributed to a design that works for both groups, namely the residents and healthcare professionals. The strategic involvement of healthcare professionals in the initial phase and design process was essential for integrating knowledge of the care process into architectural design. In addition, the structural approach fostered a better understanding of the steering mechanisms for decision-making by the facility members, staff and board members of small-scale care facilities.

Ethical considerations

In the Netherlands, this type of research is not covered for review by the Medical Research Involving Human Subjects Act (http://www.ccmo-online.nl).
The management of the organization agreed on the IE measurements, the observations of clients and interviews from the start of the project and were involved in the planning of the project. In the organization, it is standard policy to inform the client board about the research project. The client board approved of the research project.

**Disclosure statement**

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**Notes on contributors**

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**References**


