



# Technological and architectural solutions for Dutch nursing homes: Results of a multidisciplinary mind mapping session with professional stakeholders



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## ABSTRACT

There is an increasing call in society for the improvement of well-being for nursing home residents and the support of care professionals through a wide array of architectural and technological solutions that are available in modern nursing homes. This study investigated which of these solutions are considered essential by stakeholders from healthcare and technology. Data were gathered via 22 simultaneously held multidisciplinary mind map sessions with 97 stakeholders, resulting in 43 mind maps. These, in turn, were grouped into a single mind map of the nursing home in general, the private rooms for residents with somatic or psychogeriatric health problems, and the group living room. A prioritization of solutions was added. The contents of the mind maps reflect a Dutch consensus on the necessary architectural and technological features for the design of nursing homes.

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## 1. Introduction

There are approximately 165,000 persons residing in Dutch long-term care institutions (of whom about 65,000 in nursing homes). This is equivalent to around 6% of the

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Dutch population aged over 65 [1]. In the year 2008, there were 299 nursing homes for somatic residents, and 398 nursing homes for psychogeriatric residents [1]. Those older persons who live in institutions are assumed to require an increasing amount of care [1]. The built environment, i.e., the nursing home building, its architecture and the technologies applied, is seen as an indirect means of support. This implies that professionals from the domains of healthcare, technology and design need to work together in order to program and design the ideal nursing home of the future. Despite the challenges involved in working together between the two domains, the main goals in creating an ideal nursing home are quite similar. Ideally, the nursing home should be a true home instead of a healthcare facility in which they reside. A sense of home in residential care involves strategies related to three dimensions of the environment, namely, the attachment to place, to space and attachment beyond the institution [2]. Terms often heard in relation to the construction of new nursing homes as part of the continuum of healthcare facilities are evidence-based design and healing environments [3,4]. In the case of nursing homes, technology and architectural solutions are considered to support the well-being, activities of daily living and quality of life of older residents, and support and optimize the work processes of care professionals and professionals in the domain of maintenance.

Heylighen and Bianchin [5] state that in case of inclusive design, the designing should be done together with people who will use the artefact, i.e., nursing home. Both the In2Health Design Model [6] and the CeHRes Roadmap by van Gemert-Pijnen et al. [7] can be used to help plan, coordinate and execute the participatory development process of architecture and technology of healthcare facilities. Both models entail a holistic research and development approach. Getting stakeholders to work together in the design process by accounting for contexts and values of the end-users is a key element in both approaches. In this study, we have professionals from the domains of healthcare and technology work together on identifying the necessary aspects of nursing homes and relevant innovations in the fields of housing, interior design and technology. This goes together with the knowledge that the evidence of design solutions is not widely available, and that the priorities identified will reflect the views from practice rather than those from practice-based science. The factors that are to be identified can be used for two purposes: (1) making a program of future nursing homes which accounts for the needs of the main stakeholders, and (2) setting research priorities for evidence-based design. The set of identified solutions should reflect the dual character of a nursing home as a place to reside and as a place to work.

This study investigates the state of the art in technological and architectural solutions and domains as are known to, and prioritized by, professionals working in the domain of nursing home care and the implementation of technological and architectural solutions in the field, through multiple parallel sessions with professional stakeholders. The goal of the interactive sessions was to find out how various multidisciplinary groups of

stakeholders envisage the nursing home of the future (as a place to reside and work) and which innovative elements are necessary for its creation. Four types of spaces in the nursing home are discussed: two private rooms (somatic and psychogeriatric residents), the living room and the nursing home in general. There was a focus on innovations that were available in terms of the design and construction, the interior design, technology, furniture and assistive aids, and on a sense of home and home likeness, the support of work processes, et cetera.

## 2. Methodology

The methodology section deals with the procedure followed, the activity, including mind mapping and ranking of identified solutions, as well as data processing.

### 2.1. Procedure

An interactive, qualitative study design was chosen for the investigation. A total of 97 external participants joined in one of 22 mind map groups that were held simultaneously on June 11th 2013 (Table 1, Figs. 1–3). Each session lasted for 90 min. Prior to the start of the group sessions, the procedure and methodologies were explained to the group in a plenary session. Thereafter, the groups split up. All participants signed informed consent for the use of written data and photographic material. At the same time, personal data were taken, including name, sex, date of birth, organisation and position, and years of work experience. The participants either had a background in healthcare, technology and/or construction. The groups were heterogeneous in composition, meaning that professionals of various backgrounds were exchanging and discussing ideas together, as the main goal of the sessions was to explore innovation for four types of rooms in the nursing home. The group size varied from 3 to 6 persons (facilitators excluded).

Every session was guided by a facilitator. All facilitators had been briefed about the procedure and had access to a manual and instruction guide. The main role for the facilitator was to stimulate creativity and to obtain a maximum of variety in input to the mind map. The facilitators were lecturers/investigators working with the organising university, who work in the field in healthcare and technology, or students of the Department of Industrial Design of a collaborating university of technology, one staff member with a background in Industrial Design, and two students from the Bachelor course of Applied Gerontology, who were skilled in the procedure and methodology applied.

### 2.2. Activity

At the start of the session, a scenario was read out aloud by the facilitator. This scenario was the same for each group, and was linked to the needs of stakeholders.

“In this project we look for future solutions that contribute to a positive, though realistic image of living/residing, and working in a nursing home. Three elements are of importance:

**Table 1**

List of groups and the mind maps they produced.

Group	Characteristics of participants	Mind map
1. AE	n = 3 (2 females, 1 male)	PG, Living room
2. LZV	n = 4 (3 females, 1 male)	PG, Living room
3. MN	n = 6 (2 females, 4 males)	PG, Living room
4. PG	n = 4 (2 females, 2 males)	Som, General
5. EW	n = 5 (3 females, 2 male)	PG, Living room
6. MM	n = 6 (3 females, 3 males)	Som, General
7. JH	n = 5 (1 female, 4 males)	PG, Living room
8. AMS	n = 4 (2 females, 2 males)	Som, General
9. CV	n = 4 (2 females, 2 males)	PG, Living room
10. SP	n = 5 (2 females, 3 males)	Som, General
11. CDH	n = 5 (2 females, 3 males)	PG, Living room
12. TR	n = 4 (2 females, 2 males)	Som, General
13. LOW	n = 5 (2 females, 3 males)	PG, Living room
14. NP	n = 4 (3 females, 1 male)	Som, General
15. CH	n = 3 (1 female, 2 males)	PG, Living room
16. JW	n = 3 (2 females, 1 male)	Som, General
17. LV	n = 5 (3 females, 2 males)	PG, Living room
18. TW	n = 5 (5 males)	Som, General
19. MW	n = 5 (2 females, 3 males)	PG, Living room
20. BP	n = 5 (1 female, 4 males)	Som, General
21. CVL/AD	n = 4 (1 female, 3 males)	PG
22. HV	n = 3 (1 female, 2 males)	PG, Living room
Total	n = 97 (42 females, 55 males)	n = 9 general nursing home; n = 13 psychogeriatrics; n = 9 somatic; n = 12 group living room

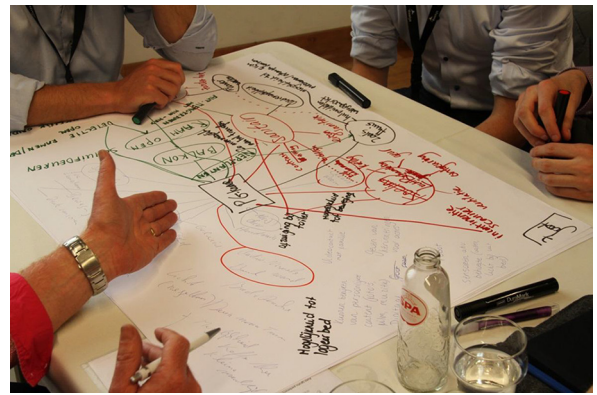
- 1.) Resident need to experience a maximum of well-being and a sense of home;
- 2.) Care professionals work with satisfaction and experience support from the built environment in the execution of their work tasks;
- 3.) Consideration if given tot sustainability and maintenance in relation to living and well-being.

In this session, we will make a mind map together, and we would like to hear your answers and vision to the three elements. We would like to hear answers to the following questions: Which innovations are available for:

- 1 the nursing home in general;
- 2 the private rooms for residents with somatic health problems;



**Fig. 1.** Twenty-two groups were working on the production of mind map simultaneously.



**Fig. 2.** Process of making a mind map for the private rooms for residents with psychogeriatric health problems using different colours. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

- 3 the private rooms for residents with psychogeriatric health problems; and
- 4 the group living room?"

Two mind maps were made per group. Roughly, the even groups worked on the nursing home in general and the private room for residents with somatic health problems. The uneven groups worked on the group living room and the private room for residents with psychogeriatric health problems (Table 1). By dividing the themes, there were eleven groups working on both sets of spaces. Participants were invited to write down their thoughts in a mind map, which was to be made on an A1-sized piece of paper. The creation of each mind map and the group discussion lasted up to 45 min per mind map.

### 2.3. Mind maps and ranking

This study made use of mind maps as a tool to gather information, which is a qualitative study design. A mind



**Fig. 3.** Process of making a mind map for the private rooms for residents with somatic health problems. Letters in the blue circles indicate the MoS-CoW letters. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

map is a diagram used to visually outline and structure information, such as words, ideas, and other concepts arranged around a central word or idea [8–13]. Mind maps are structurally more flexible than other sorts of maps, to present ideas in a variety of ways, and have numerous benefits as a research methodology [8,11,13]. “[Mind maps] are especially useful to designers as they begin to work on new projects, record and take notes, reflect on their thought processes, communicate ideas quickly and collaboratively with others, and look for patterns when synthesizing information” [[10], p 2138].

In this session, the mind maps – as a collaborative method – was applied for brainstorming. The methodology of creating mind maps was used to identify innovations that are available for use in future nursing homes, to represent relationships between these innovations and link them to perceived needs. Moreover, mind maps were made in order to stimulate creativity and synergy-creating activity between session participants, and to condense material into a concise format. The mind maps made in this work session were created around the two themes per group, represented by the type of space the innovations were identified for, which were placed in the centre of the paper. From this centre, associated ideas, words, concepts and little drawings were added on the paper by the participants, who were stimulated by the session leaders. Major categories radiate from the central node, and lesser categories are sub-branches of larger branches. The number of ideas that the participants could write down was without a limit. The ideas, however, had to be related to the theme of the evening: the future nursing home, and the four spaces. Participants were requested to focus on innovations that were available to the four spaces in terms of the design of these spaces.

In this session, ideas were inserted into the map without any prioritisation. After adding ideas on paper, these ideas were discussed in the group (Fig. 3). Participants were invited to think about the so-called “4W1H” questions: who, where, why, when and how, when coming up with innovations.

Moreover, the MoSCoW methodology was used as a secondary tool to discuss the relevance of the innovations [14]. MoSCoW is a technique used in business analysis and software development to reach a common understanding with stakeholders on the importance they place on the delivery of each requirement. The MoSCoW methodology was used as a way to prioritize the innovations in terms of necessity. The MoSCoW letters stand for:

- M – must haves: these requirements (innovations) are essential parts of the nursing home of the future. Without these innovations, a nursing home cannot be considered a success;
- S – should haves: the requirements are very much wanted parts of the nursing home of the future. Without them, the nursing home would still be usable;
- C – could haves: these requirements will only be incorporated in the nursing home of the future when time and budget constraints allow; and
- W – won’t haves: these requirements may be of interest for future projects. They are not a priority.

## 2.4. Data processing

After the sessions, the mind maps were collected, photographed and processed by the students from the Department of Industrial Design of Eindhoven University of Technology. Digitalization took place with Mindjet software package (<http://www.mindjet.com>). These digital mind maps were sorted by theme and analyzed one by one by MW in order to identify reoccurring themes. Such reoccurring themes are technology, arrangement, staff, etc. These reoccurring themes were then used to produce a set of four new aggregated mind maps of the four main themes. These four new mind maps were produced in MindNode (<http://mindnode.com>) based on the data available in the Mindjet files. These first steps were all carried out in the Dutch language. The translation from Dutch to English was done by MW and JH in order to account for jargon. Based on the data available from the paper mind maps, the separate MoSCoW analyses were translated to the aggregated mind maps.

## 3. Results

The results of the mind map sessions are presented as four collective mind maps: the nursing home in general, the private rooms for residents with somatic health problems and psychogeriatric health problems, and the group living room.

### 3.1. Nursing home in general

Fig. 4 shows the mind map for the nursing home in general. The six main themes which emerged from the parallel sessions are: technology, staff, arrangement, activities, resident, and care. Resident and arrangement of the space received most attention. Technology, according to the participants, needs to be user-friendly, should serve the needs of staff and residents, should be integrated into the living environment, there should be wireless access to the internet. These aspects of technology are considered valid for the nursing home as a whole. When considering care professionals, referred to as staff, it is often mentioned that the level of expertise needs to be enlarged in order to meet the needs of modern nursing home practice. The participants also stressed the need for activities, both indoors and outdoors, as they think the nursing home is primarily a place to live, and not a place where you spend the last phase of your life being cared of by care professionals. As to the resident, the needs in terms of safety and security, privacy, welfare and being able to receive guests are important factors. The same goes for food, a theme which emerges in other mind maps too. The atmosphere and being together with others and relatives are items the built environment should support and facilitate. When looking at the theme of care, participants stress the need for involvement of residents in activities of daily living, as well as the mix of residents. The theme most related to architectural design is arrangement. There should be sufficient single person bedrooms, and home likeness should again be fostered. In relation to the shared facilities, the service level should be high, with more options for self-



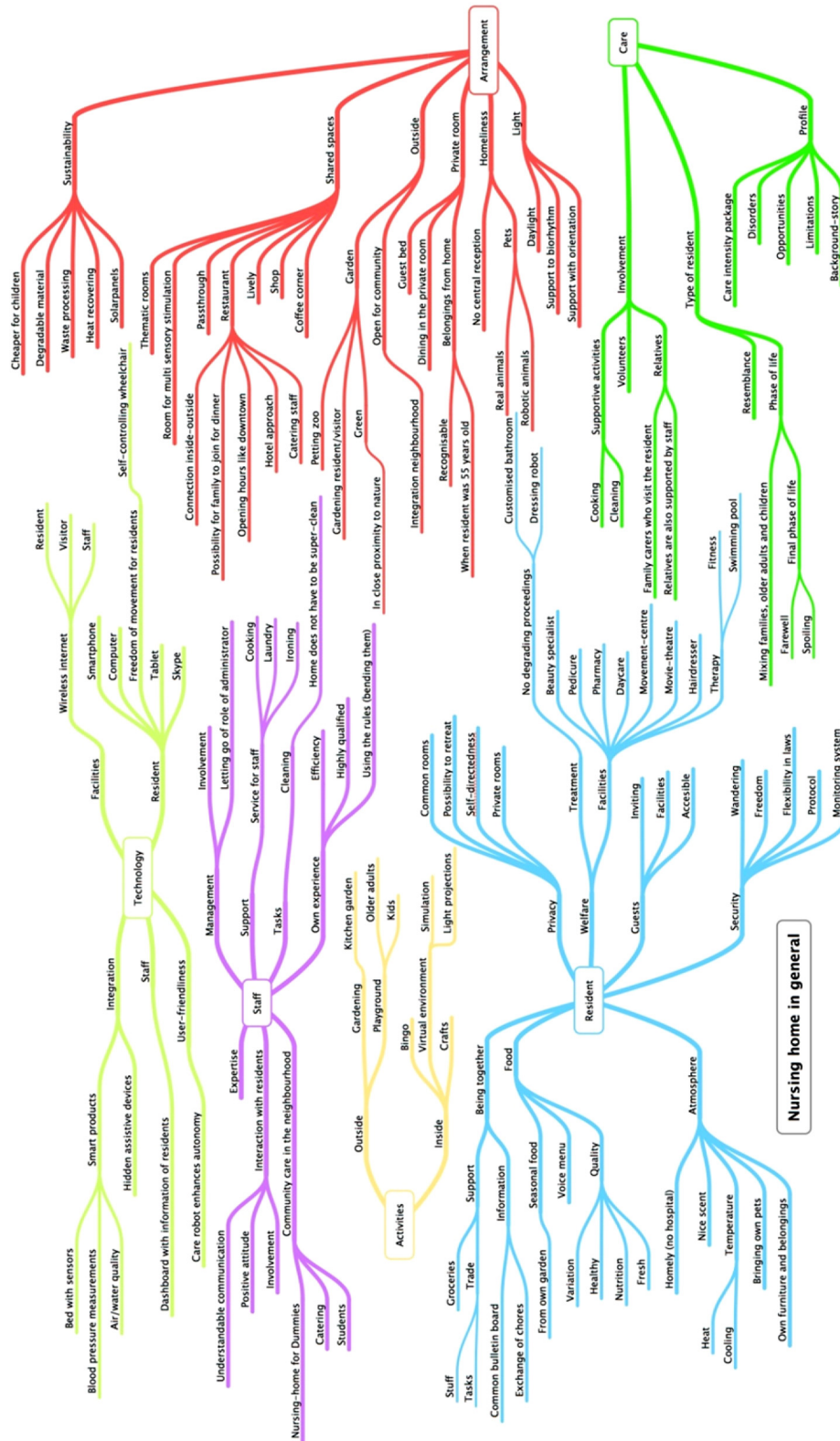


Fig. 4. Grouped mind map of the nursing home in general.

directedness and longer opening hours. The relationship with the outdoor world is stressed as being important, for instance, being able to be in touch with nature. In addition, the built environment should be sustainable and energy-efficient.

### 3.2. Private rooms for residents with somatic health problems

Fig. 5 shows the mind map for the private rooms for residents with somatic health problems. A total of six main themes emerged from the parallel sessions, which are: technology, staff, construction, care, arrangement, and the resident. Technology is regarded from the perspective of support of older persons with mobility problems, particularly from the perspective of hoists needed for transfers, and smart products to monitor and measure physical values. Moreover, technology should be user-friendly for staff, and there should be sufficient technological options for entertainment and leisure. Again, staff should be well-educated and trained to care for its resident population. In order to improve the home likeness, staff should no longer wear white uniforms according to the participants. In relation to the arrangement and lay-out of the building, private single-person bedrooms are considered essential for the well-being of the resident. People should be allowed to bring sufficient amounts of own furniture for familiarity. Of course, the room should be practical and accessible, and relatives who want to stay over for the night should be able to do so. Private sanitary spaces, as bathrooms, are considered to be an essential element. System-ceiling and other items that do not contribute to a home-like atmosphere should be eliminated.

### 3.3. Private rooms for residents with psychogeriatric health problems

Fig. 6 shows the mind map for the private rooms for residents with psychogeriatric health problems. A total of seven main themes emerged from the parallel sessions, which are: care, food, staff, technology, the resident, arrangement and construction. This mind map is the most extensive of all four. The most frequently stressed sub-theme for care was to have a management vision on care and housing. Also, food was mentioned as a theme, in particular, its quality and being able to make simple meals oneself. Although this theme is not directly linked to housing, architecture and technology, residents should be free to choose what they want to eat, when and where. Care professionals should receive training and have sufficient skills, and they should take initiative more often. Technology is an important theme for dementia care. Safety and security are important subthemes. Various technologies are suggested in order to improve safety and security, such as monitoring technologies. Computerized technologies, including tablet computers, are seen as a welcome solution for dementia care, also from the point of entertainment and leisure. Health monitoring and light therapy are frequently mentioned types of technology. Independence of residents should be stimulated through a wide array of technologies, including home modifications, assistive technologies and monitoring technologies. Residents, according to the

participants, want a homelike atmosphere with familiar items and furniture. Pets and connectedness to the outside world are items that are mentioned in relation to what residents with dementia want. Well-being and communication are essential items in the daily lives of these residents. Moreover, residents from the psychogeriatric ward should be stimulated to participate in daily activities, and cleaning in particular. The arrangement of the rooms is another important theme. Private bathrooms, personal heating, ventilation and cooling systems, designing for familiarity, using non-stigmatizing beds (without rails) and facilitating visitors to come (and join in activities) are items mentioned. As to construction, small-scale facilities are mentioned, as well as low-maintenance buildings and facilities which are located within a neighbourhood. Being part of society is considered to be an essential precondition for any nursing home.

### 3.4. Group living room

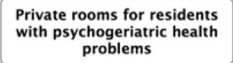
Fig. 7 shows the mind map for the group living room. A total of seven main themes emerged from the parallel sessions, which are: construction, technology, the resident, food, arrangement, division and staff. First of all, the staff should not be supervisors of a group. They should be close at hand in a staff room instead of in a nursing station. Participants stress the importance of staff to be amidst the residents, and contribute to a feeling of home and home likeness. The culture, and thus the appearance of a room, should fit with the needs and preferences of the residents. It matters when a nursing home is constructed in either a rural or an urban setting when creating an appropriate living room. The location of the centre, in a neighbourhood or in a forested area, is another item that is mentioned by the groups, as stakeholders like to see the nursing home as an integral part of society. The living room should be large enough to accommodate all participants, and one should be able to make partitions in order to facilitate the interests of all residents. Participants also mention the options for simulation, for instance, projecting items from the past on digital displays, as well as projected fireplaces and aquariums and pets. Another item mentioned is that it is better to give residents a private tablet instead of having a shared group television for entertainment. One scenario that is mentioned is 'the compulsory sitting in front of a TV all day'. Residents should be able to engage in a wide variety of activities, which should also be fitting for the residents themselves as for playing with (grand)children. Lifestyle differentiation, involvement and privacy are considered important items. Residents should have access to a kitchen area where they can prepare small meals or coffee. Furniture should contribute to a home-like atmosphere. Sterile items and plastic covers are considered to be absolutely unwanted items.

### 3.5. Emerging themes

There are nine main themes that are included in the mind maps: technology, staff, arrangement, activities, resident, care, construction, food, and division (Table 2). Not all similar subthemes are clustered with the same main



Fig. 5. Grouped mind map of the private rooms for residents with somatic health problems.



**Fig. 6.** Grouped mind map of the private rooms for residents with psychogeriatric health problems.



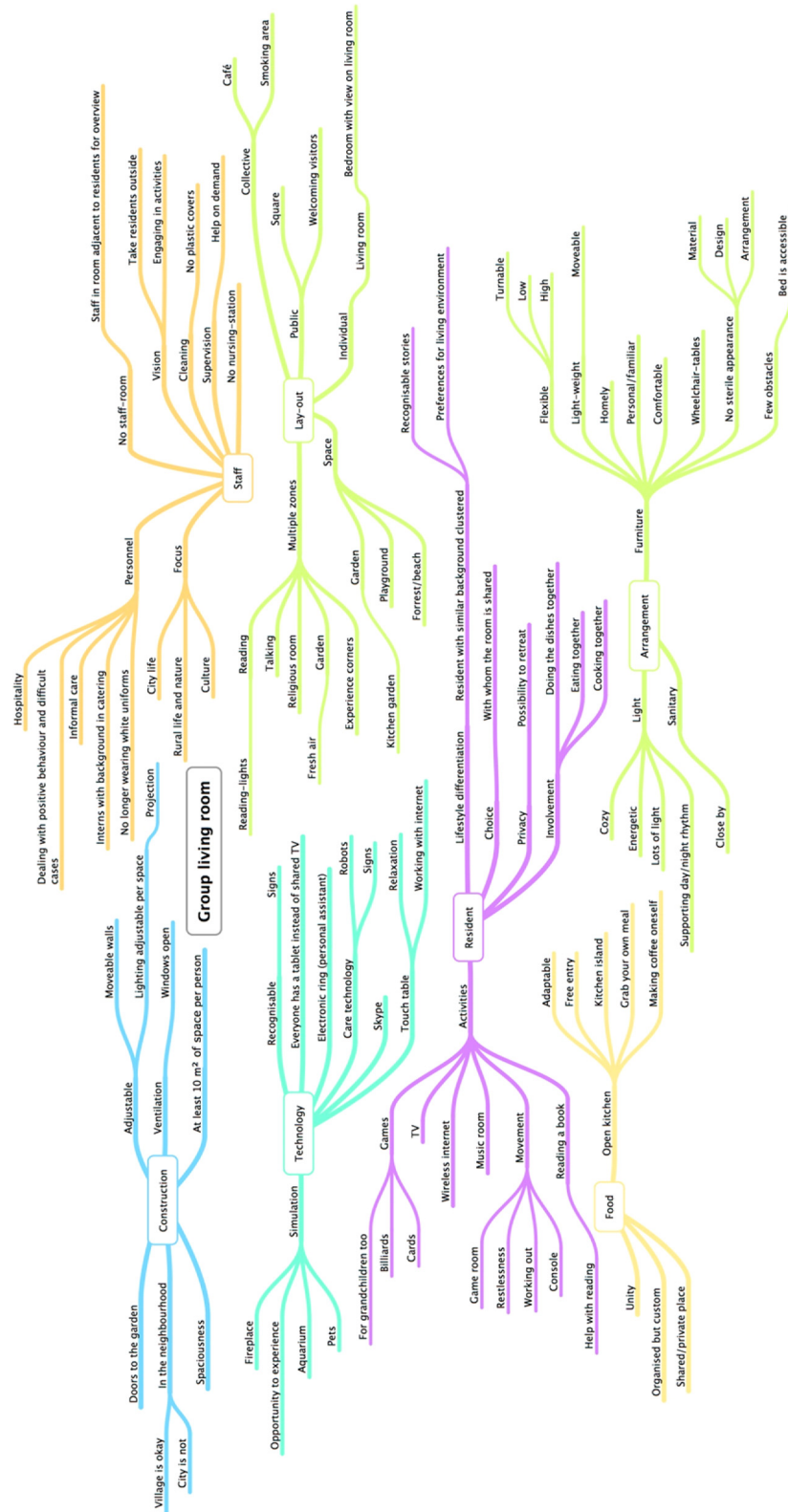


Fig. 7. Grouped mind map of the group living room.

**Table 2**

The main themes of the four mind maps.

Themes	Nursing home in general	Private rooms for residents with somatic health problems	Private rooms for residents with psychogeriatric health problems	Group living room
Technology	x	x	x	x
Staff	x	x	x	x
Arrangement	x	x	x	x
Activities	x			
Resident	x	x	x	x
Care	x	x	x	
Construction		x	x	x
Food			x	x
Division				x

themes in all four mind maps. All of these items have an impact on the design of the space. This is a small impact in the case of food (being able to eat in the private room, having an accessible kitchen for making coffee) to concrete recommendations for the design of spaces (construction) and the choice of furniture (arrangement) and the desire for familiar and home-like environments (resident).

### 3.6. Prioritizing with the MoSCoW-methodology

For the private rooms for residents with somatic health problems, the layout 'must' be flexible, staff 'must' be well-trained and educated, self-directedness of residents 'must' be stimulated. The room 'must' be a fitting environment for carers to do their work. The provision of physical comfort is considered a should-have item, as well as designing a private room that it looks like an apartment, being able to live together with a partner, and offering a room as a mobile home.

For the private rooms for residents with psychogeriatric health problems, safety and security are must-have features. Also, wireless sensor-based monitoring techniques are considered to be a must-have feature, which can be used for facilitating safety and security (detection). All assistive technologies and hoists should be placed out of sight, or be hidden. All technologies 'must' be easy to understand and use. Another must-have feature is for residents to be able to bring their own personal belongings. Rooms 'must' not look sterile and clinical, but home-like and familiar. There 'must' be private bathroom units (with a toilet), as well as a bed for guests. This is also the case for maximum daylight access and adequate lighting systems for stimulating one's day and night rhythm. Again, appropriate entertainment and leisure (including reading) are seen as must-have features, which are also related to being able to receive visitors. Should-have features include having separate rooms to withdraw (privacy is a 'must'), but the creation of experience corners for persons with a certain lifestyle is considered to be a 'must'. The integration of technology in furniture is seen as another should-have. Could-have items are sliding doors and low maintenance items. Pets are another could-have, just like options for residents to maintain mobile (walking routes).

For the nursing home in general, participants have indicated that the building 'must' be user-friendly. Self-directedness of residents is another must-have feature. Contact between residents and with other human beings is

another must, which needs to be stimulated through the nursing home's design. Intelligent solutions (technologies) are considered to be a should-have feature. The nursing home should be a safe and secure place to live, and interaction with the neighbourhood and direct society should be stimulated. The use of screen-to-screen technologies and having a shop nearby are both could-haves. Fixation of residents and force are absolute won't-haves.

For the living room, fitting entertainment, and staff to supervise, is a must-have feature. Solutions include tablet computers (with Skype), personalized television, and the availability of things to read. All sophisticated technologies 'must' be plug and play, without requiring the intervention of skilled technicians. A garden to move around is another must-have feature. The room itself needs to be flexible in its layout and mustn't look sterile. Tables 'must' be usable for persons in wheelchairs, i.e., adjustable in height. Maximum daylight access is another must-have feature. Being able to receive visitors in a separate room is also a must-have. Having separate spaces for people with different interests is a should-have feature, but having separate rooms to withdraw (privacy) is a 'must'. Social robots are considered by the participants are should-have items. Pets are considered a could-have item.

## 4. Discussion

The discussion section deals with a reflection on the methodology applied, and the availability of scientific evidence for the design of nursing homes.

### 4.1. Mind mapping as a tool for multidisciplinary design

Within the scientific literature, the use of mind maps in large groups of stakeholders has not been reported as being used as a methodology for the investigation of nursing homes. Due to its inclusive and creative character, it is a great method to work in multidisciplinary teams. As there were 22 parallel groups with 97 participants working on the four areas of a nursing home, one could speak of a process of researching consensus on what is deemed necessary for the creation of a nursing home. The scale of having 22 groups work on the theme is unique and not seen before. The grouped mind maps are, therefore, an overview of important ingredients for the design of nursing homes which suit the needs of the residents and staff. We use the word ingredient on purpose. Although the mission was to

identify solutions and innovations, the smaller group discussions revealed a mixed set of end-user needs, their personal and professional values and a set of building- and technology-related solutions and innovations.

The mind map session did not lead to a concrete set of recommendations or a concrete programming list, which is one of the limitations of this study. Instead, the outcome of the sessions was a set of themes that need to be addressed when programming and designing a nursing home. As said before, by grouping the separate mind maps into four aggregated thematic mind maps, a sort of consensus mind map is created. Normally, consensus can be defined as the substantial agreement reached by concerned interests according to the judgement of a duly appointed authority, after a concerted attempt at resolving objections. It implies much more than the concept of a single majority but not necessarily unanimity. Consensus is obtained through participation of various stakeholders, who are generally qualified in the subject area of the standard. Given the interactions between the participants and the aggregation of data, we can speak of a global consensus and that the mind maps represent the state of the art in thinking of the community working on the design, operation and maintenance of nursing homes in The Netherlands.

There are, however, some critical remarks to be made. Although the mind maps show which items are most frequently mentioned, they do not provide in depth information on views and thoughts of the participants or the rationale behind the inclusion of the items. Emerging themes should – in a future study – be elaborated by conducting small-scale focus groups or in depth interviews with stakeholders. Mind mapping is a method which allows fellow group members to interact with each other and have discussions about items that are to be included. When applying the MoSCoW prioritisation methodology, not all groups were able to be concise about what to prioritize. Therefore, the MoSCoW items are a first representation of a prioritization of design solutions.

Then, there are issues with the usability of the mind maps. As mentioned before, the mind maps reveal themes for future study. One could wonder if the results can be used for design purposes straight away. First of all, the mind maps can be used as a guide for designers. Designers can go through the items point by point and discuss the relevance of items for their own work. The mind maps can serve as a source of inspiration or a quasi-checklist along with existing standards and guidelines for the construction of nursing homes. These checklists, however, often deal with dimensions and accessibility. The mind maps do not provide any exact recommendations in terms of dimensioning. This is again another limitation for those in search of specific data. In relation to the generalizability and transferability of the research findings, there are some issues that need to be addressed. First of all, The Netherlands are known for its extensive system of residential and nursing home care. The socio-political system, in combination with national architectural and construction practices, influences the extent to which the results can be transferred to other countries, even when they are geographically and culturally close to the Netherlands, for instance, Germany. Still, the consensus which is reflected in the four mind

maps is very much resident-centred. It remains the question whether the needs of Dutch and German residents, or residents in Western countries in general, differ that much. Building a healthcare setting that feels like home is a universally accepted concept [2,15–17], which goes together with meeting a large and complex set of needs. The design of a new healthcare facility is a complex task, as a building itself includes various subsystems [6,18], namely, stuff, space plan, services, skin, structure, and site. The success of the final design is the result of how well the needs of the stakeholders are met by the building systems. Although the solutions pertaining to these subsystems appear throughout the map, there is no fixed structure or tabulated output available to help steer a design process.

#### 4.2. The evidence-based implementation of design solutions

Although many potential solutions have been identified, one could question the usability of these solutions for all end-users, particularly those with dementia. Mace and Rabins [19] stated that it is important to remember that no single design suggestion will work in all situations. Different people need different approaches and solutions that work as facilitators, which in turn are influenced by the client system. One should look for solutions that make sense to the carer and are low in cost [19]. Solutions that are facilitators to one individual may turn out to be a barrier to another. The real challenge to implementing the identified design measures is not in new designs, but when retrofitting existing nursing homes. Given their age, the flexibility to implement large-scale design changes as creating large windows or accessible gardens is not an easy, and financially-attractive, task. Retrofitting is more expensive than designing properly in the first place [20].

Van Hoof et al. [20] discussed the availability of evidence-based design solutions for nursing homes and psychogeriatric care facilities. Weisman [21, p 171] also states that there is “a growing number of model facilities, with care providers increasingly willing to develop environments which purposefully implement and evaluate innovative approaches to dementia care.” Weisman [21, pp 171–172] continues by stating that “[t]he findings and lessons to be derived from the body of work on dementia care environments seem to be substantial. They should not, however, be limited to those derived solely from the empirical research on environments for people with cognitive impairments. It’s equally important that we keep in mind the innovative ways in which these model facilities were planned, programmed, and designed; the systemic way in which they were conceptualized; and the innovative ways in which they have been publicized.” In relation to the design of nursing homes – even more than for hospital facilities – there is a substantial lack of evidence for the majority of frequently implemented design measures. There is a lot of focus on dimensioning, for instance, of bathrooms, in order to accommodate transfers of residents. This, in turn, is related to budgeting. The smaller (or more optimized in terms of surface) a room, the less costly it is to build a facility. Therefore, financial aspects are a large driver than quality or outcome for the resident or the care process per se. If the evidence-base of design measures is growing in the years to come, all

practice needs is access to the data in order to start working with this knowledge. In turn, practitioners will ask for practice-based evidence and a critical discussion on how results of international studies can be used in a national context of building and care practices. There are, however, hopeful signs. Mitchell [22], p 107] stated that, as a practitioner in the field, one has an instinctive feeling that something is working. “*You can see it on the faces of the group members, you can feel it in the atmosphere, you can capture it in people’s comments.*” Even though compelling arguments are made for the therapeutic efficacy of design solutions, little research has been carried out to date to determine whether they are truly effective in reducing symptoms, and to quantify to which extent they contribute to self-care, well-being, and vitality [23,24].

#### 4.3. Conclusion

This study based on multidisciplinary assignments has produced a set of four mind maps containing design items and management recommendations for four spaces of future nursing homes, i.e., nursing home in general, the private rooms for residents with somatic or psychogeriatric health problems, and the group living room. The items on the mind maps provide rough guidelines for designers as what to address in their designs of nursing homes. Due to the scale of the study, the mind maps present a general consensus on what is important for the design process of Dutch nursing homes. At the same time, in addition to the mind maps there is a list of must have and should have items, which provide a prioritisation of design features. Applying multidisciplinary methods can be a valuable tool in bringing insights from professionals with a different background closer together. In addition, a group discussion of the need for a given solution is an integral part of the method. Despite the large scale of the study, the results are largely non-specific and not backed by scientific evidence.

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