ARCHITECTURE OF SPECIAL CARE UNITS FOR PATIENTS WITH DEMENTIA IN GENERAL HOSPITALS

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Abstract

Objective – The aim of the study is to provide planning recommendations for special care units for patients with dementia in general hospitals. Therefore, (1) an overview of existing structural concepts and, (2) results of a systematic environmental assessment regarding the dementia-sensitivity of the built environment will be presented.

Background – Due to demographic change, the number of acutely ill, geriatric patients with additional cognitive impairments in hospitals is increasing. Since this patient group often shows adverse outcomes during their hospital stay, specialised wards ("special care units") have been implemented as part of dementia-friendly hospital concepts. In Germany, the number of special care units has been rising over the last years and more than forty units are currently known [12]. Research has shown positive effects on patients' self-care and mobility as well as a decrease in challenging behaviour. However, an overview of spatial concepts, which can serve as basis for planning recommendations, is missing.

Research question – What are architectural characteristics of special care units for the care of patients with dementia in general hospitals and how is dementia-friendly design implemented?

Methods – Site visits and interviews with responsible medical and nursing staff leaders of special care units in German general hospitals (N=20) were conducted. The implementation of dementia-friendly design recommendations based on publications by Hofmann et al. 2014 [23] and King's Fund 2014 [24] was systematically documented. Additionally, floor plans of the units were analysed regarding their integration into the building structure, spatial programmes and use of space. Implementation of design criteria was discussed in the light of planning recommendations for dementia-friendly hospital wards given by Büter et al. 2017 [25]

Results – The units differed greatly in terms of their building structure and their spatial programs. The floor space per unit varied from 120 to 1200 sqm depending on the number of beds in the units starting from 6 to 30 beds. Three types of structural concepts were identified which were characterised by their spatial organisation within the building and the resulting autonomy in the workflow of the units. Regarding the implementation of dementia-friendly design recommendation, it was found that especially interior design elements, such as colour contrasts or visual cues to improve visibility of patient-relevant objects, were often used.

Conclusion – A high number of individual spatial concepts for special care units exists in German hospitals. These concepts were highly dependent on specific building conditions and functional requirements, especially fire protection, hygiene and floor plan structure. The implementation of some core recommendations, such as a visual relationship between areas for patients and nurses, requires early consideration in planning processes as it refers to the building structure. Otherwise, these implementations may result in extra effort in terms of construction works and financial expenses.

Keywords: *Architecture | general hospital | dementia-friendly design | special care unit | environmental assessment*

Background

The concept of special care units

Due to demographic change, the number of acutely ill, geriatric patients with additional cognitive impairments in hospitals is increasing. Usually, symptoms of dementia do not represent the reason for hospital admission, however, these symptoms strongly influence the hospital stay and the treatment procedure. People with dementia often do not understand necessary therapeutic and medical procedures and feelings of excessive demands may result in negative outcomes, such as challenging behaviour or apathy. They reflect a highly vulnerable group of patients and considering their needs is not only beneficial for them but will also relieve caregivers and other patients. Since patients with

dementia often show adverse outcomes during their hospital stay, specialised wards named special care units (SCUs) have been established as part of dementia-friendly hospital concepts. The concept originates from nursing homes where the integration of so-called "special care units" has been common practice for a long time and where positive effects have been observed relating to residents' quality of life, behaviour or reduced use of psychotropic drugs [1]–[3]. In the acute hospital setting, the care concept needed to be adapted to different conditions, concerning privacy, hygiene and length of stay among others. SCUs in general hospitals can be found in a number of different countries [4]–[8]. All are characterised by a comprehensive care concept, but there are individual modifications, for example the number of beds, the integration of the unit in the hospital structure and its spatial demarcation, or additional occupational opportunities. Compared to regular hospital wards, special features of SCUs include special training of employees, day-structuring measures, extended geriatric assessment, patient selection and particular architectural features. Evaluation of these units has shown positive effects on patients' self-care and mobility as well as a decrease in challenging behaviour [5], [7], [9], [10]. Cognitive impairment is the main inclusion criterion for the admission to an SCU. However, people were mostly moderately impaired and often physically mobile and thus able to benefit from the particular care concept, such as walking around independently or participating in group occupational therapies [11]. Since 1990 SCUs have been mainly established by geriatric departments in Germany and there are currently 44 known SCUs [12].

Dementia-friendly design in general hospitals

Common theories of human-environment research prove that well-being and behaviour of people depends on the interaction of environmental factors and individual coping skills [13]. Due to cognitive impairment, people with dementia are particularly sensitive to their surroundings [14]. Dementia-friendly design tries to compensate impaired coping skills by creating an environment that promotes orientation and safety and enables intuitive usability [15]. The systematic review of Marquardt et al. shows that effective dementia-friendly design interventions are manifold and reach from architectural features, such as building typologies and spatial layouts, to interior design elements [16]. The majority of research on dementia-friendly design was conducted in long-term care facilities. However, during the last years, dementia-friendly hospital initiatives have been conducted on an international level and the topic of dementia-friendly hospital design has raised more awareness [17]–[22]. Also, the comprehensive care concept of SCUs includes measures regarding the built environment as one treatment component [23]. Following a dementia-friendly design approach, spatial measures on the SCU were intended to, among other things, support patients in their independence and strengthen feelings of security and orientation. Although considered as a crucial component, an overview of their spatial attributes and the implemented dementia-friendly design measures is missing. The aim of the present work is therefore to summarize existing spatial situations of SCUs with special regard to dementia-friendly design measures and to use these examples as inspiring references for the further development of dementia-friendly hospital design.

Methods

The responsible chief physicians of all known SCUs in Germany were requested in writing to participate in the study. In 2018, on-site visits were carried out at 20 cooperating hospitals. These hospitals are distributed throughout the country and show a wide variety with regard to their hospital characteristics in terms of number of beds, construction period and hospital owners. The intention of the establishment of these units was to provide better hospital care for patients with dementia by implementing this specialised dementia-friendly ward concept.

Based on this sample of 20 SCUs, spatial characteristics and examples of dementia-friendly design interventions in general hospitals are provided. The following aspects were the focus of this research: 1.) conceptional and spatial data of SCUs, and 2.) implementation of dementia-friendly design recommendations. Therefore, site visits and interviews with responsible medical and nursing staff leaders were conducted on the basis of questionnaires regarding general hospital data and unit characteristics. Conceptional data was systematically collected on the basis of a position paper that gives recommendations for the operation of SCUs [23]. Spatial data were collected by documenting spatial programmes and floor plan structures. Depending on the autonomous workflow of SCUs, floor plans were analysed regarding their integration into the building structure. The implementation of dementia-friendly design measures was rated based on the existing environmental assessment tool "Is your ward dementia friendly" by King's Fund [24]. With this tool, the built environment was evaluated in seven categories on a 5-point likert scale (1=criteria were barely met, 5=criteria were totally met). The data was further discussed in the light of design recommendations for dementia-friendly hospital wards published by Büter et al. [25]. Interventions were also documented photographically. Units where a high number of implemented dementia-friendly design measures could be found served as case-studies presented in the paper.

Rationales of spatial recommendations

Building layout

With regard to building layout, existing recommendations for dementia-friendly wards propose organising the unit as a spatially separated area in which patients can move independently. The building structure of dementia-friendly units should increase patients' mobility and perceived safety through a clear building layout. It must therefore be designed

in such a way that clarity, accessibility and visual connections to relevant places are ensured. The provision of a circular movement area is supposed to enhance patients' mobility. However, the entrance should be outside the visibility of movement areas so that patients are less stimulated to leave the ward independently. A further substantial aspect is the location of the nursing point and/or an obvious reception desk, which shall be positioned in such a way that there is visual connection from the nursing point to the joint living room, the entrance and the patient rooms. Also seating options are suggested to be placed nearby the nursing point. To enable patients to rest between their walk but also allow them to choose between different seating options and to observe the units' daily life, it is advisable that additional seating areas along the corridors are provided.

Orientation

People with dementia can easily develop fears in unknown environments. Spatial measures therefore seek to convey the situation in which the patient situates themselves and make it easier for patients to recognise relevant spatial and design objects. The subject of orientation can be meant in terms of place, time, date, local region, and situation. For this purpose, visual guidance systems, visual cues such as distinctive colours or pictures showing local landscapes could be used to help patients identifying their own room, bed or wardrobe. In addition, a high-contrast design of relevant room elements helps patients to recognize the room and its elements more easily, e.g., by contrasting the colour of the wall and the floor covering or by installing handrails with high contrast to the wall. Objects and rooms of patients' interests are visually highlighted whereas non-relevant objects are hidden through a discreet, unobtrusive design.

Ambience

It is recommended to create an atmosphere that conveys cosiness and familiarity to patients and their relatives in order to relieve anxiety and to evoke feelings of confidence. To achieve this in a hospital setting, a balance must be found between clinical functionality and a comfortable ambience. Recommendations therefore range from a joint living room and lounge as a space where patients can eat together, and chairs arranged in clusters to encourage conversation. Sound absorbing measures, occupational offers, for example board games, joint newspaper rounds, or supervised handicraft work as well as the provision of photographs depicting interesting topics or tactile artworks can support these efforts.

Results

Spatial characteristics

Structural concepts

A great variety of different spatial concepts can be presented. The floor space per unit varied from 120 to 1200 sqm depending on the number of beds in the units, starting from 6 and going up to 30 beds (mean: 14 beds, 666 sqm). On average 38 sqm per patient bed were needed and nearly half of that area is needed for patient rooms (43%) whereas about a quarter of it make up circulation areas (23%). The rest of the area was needed for rooms for hospital staff, storage and electrical supply as well as for building construction (34%).

Three different types of structural concepts were identified and characterised by their spatial organisation within the building and the resulting autonomy in the workflow of the units (Figure 1):

- Concept A typifies a spatially independent unit, where in addition to patient rooms and a living room, one can also find the nursing point, doctor and service rooms as well as examination and therapy rooms. Beds are exclusively provided for cognitively impaired patients (n=8).
- Concept B represents a spatially separated sub-unit. That means that there is a spatial separation at the end of a regular ward corridor. Patients' rooms and a joint living room were within the separated area, however, therapy and examination rooms are outside the sub-unit, although spatially nearby. In some cases, the nursing point is located within the area, but sometimes outside the sub-unit or located in a position that allows a common usage for both parts (n=9).
- Concept C instead illustrates a spatially open approach where a small number of dementia-sensitive patient rooms are provided for those with cognitive impairments. Dementia-friendly design elements were implemented, the number of beds per room is reduced and there is a joint living room close to patient rooms exclusively for the target group. The ward itself contained a mix of geriatric patients with and without cognitive impairments. Nursing point, doctor and service rooms, examination and therapy rooms were allocated to the ward and for the use of all patients (n=3).

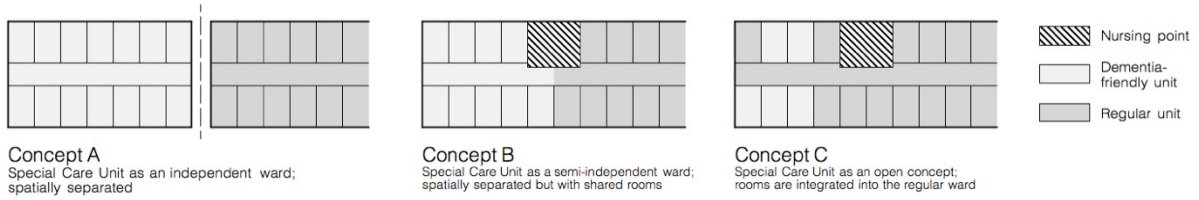


Figure 1. Three types of structural concepts of special care units.

Usually, the units were realised in existing buildings (17 out of 20), so that nearly all concepts needed to be implemented under given structural conditions. Only occasionally, the installation of a special care unit was set up in a new building, so that in most of the cases dementia-friendly design criteria regarding the building layout were not considered at the beginning of the planning process. In particular this refers to recommendations regarding clarity in visual directions, the provision of a spatial anchor point, and additional storage spaces.

Corridor types

To avoid traffic through the units, they were usually laid out on the far corner of the floor. The aim was to provide a quieter and more protected ambience for the patients. Depending on the size of the unit and on the existing building conditions, three different corridor types could be defined (Figure 2). Mostly there was a straight corridor with patient rooms on one side and functional and common rooms on the other side (type: “straight corridor”, n=10). Some corridors bended (n=6) and were mostly built either as L-shaped or T-shaped corridor. Another type with two parallel corridors (type: “U-shaped” or “square-shaped corridor”, n=4) could be provided when building depth is about 25-30 meters. The simpler the building structure is regarding the building depth and its linearity, the less patient beds could be placed in the unit. Only two parallel corridors allowed an increase in the number of beds to more than 30. Exclusively under this condition, the possibility of circular movement is given. Here, the patient rooms were often located at the outer side, allowing exposure to daylight, whereas utility rooms are located in centrally. This layout structure also sometimes contained an inner courtyard. Depending on fire regulations, units may require having at least two emergency exits. In these cases, one exit represents the main access to the unit and the second is an unobtrusive exit at the end of the corridor.

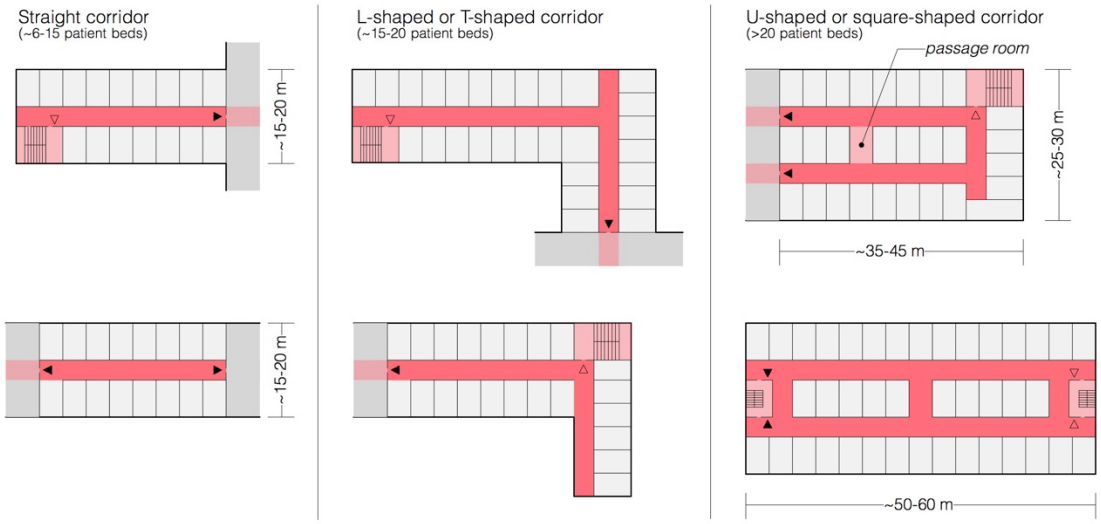


Figure 2. Corridor types in special care units and the related number of beds.

Implementation of recommendations for SCUs and space required

Building on existing recommendations, an SCU has ideally implemented the following spaces and architectural features [11]: size of the units should be about 8-12 beds, with a maximum of 20 beds. The findings of milieu therapy should be used to ensure a dementia-friendly surrounding. The focus here is ideally set on the topics of lighting and familiarity. This leads to a mandatory presence of a living and a therapy room, as well as the optional installation of a lighting system that has proven positive effects on people with dementia. In addition, an institutional-like appearance should be avoided by creating a homelike atmosphere.

The percentage of implemented recommendations can be seen in Table 1. Besides patient rooms, a joint living room is provided in each of the units. Therapy and examination rooms could be found in nearly half of the units (40%).

However, therapy rooms were often located nearby or in some cases these were not judged important, because therapeutic sessions were often conducted along the corridors (physiotherapy) or in the living room (occupational therapy). To create a cosy atmosphere was also a main concern on the units. The living room was therefore usually decorated with homelike furniture and seasonal and local decorative objects. In addition, colour design was used to evoke a feeling of cosiness. Because of fire regulations, decorative objects in the corridors often had to be limited to pictures and colours. Further requirements

The interviews and observation during the site visits revealed further spatial requirements. Firstly, there was an urgent need for more storage space because of extensive care aids in geriatrics. Often there was insufficient space for the storage of geriatric equipment, which meant that walking aids, such as wheelchairs or wheeled walkers, were located along the corridors so that equipment was nearby. Secondly, there was a lack of places where confidential conversations between hospital staff and family caregivers could be held. In addition, the importance of the physical presence of the nursing staff on the unit was emphasised because patients often sought social contact.

Dementia-friendly design in special care units

The evaluation of the units shows that a high level of dementia-friendly measurements were implemented in SCUs (Figure 3): the average score was 3.41 out of 5, with more than 3 points obtained for each of the seven categories. All of the units provided a joint living room with a lounge that was primarily designed to convey a familiar ambience. However, from an architect's view recommendations regarding the building layout have been implemented much less frequently. This includes, for example, the provision of a therapy room, additional storage rooms or the visual connection between nursing point and living room. In contrast, easily-applicable measures, such as colour cues, wall clocks or calendars, to enhance patients' situational and temporal orientation were found on nearly all of the units. Also, pictures, decorative objects and furniture unusual for a hospital setting were often used to evoke feelings of familiarity.

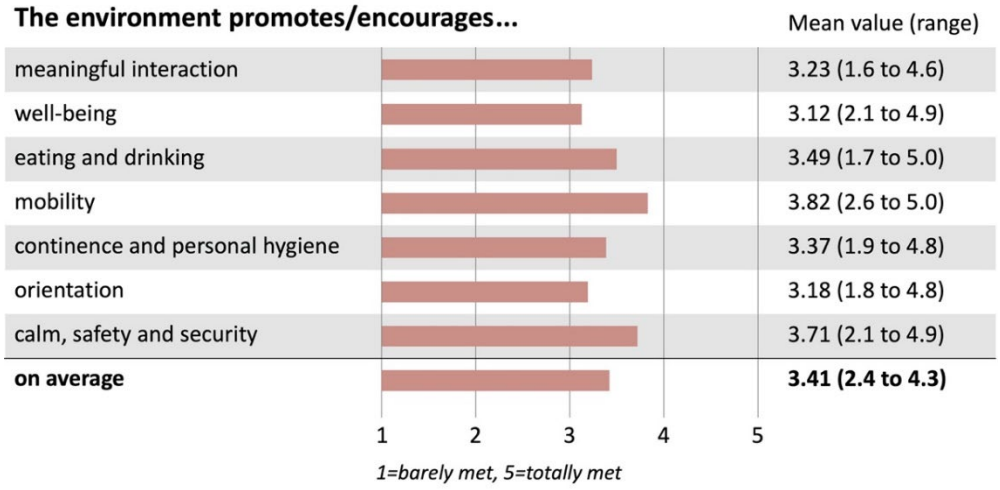


Figure 3. Level of implementation of dementia-friendly design criteria in special care units assessed with environmental assessment tool by King's Fund (2014) on a 5-point likert scale. Number of units N=20.

Building layout

To realise a dementia-friendly structural layout, measures require an early consideration in the planning processes. Some dementia-friendly design criteria could not be fulfilled, such as the provision of a therapy room or nursing point, because there were restrictions due to the building stock situations. In particular, the smaller units often had little opportunity to establish an additional nursing point in the unit because the nurse-patient ratio cannot be guaranteed permanently. However, for smaller units it is easier to provide a clear, easily understandable floorplan layout. The possibilities of a centrally located nursing point were found in newer buildings in particular, because this concept has now also proven itself for non-dementia-specific hospital wards and was established in many recently built hospital wards.

A great strength of the units was the location at the end of the hallway so that through-traffic could be avoided. Because of that and a decreased number of beds, the units provided a quiet and protective atmosphere to patients. A typical way of spatial implementation was the demarcation of a less frequented area without through traffic and keeping the ward door closed. Patients' rights prevented the locking of the patient or ward doors, but technical systems like numeric keypads or tracking systems at the ward door were sometimes used as a door safety device. Patients on these units were all allowed to walk in the protected space of the unit independently. To provide a visual connection between nursing point and relevant patient areas, the nursing point was often placed in the centre of the unit (Figure 4). A circular movement could only be observed in building structures with parallel corridors. In some cases, a room was

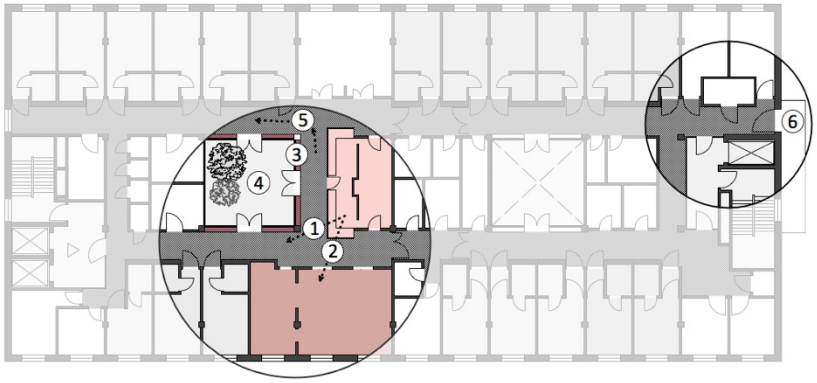
turned into a passage to allow a circular movement (see "U-shaped corridor" in Figure 2). However, according to statements by the hospital staff, often patients did not consider this room as a corridor area, so it is difficult to judge the success of this measure. It can be concluded that more area is needed to allow for a circular movement. Access to the outside was possible either through a direct access to a safe outside garden, or – on higher floors - an inner courtyard or safe balcony, for example with vertical glass elements that prevented patients from leaving. Many units provided an additional seating area at the end of the corridors. A further possibility to provide seating options near to the nursing point is to use window recesses where patients can sit down.

The units shown in Figure 4 are built in different existing building structures, but present good examples for the realisation of a high number of recommendations relating to the square-shaped, T-shaped and straight corridor systems.

Table 1. Percentage of implemented design recommendations for the operation of special care units.

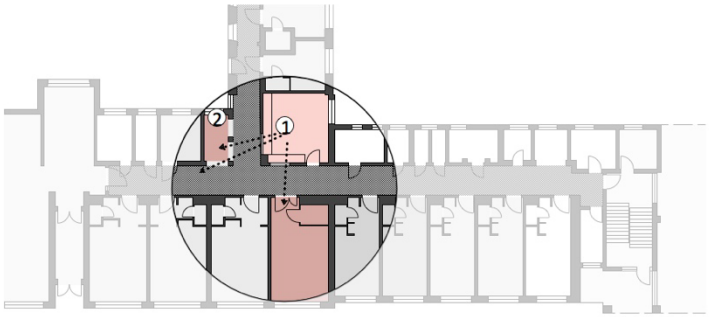
Spatial recommendations for SCUs according to Hofmann et al. (2014)	**Percentage of units which implemented recommendations (N=20)**	**Required area per patient bed and/or further comments**
Obligatory		
8-12 beds, max. 20	8-12 beds: 35% (n=7) 8-20 beds: 70% (n=14)	- On average: 38 sqm per person with a number of beds of 14 (range: 6 to 30 beds). Compared to standard inpatient wards in Germany with an average ward size between 30 and 36 beds, the size of an SCU is about half.
Unit spatially separated	90% (n=18)	- Separation often realised by a closed ward door which was covered with decorative laminate
Joint living room	100% (n=20)	- On average: 3,2 sqm per patient (range: 0,5-10 sqm)
Therapy and/or examination room	40% (n=8)	- On average: 1,3 sqm per patient - Mostly room for physiotherapy - Examination room: ultrasound equipment was considered particularly useful
Optional		
Homelike atmosphere	80% (n=16)	- Homelike atmosphere was confirmed when, for example, traditional furniture or decorative objects have created a domestic character. This was mostly implemented in the living room. The provision of untypical hospital furniture usually required special consultation with the hygiene department.
Particular lighting concept	50% (n=10)	- Lighting concepts could only be found in corridors or living rooms. In most cases the level of brightness could be adjusted in the corridors to reach a high level of luminance. Circadian lighting along the corridors was found in 3 units.

Example "Square-shaped corridor"



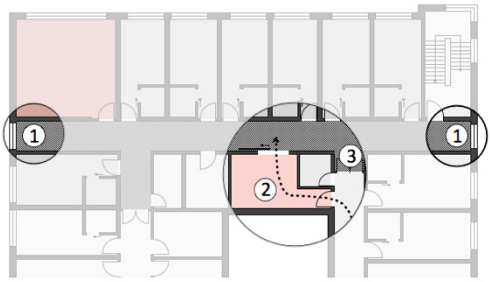
Strengths:
(1) Visual connection between nursing point and entrance
(2) Visual connection between nursing point and living room
(3) Additional seating options in window recesses
(4) Safe inner courtyard with seating options
(5) Possibility of a circular movement
(6) Access to a safe balcony, e.g. for smoker

Example "T-shaped corridor"

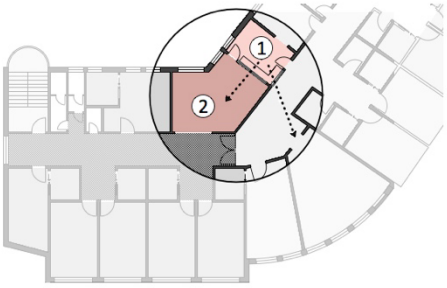


Strengths:
(1) Visual connection between nursing point and: entrance, living room, patient room
(2) Additional seating options near to the nursing point by re-constructing the corner room

Example "Straight corridor"



Strengths:
(1) Additional seating areas at both ends of the corridor
(2) Main entrances were less frequented, because the nursing point was used as passage to the ward
(3) Entrances out of visible patient movement areas



Strengths:
(1) Joint nursing point with access and visual connection to living room of the SCU and living room of the standard ward
(2) Large lounge with the possibility of both a dining area and a living room corner

Nursing point | Living room and lounge | Patient room SCU | Patient room "standard" | Corridor of SCU

Figure 4. Examples of dementia-friendly floor plan designs.

Orientation

Exposing vs. hiding

Apart from the building layout, spatial orientation was also supported by outlining important architectural elements like floor, wall, ceiling and doors. Elements of space that are unimportant to patients should be designed in a discreet way, so that irrelevant objects do not raise patients' awareness. One way to achieve this is to paint doors and walls in the same colour. Elements may therefore optically disappear. Sometimes, patterns in floor coverings were intended to influence patients' walking direction, like a dark floor area in front of exit doors designed to discourage patients from leaving (Figure 5).

- Vision panel to show where the door lead to; signs and typo of a good size and a contrasting colour to the wall so as to be read easily
- Installed on an appropriate height
- Colour contrast from door handle to door and from handrail to wall

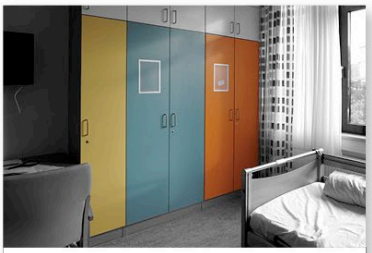
- Flooring matt and in a consistent colour, without any speckles
- Flooring designed in a distinctive way, so to be visually separated from walls
- Handrails in a colour that contrasts with the walls

- Covered with a semi-transparent foil, the exit door appears more unobtrusive
- Colour design matches with the colour concept of the unit

Figure 5. Examples of spatial measures to support patients' spatial orientation in special care units.

Identifying

In addition, colours or pictures can also be used to help patients identify their own room, bed or wardrobe. Examples include large images with distinctive motifs that were affixed to the doors, signs with patients' names or colour cues applied to beds, wardrobes and shelves in the bathroom. Although hospital staff mentioned that patients sometimes stopped recognising visual cues, they were also useful for caregivers or personnel (Figure 6). However, the patient's or caregiver's permission is required to display their names on doors or beds. Due to relatively short hospital stay and compared to stationary long-term care, it is very challenging to personalise patients' areas any further and would require more efforts from staff and caregivers.



- Personalisation through distinctive colour design of the wardrobe doors
- The same colour scheme is continued on the bed and on the bathroom shelves

- In addition to the colour design, individualisation is achieved by means of blackboards on which the patient names are written with chalk
- Chalk boards are also used on the room doors

- Door frames of the room doors clearly contrasted in colour
- Support of the recognition of the own room by large number and picture
- Floor covering patterns and green colouring around the door frame additionally emphasise the door

Situating

Another aspect is to give patients cues with regard to time, date and local region. The living rooms in the units had calendars displaying the present month, season, year and date, as well as wall clocks displaying the current time of day. Patient rooms had a large clock installed. Furthermore, large pictures in patient rooms, corridors and living rooms showed a mix of past and present local motifs. These pictures served to kindle conversations but can also contribute to supporting local orientation (Figure 7).

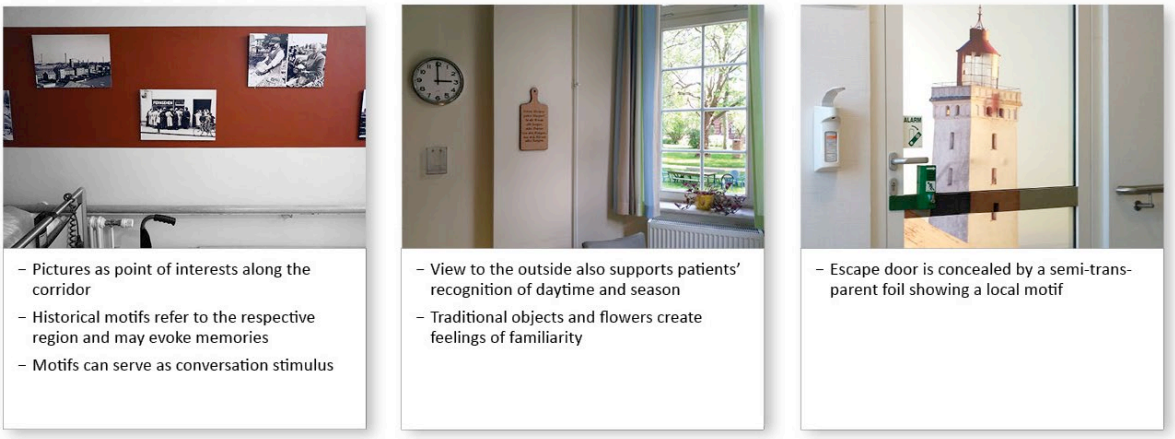


Figure 7. Examples of spatial measures to support patients' local and temporal orientation in special care units.

Ambience

A joint living room and lounge as a space where patients can eat together is of great importance and could be found in all of the examined SCU. In nearly all of the units, efforts intended to contribute to feelings of familiarity were observed. This was most evident in the design of the living room, which was often equipped with special furnishings and decorations. Shared mealtimes were an important part of the ward concept. A design to support these common lunchtimes included small seating arrangements and was extended to table decoration and tableware. These were consequently of familiar design and in a distinctive colour that contrasted with tables or trays. Where possible, bowls were used during meals instead of the usual hospital tray system. However, taking meals together in particular required more personnel and this need was often met by additional non-professional volunteers.

Some of the units offered a patient kitchen which not only created a cosy atmosphere but was also used for therapeutic purposes as part of occupational therapy, for example by cooking or baking together. The installation of luminous ceiling increases the luminous intensity in the room and thus contributes to the activation of patients. Luminous ceilings were often used in corridors and its activating effect was confirmed verbally by the staff. Moreover, distinctive spatial features were observed in the corridors, where points of interest were created by offering tactile artworks or photographs, as well as comfortable seating areas (Figures 8 to 10).

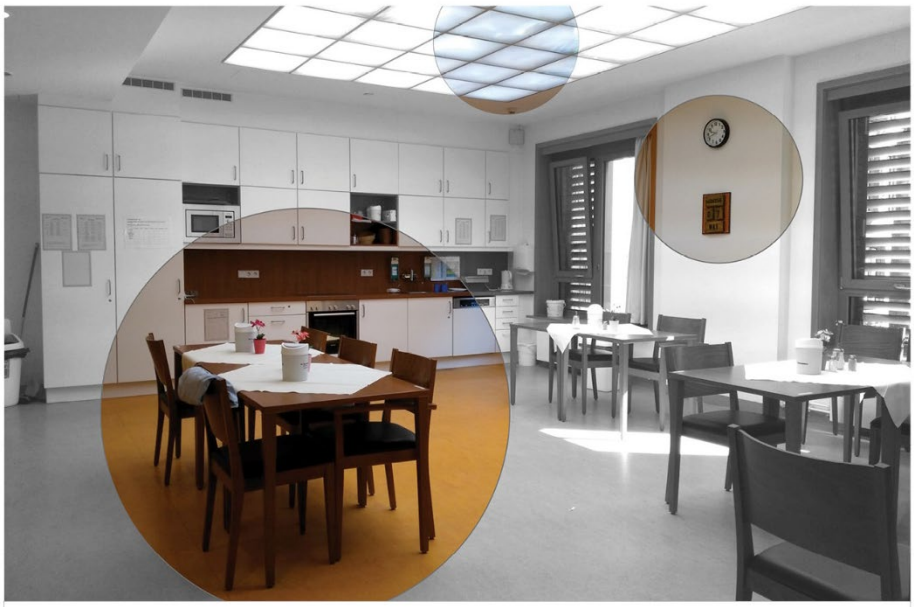
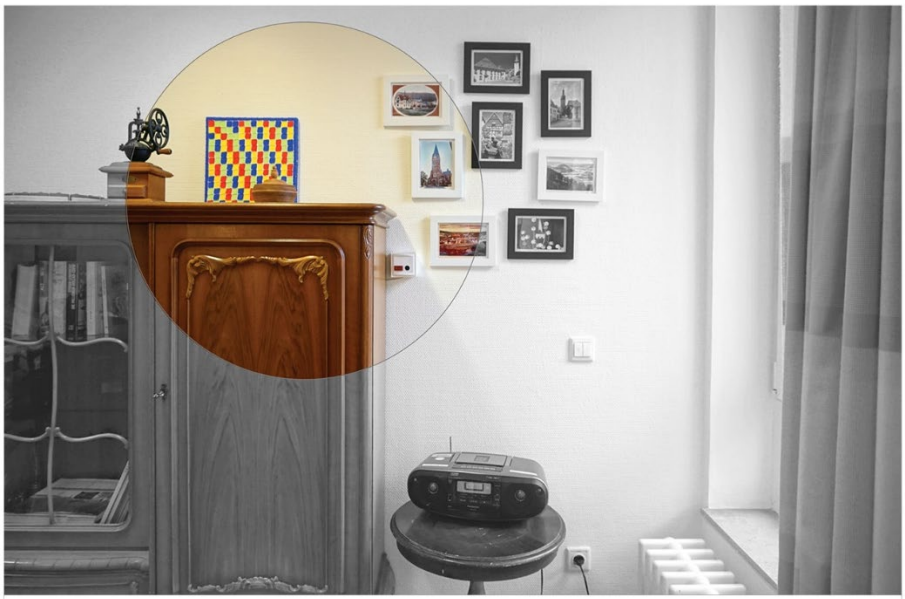
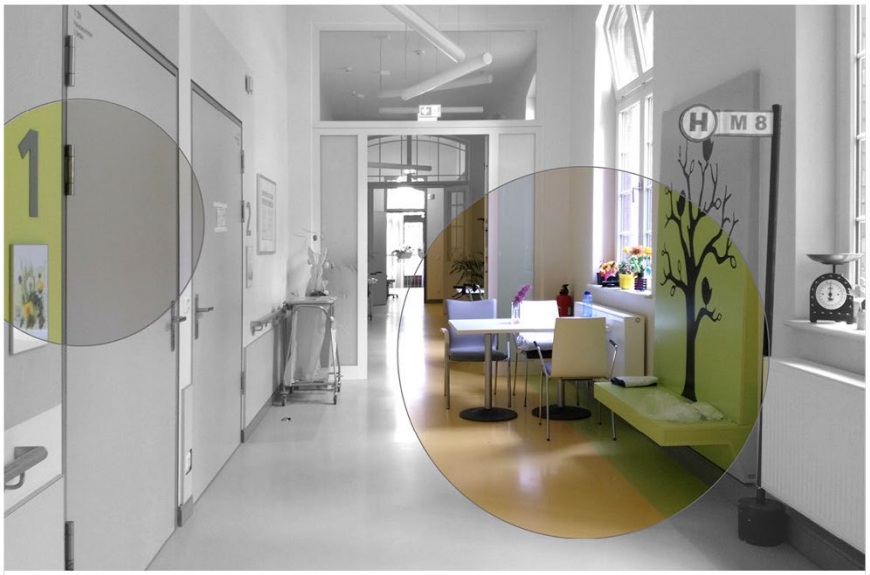


Figure 8. Example of a living room in a special care unit with various dementia-friendly spatial aspects, e.g., kitchenette, small seating groups and luminous ceiling.



– Traditional furniture and decoration create a familiar atmosphere
– Images of the town support local orientation
– Games and books give the opportunity to engage in activities other than watching television

Figure 9. Example of traditional furniture and decorative objects to create a familiar ambience in the living room of a special care unit.



– Seating possibilities in the corridor offer the possibility of resting
– Seating arrangement promotes communication among each other
– Colour concept creates a modern, fresh atmosphere
– Concise framing, illustration and number of the room doors facilitate the recognition of the individual patient rooms

Figure 10. Example of a corridor in a special care unit where a seating group along the corridor is provided.

Conclusion

To our knowledge, this is the first study summarising spatial aspects and dementia-friendly design measures of SCUs for patients with dementia in general hospitals. A high number of dementia-friendly design measures was observed in the hospitals included in the study. The presented examples demonstrate not only that dementia-friendly design is possible under various conditions in acute hospitals, but also that there is a great leeway for design, as spatial concepts were adapted individually. Further, conversations conducted during the site visits revealed that dementia-friendly design measures on SCUs had met others' approval and were therefore implemented in non-specialised wards as well. Therefore, SCUs can be seen as inspirational examples of useful design because they show a thorough understanding of dementia-friendly environments.

Spatial concepts of SCUs need to be worked out not only under building conditions, but also in relation to the care concept. With regard to existing recommendations for the operation of SCUs, it is suggested that they are extended to include the presence of a nursing point. Otherwise, conditions might lead to conflicting demands with regard to a dementia-friendly care concept. For example, physical presence of nursing staff cannot be guaranteed for 24 hours in smaller units depending on a given nurse-patient ratio. In that case, the building layout should be designed such that the unit can be opened and combined with other wards in times of a lower nurse-patient ratio, specifically during night times.

Due to an expected increase of people with dementia worldwide [26] and the demographic change in many western countries, the number of geriatric patients in acute hospitals will increase and so will patients with dementia [27]. As patients with dementia are present in nearly all hospital departments and SCUs will most likely not become the standard care for all these patients, it is even more important to also consider dementia-friendly design in other hospital parts, especially on wards with a high prevalence of geriatric patients like internal or orthopaedic wards. Although the SCUs included in this study showed many dementia-friendly design interventions, it would be further enlightening to evaluate dementia-sensitivity of the built environment in other hospital departments, such as regular wards, emergency departments or intensive care units. We assume very strongly that significantly less dementia-sensitive design criteria would be found. The approach used in this study, including environmental assessment tools and photo documentation, could be used to assess other hospital departments and report the findings.

Research results show positive effects of dementia-friendly design approaches in hospitals [28], [29] and a lot of presented measures can easily be transferred to standard hospital wards, in particular visual cues and a contrasting design that both support orientation. However, regarding a dementia-friendly structural layout the present study emphasises the necessity of an early consideration in the planning process as it refers to the building structure. Otherwise these implementations may result in additional effort in terms of construction works and cost [22]. As research from stationary long-term care facilities strongly suggests that physical design is a contributing factor on the health status of people with dementia [16], we also recommend considering the built environment more seriously as one component of hospital treatment procedure. For example, corridors and staircases could be involved in physiotherapeutic measures as cognitively impaired geriatric patients often do not fulfill the requirements for usual therapeutic equipment in treatment rooms. Here, architects and designers could contribute through sophisticated hospital design to support these efforts. However, more research is needed on the impact of implemented spatial measures on health status and treatment results of patients with dementia in hospitals [21]. Whereas other studies judged the length of stay as an ill-fitting measure to assess the success of hospital wards [4], [30], possible outcome criteria could be the frequency of discharge to a patient's home or reduction of psycho-tropic medication [10], [31]. As a result, additional costs for spatial measures for this group of patients could prove as cost-effective.

Against the background of an ageing population, and the improved satisfaction and enhanced motivation of caregivers [32]–[34], as well as a greater satisfaction with the quality of care perceived by family carers [35], we assume that a dementia-friendly care approach can also benefit a larger group of people in general hospitals.

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