EVALUATION OF HOSPITAL WARD LAYOUTS IN RECENT NORWEGIAN HOSPITALS

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Abstract

Objective – This paper presents current results from evaluations of two recently built Norwegian hospitals and aims towards collecting data to develop guidelines for hospital ward layouts.

Background – There is a growing interest in making decisions on hospital design based on evidence and post occupancy evaluations.

Research question – Which design solutions, investigated in evaluations of different hospitals, can give valuable input to guidelines for best design and layout principles of hospital wards?

Methods – Six hospital cases were chosen to represent different layout solutions of ward design. This paper presents and compares two of them. The methods included assessment of floorplans, walk-through evaluations with hospital staff, semi-structured focus group interviews and individual interviews. The combination of methods was used to investigate layout of wards, workstations and patient rooms. Focus was also on patients' comfort and possibilities of observation of patients as well as work processes in the workstations. Data and photos of specific areas were collected, interviews transcribed, analysed and summarised.

Results – The results show both similarities and variations in design solutions concerning architectural layouts of wards, workstation, patient room and bathroom.

The cases have following common features: Single-bed patient rooms, large windows providing daylight and view, wards divided into 3 smaller units – bed clusters organized around workstations, each monitoring 8-9 patient rooms. Both hospitals have open workstations located in the corridor and including a small glass-sheltered work area and 'support rooms' nearby.

Differences: The distance and visual contact between the workstations and the patient beds vary. One ward case provides bathrooms shared by two adjacent patient rooms, the other a private bathroom for each patient room. Furthermore, one ward includes a centrally placed patient leisure/waiting room with library while the other offers several small social areas for patients in addition to kitchen/dining room.

Perceived comfort, satisfaction and functionality differ relating to the design solutions. The linear design of wards gave a better overview and shorter walking distances than the L-shape. Open workstations functioned well and made the staff available for patients and nearest relatives but showed challenges with confidentiality and capacity. Both patients and staff were satisfied with single-bed rooms and report improved rest, confidentiality and containing infections.

Conclusion – The current evaluation provides preliminary results for design solutions concerning layout of wards, workstations and patient rooms. These solutions are associated with positive impact on experiences of architectural quality, functionality and patient and staff satisfaction and may therefore influence current guidelines for hospital wards.

Keywords: *hospital ward layout | evaluation | satisfaction*

Introduction

A knowledge-based design process

There is a growing interest in making decisions on hospital design based on evidence and post-occupancy evaluations. In the Norwegian guidelines for hospital planning there is from 2017 onwards a claim that all new hospitals should be evaluated, to contribute to the re-use of best solutions and to a knowledge-based design- and building process [1], 2018). On this background, the Norwegian agency for hospital planning and construction (Sykehusbygg HF)- has done evaluations of new hospitals, focusing on experiences of the built solutions, as well as evaluations of the

extrapolated capacities compared to actual activity. The knowledge that stems from these evaluations is used to develop guidelines to help decision processes related to design of functional areas in hospitals.

This paper will focus on the design of wards (bed areas). The aim of the paper is to identify important design features of the ward, the workstation (a separate work area for nurses and other staff) and the patient rooms, based on existing research and recent evaluations done in Norwegian hospitals. The knowledge from the study aims to contribute to the development of guidelines for hospital ward layout in future new or rebuilt hospitals. This is a work in progress, and data from more hospital cases will be included at a later stage.

Hospital ward layout

Several relatively new Norwegian hospitals are built with bed clusters (sengetun). Important reasons for a change from traditional nursing units to bed clusters are to facilitate a closer contact between patients and staff, to improve observation of patients, increase safety and a feeling of security for patients, and to improve bed utilization. Typical elements in the design of bed clusters are:

- Clusters of patient rooms surrounding a decentralized workstation
- Decentralized equipment storage

Normally 3 or 4 bed clusters share common clinical 'support rooms', e.g., a group/meeting room, kitchen/dining room for patients, medicine room, and rooms for soiled and clean utilities. The bed cluster is not meant to be a separate organizational unit, but part of a larger hospital ward [2].

Research on ward layout shows that an important factor in developing functional ward areas is the location and design of the workstation. A general advice is to build decentralized workstations close to patient rooms. Studies have proved that this may reduce walking distances and improve the possibility to observe patients [3], [4]. Decentralized storage facilities for linen, medical supplies, and equipment are also shown to minimize walking distances [5]. Factors contributing to medical staff efficiency and satisfaction are workstation design, an integrated team approach and the overall physical layout of the space on walkability, allocation of caregiver time, and visibility [6]. Furthermore, Copeland and Chambers [7] found that nurses were more content with decentralised workstations compared to centralised ones.

In general, hospital buildings should contribute to environments that support work processes and interaction between staff and patients. Hua et al. [8] describe communication between different staff (nurses, physicians, physiotherapists mm) as an important aim of the development of wards. Communication between different staff is crucial for efficient patient care, and accordingly it is important to plan areas that provide space and overview (see also [9] and [10]). Research on this subject shows that communication may be influenced by different designs. Real et al. [11] found that centralized units facilitate nursing communication while decentralized units seem more supportive to proximity to patients.

Several studies over the last decades have analysed different aspects of design of patient rooms, particularly single vs multiple patient rooms, e.g., [12]. Research has proved that single-bed rooms help to reduce hospital-induced infections, noise, room transfers and associated medical errors, improve confidentiality and patient privacy, facilitate social support by families, improve staff communication to patients, and increase patients' general satisfaction with health care [13]. Research has also suggested that it is more expensive to run single-room wards as it entails a need for increased numbers of personnel. However, the research on this subject is not univocal [14].

Several guidelines have been developed to help knowledge-based design choices. One example of this is Health building notes in England, that give detailed best practice guidance on the design and planning of new healthcare buildings and on the adaptation or extension of existing facilities [15]. In Sweden, Chalmers technical college in cooperation with PTS (Program for technical standard) has developed research-based "concept programs" on specific functional areas in hospital, and among these, ward areas [16].

Choice of hospital cases

We recognised several concept solutions of ward layout and we chose to evaluate six recent Norwegian hospitals with focus on different ward design and their impact on daily practices in the hospital. Figure 1 shows the cases with their unique layout design solutions and distribution of wards. This preliminary study focuses on 2 cases: The St. Olavs Hospital (St. Olavs) phase 2 and Nordland Hospital Vesterålen (Vesterålen), the first with "L" layout and second with a linear layout.

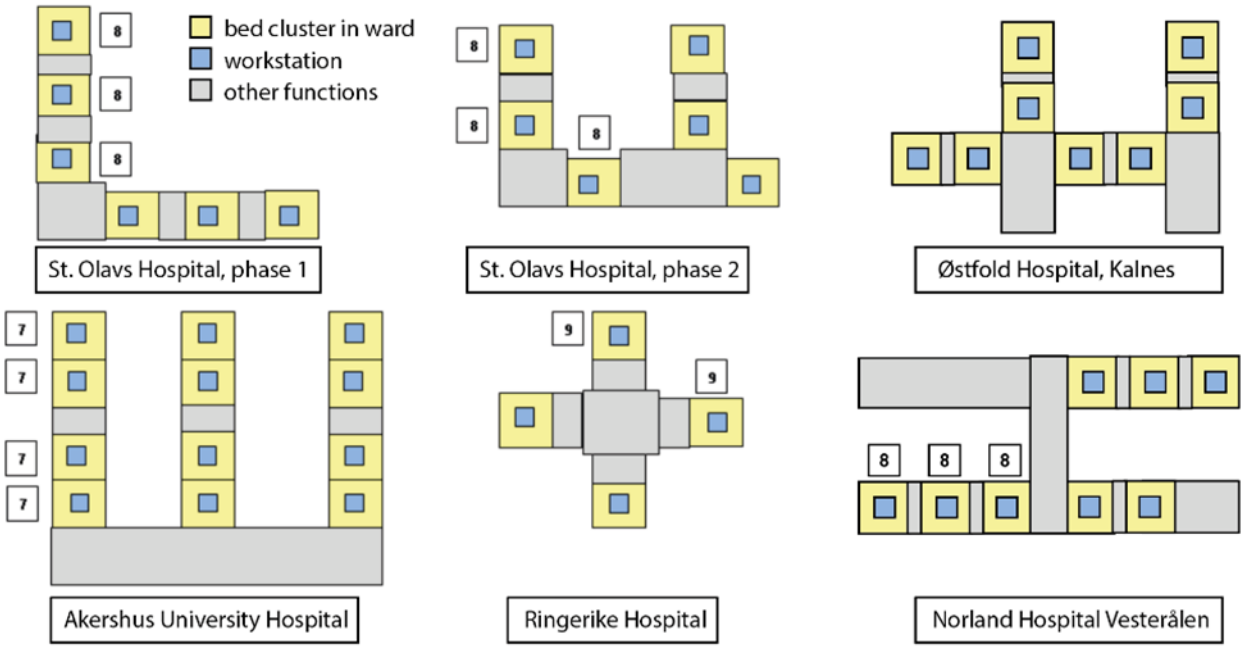

Figure 1. Different concept solutions of ward layout with bed clusters at six recent Norwegian hospital cases

Research question

We have decided to focus on the following research question: Which design solutions, collected from evaluations of different hospitals, can give valuable input towards current and future guidelines for best design and layout principles of hospital wards?

By evaluating different hospital cases we collected information about the experiences of the different solutions and their advantages and disadvantages. We focused on several topics to study. In this paper we will describe the following: the layout of wards, location and design of the workstations, the form and materials of patient rooms with special focus on bathrooms, the social areas and dining areas for patients, and the walking distances between those functions.

Methods

The most known evaluation methodology for buildings is POE – Post Occupancy Evaluation, as defined by Preiser et al. [17]; [18]. They define Post Occupancy Evaluation as "the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time".

Recent research sees POE as “one of the tools to measure building performance and should be used in conjunction with other methods to evaluate all aspects of a building, including the social, psychological and physical” [19]. They suggest a combination of objective building performance data and subjective satisfaction ratings to achieve a valid and reliable evaluation of a building. There are over 150 POE techniques available worldwide [20]. The numerous existing methods often have one focus area that is evaluated more accurately than others. This is illustrated in the Evaluation focus flower model [21], where many of the existing evaluation methods for buildings have been mapped according to their main focus, see Figure 2.

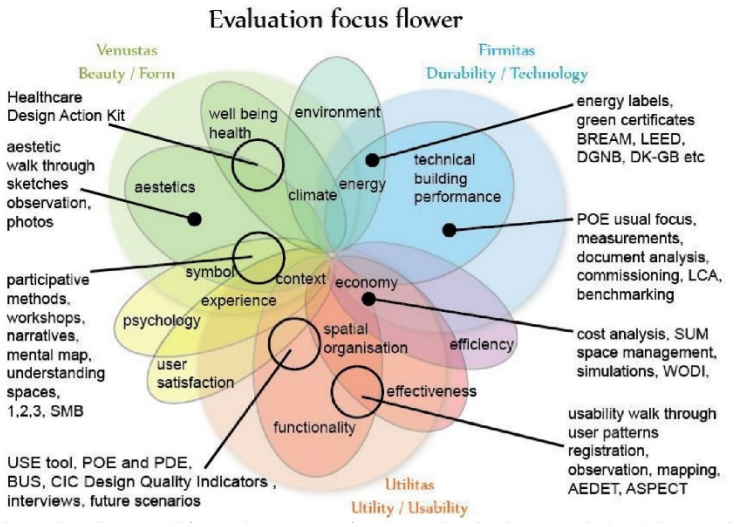

Figure 2. Evaluation focus flower model (Fronczek-Munter, 2013), with examples of different evaluation methods and their main focus.

As this is a work in progress, data from two hospital cases is included in the present study and four more cases will be included at a later stage. The cases are presented in Figure 1. The different hospitals represent different layout solutions to ward design.

The choice of methods for this study, following literature on evaluation methods, consisted of first choosing the focus areas: functionality, user satisfaction, aesthetics, well-being, and health. This was followed by choosing appropriate methods for collecting the data. The methods subsequently comprised a comparison of floorplans, visits to each hospital, and interviews with staff, managers and patients to evaluate the usability of the wards. This includes examining patient and staff satisfaction and collecting opinions on the ward's architecture, layout and functionality, and specifically how well the layout supports the daily practice in the hospital.

Overview over data from the two hospitals included in the current study is presented in Table 1:

	Vesterålen	**St. Olavs hospital, phase 2**
Floor plan analysis	x	x
Visit	x	x
Staff and manager interviews	x	x
Patient interviews	x	

Table 1. Overview of data sources from the current two hospital case studies included in the study, April 2019

Methods included walk-through evaluations with hospital staff members, followed by semi-structured focus-group interviews and individual interviews, to compare results on patient's comfort, safety, heath promoting architecture, workstations, efficiency, and physical solutions supporting or obstructing work processes.

In Vesterålen 21 interviews were conducted with managers and staff, partly in focus groups and partly individual. This comprised 9 managers from three different levels, and 12 employees (physician, nurse, nurse aid, and nurse specialist from anaesthesia, intensive care, emergency and wards). Three walkthroughs were made in the wards, in day surgery and the operating suite. Furthermore, 17 interviews were conducted with patients from medical and surgical wards (8) and day surgery (9).

At St.Olavs hospital three visits/walk-throughs were conducted, in the neurology/stroke department, in the department of vessels and endocrine surgery at the heart and lung centre, and in the gastro centre. Three in-depth interviews were conducted with two managers and one nurse in the gastro and neuro/stroke departments.

Data and photos of specific areas were collected, interviews transcribed, analysed, and summarised. Results were compared with recent scientific literature on hospital design and ward layout.

Results and analysis

Vesterålen hospital is part of Nordlandssykehuset HF in Nordland county. It was built between 2010 and 2014 and was evaluated in 2017, three years after occupancy. The size is 15000 m^2. The hospital consists of 79 beds, 69 are in the wards.

St. Olavs hospital HF is a large university clinic in Trøndelag county. It was built in two periods, between 2002-2006, and 2008-2013. It has 737 beds (2017) The size is 226000 m^2. The case included in this paper is from phase 2.

Figure 3. Overall views of the two studied hospitals – Vesterålen and St. Olavs Hospital, Photo 1: Evaluering av Nordlands-sykehuset Vesterålen, Sykehusbygg 2018, Photo 2: Helsebygg Midt-Norge, Synlig.no

Criteria for analysis:a

Several topics were analysed. In this paper we will describe the results with the following focus criteria:

1. Architectural layouts of wards and overview plan. Comparison of shape, visual comfort and main impressions. Measuring shortest and longest walking distance from patient bed to workstation, and from patient bed to social rooms/dining rooms.
2. Workstations. Location and design, layout, visibility, overview, description of workstations and staff experiences with layout and place – closeness to patient rooms, view to patient rooms, confidentiality, number of workplaces, and access to clinical support rooms. Furthermore size, distance from workstation and functionality.
3. Patient rooms and bathrooms, the social areas and dining areas for patients, and the walking distances between those functions. Patient and staff experiences with patient rooms and possibility to observe the patient and secure safety. Window and view to nature.

Architectural layouts of wards

The study in Vesterålen was done in the medical and surgical wards, which both have three bed clusters organised in a linear layout, along a corridor (Figure 4). Each bed cluster consists of 8 beds (single-bed rooms with private bathrooms), a decentralized workstation, storage for daily utilities, a social area for patients, and a combined work room/meeting room for staff. In addition, three bed clusters share clinical support rooms: A medicine room, equipment storage, room for soiled and clean utilities, disinfection room, and kitchen/dining room for patients (Figure 5). There is one staff manager office in each ward.

Figure 4 Vesterålen overall plan, level 2, including wards

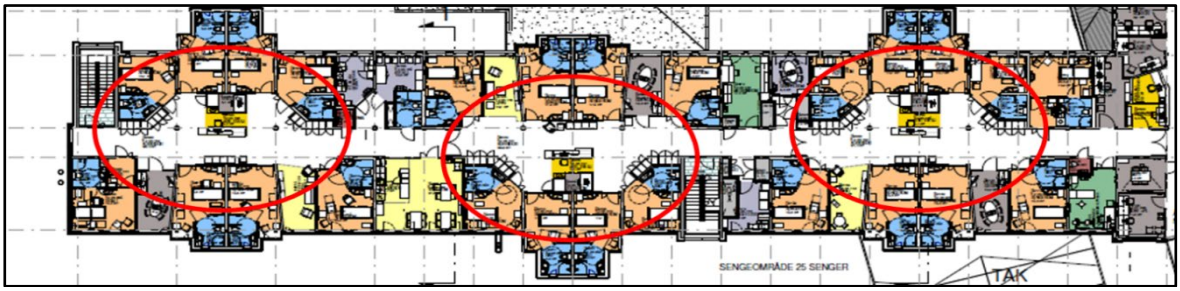

Figure 5. Vesterålen -plan of ward with three bed clusters

The ward studied at St.Olavs hospital is from building phase 2. The ward is L-shaped with three bed clusters, used for patients from the vessel- /endocrine section: Endocrinology and thorax (chest, heart, and lungs). The middle bed cluster is shared by patients from the two specialities endocrinology and thorax (Figure 6 and 7). Each bed cluster has 8 single-bed rooms, 6 of them share bathrooms and 2 rooms in each cluster have separate bathrooms (including one isolation room).

Figure 6. St. Olavs Hospital, plan of the Acute, Heart and Lungs Center building, case level 5

Three bed clusters in the ward share clinical support rooms: A medicine room, disinfectant room, equipment storage, room for soiled and clean utilities, personnel room, a room for teamwork, and kitchen/dining room for patients. There is staff manager office and a shared reception in each ward. Common rooms are shared across specialities.

The main impression from interviews in both hospitals is that the staff is satisfied with the general design and layout of the wards. The areas are light and airy with art and furniture in vivid colours. In Vesterålen it is possible to see across bed clusters and workstations, and it is easy to get an overview over patient rooms. Staff at St. Olav point out that one part of the ward is behind a corner, which prevents an overview over the ward. Consequently, it has been necessary to hire more personnel in the afternoon/evenings. In both hospitals patient rooms and support rooms are within short distance. It must be mentioned that at St Olav, the endocrinology has needed more patient rooms and expanded with four rooms in the thorax department.

St. Olavs hospital has wards including bathrooms shared by two adjacent patient rooms, Vesterålen provides a private bathroom for each patient room. The ward in St. Olavs hospital additionally provides a centrally placed patient leisure room including a waiting area with library.

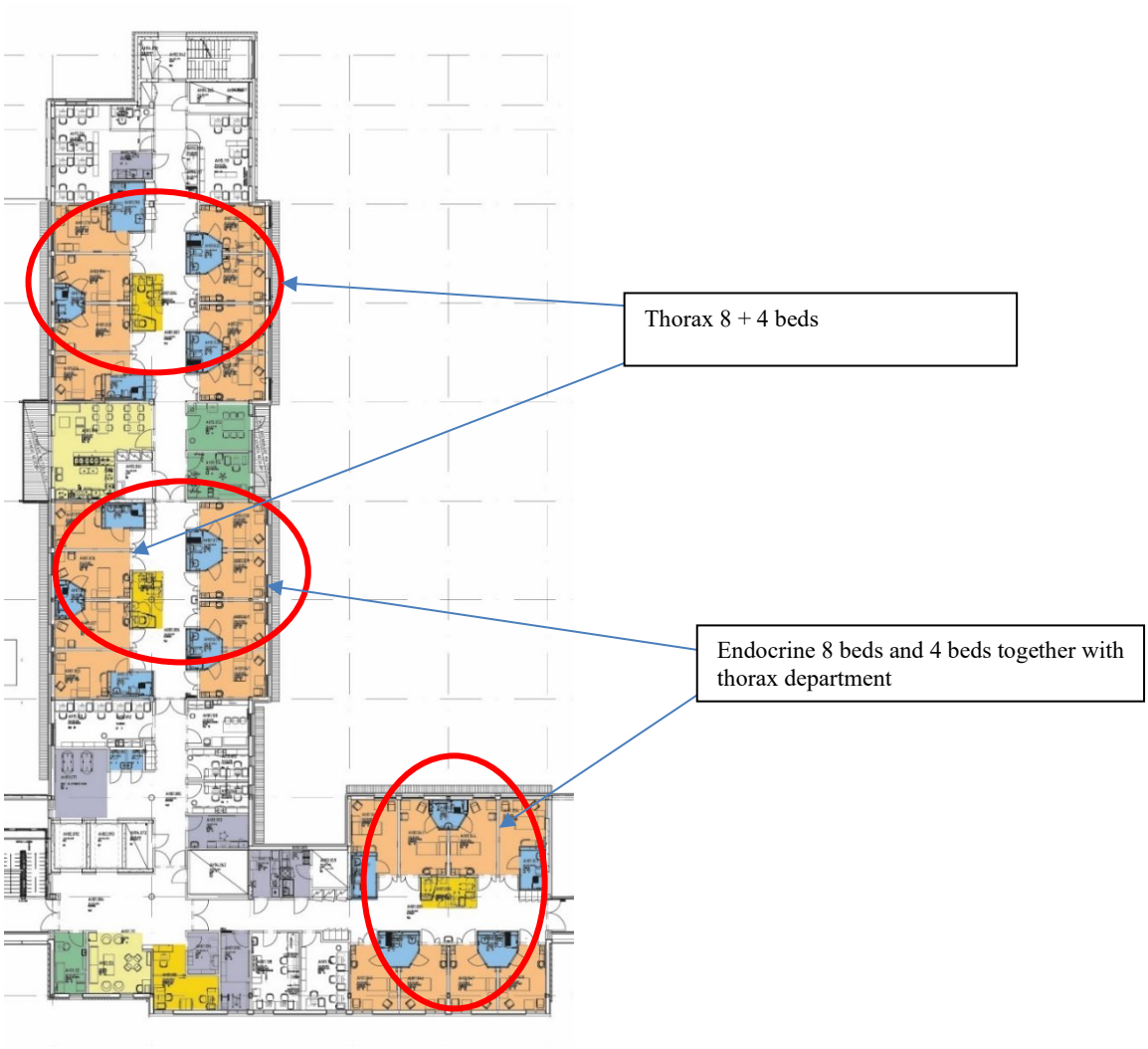

Figure 7. St. Olavs Hospital, plan of the ward of endocrinology and thorax, level 5

Measurements of walking distances

The distance and visual contact between the workstations and the patient beds vary. The measurements of shortest and longest walking distances from patient bed to workstation, and from patient bed to social rooms/ dining rooms are presented in Figures 8 and 9.

At St. Olavs Hospital (Figure 8), the walking distance from a workstation to closest patient bed is 9,6 m and to the furthest patient bed (in same bed cluster) is 14,8 m. The distance from workstation to furthest patient in the neighbouring bed cluster in nighttime is 62,8 m. According to staff, the layout is challenging in nighttime as shifts for staff are smaller, and a nurse needs to walk around a corner, making visibility and accessibility for other patients more difficult. The walking distances from patient bed to common social area, kitchen and dining area are marked with a

blue line. The shortest distance is 17,1 m and longest is 75,2 m. According to staff, both the distance and visual barrier caused by the turn of the pathway makes it difficult for the furthest patients to walk to the dining room.

In Vesterålen (Figure 9), the walking distance from workstation to closest patient bed is 7,7 m and to the furthest patient in neighbouring bed cluster in nighttime is 43,2 m. The walking distances from patient bed to common social area, kitchen and dining area are marked with a blue line. The shortest distance is 12,9 m, longest to small social area is 25 m and longest distance to main dining area in the ward is 57,2 m. The ward in Vesterålen offers several small social areas for patients in addition to kitchen/dining room. The small areas are sometimes used for storage of equipment and, according to staff, are not often used by patients.

Figure 8. St. Olavs Hospital, measurements of walking distances, in meters; red line: from workstation to patients in bed cluster during daytime, to furthest patient in night time, blue line – walking distances from patient bed to common social area, kitchen and dining area, marked shortest and longest distances

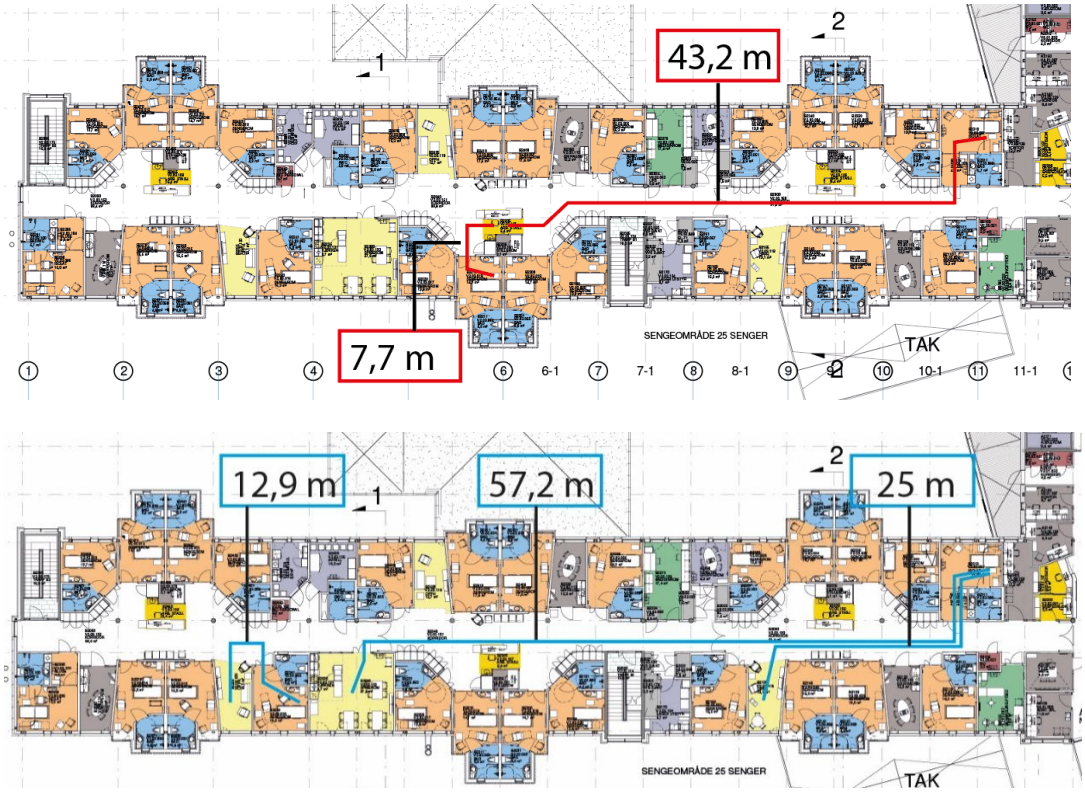

Figure 9. Vesterålen, measurements of walking distances, in meters. Red line: From workstation to patients in bed cluster during daytime, to furthest patient in nighttime. Blue line: From patient bed to closest common social area and main kitchen and dining area, marked shortest and longest distances to small and large areas

In Vesterålen the ward is designed to support flexible use of personnel across bed clusters. Storage in different bed clusters was equipped in a similar way to enhance recognizability across bed clusters. During nights staff would gather in the middle bed cluster to be able to see the whole bed area. There was an agreement that medical patients could use surgical beds if the medical bed area was full. However, the interviews showed that there was a relatively limited use of personnel across bed clusters. This was because personnel preferred working with patients within their specialist field, and there was limited time to provide extra training across specialities.

In both hospitals there is room for equipment storage close to the workstation, and storage for bed linen close to the patient rooms. Interviews showed problems with capacity of storage, both for linen (Vesterålen) and equipment (both). This was caused partly by routines of delivery and partly by planning and building too small storage space. In Vesterålen observations showed that wheelchairs and large equipment was stored in corridors and patients' social areas. Due to lack of storage, St Olav had placed an extra cupboard in the corridor.

Both hospitals have one kitchen/dining room for patients per ward. Staff in Vesterålen experienced that there were more patients who needed food served in the patient room than they had anticipated before moving in. In both hospitals staff pointed out that there was a significant walking distance to the kitchen. At St. Olavs this was especially noticed in the bed cluster behind the corner from the kitchen area.

The medicine room in both hospitals is shared by three bed clusters. The bed cluster farthest away use an electronic medicine trolley to minimize walking distances. The medicine rooms in both hospitals were said to be small, particularly if several nurses worked there at the same time.

In general, there were temporary solutions to minimize walking distances for the bed cluster farthest away from the clinical support rooms. Staff explained this with the need to stay close to the patients.

Workstations

In both hospitals each bed cluster has a decentralized workstation, and the patient rooms are placed facing the workstation, which gives a direct view to most patient rooms (Figure 5 and 7).

At St. Olavs hospital the open workstation has three computer workplaces, and one of them is partially closed in. Documentation work is done here or in a separate workroom. The design and form of the workstation is welcoming and pleasant, inclusive, with accessible design for wheelchair users, and uses natural materials as stone and wood. Interviews with staff at St. Olavs hospital showed that there were not enough workplaces in certain periods and in general a lack of facilities. For instance, an examination room was taken for documentation and meetings.

In Vesterålen each bed cluster has five computer workplaces that are used by nurses, physicians, occupational- and physiotherapists. Two computers stand in the open workstation, and one is placed in a small glassed-in cubicle behind the workstation. Another two computers are in a group room across the corridor from the workstation. This group room serves multiple purposes for staff: Meetings, pre-rounds, lunch breaks, computer work etc. In daytime all the workplaces in the workstation in Vesterålen are normally in use, and interviews with staff showed that the need for computers has increased over time, because of an increase in need for documentation and supervision. The workstation is particularly busy during and after doctor's rounds. The doctors have workplaces further away in the hospital, but the nurses prefer the doctors to remain in the ward after rounds, because it makes them available for questions and clarifications.

In Vesterålen, staff described open workstations as demanding for them, but positive for the patients. The patients were content that staff appeared available for contact, but some of the staff could wish for more shelter for concentration work. However, they saw that this might put off patients who might not dare to contact them behind a closed door. Several staff also said that it was difficult to maintain confidentiality in open workstations, particularly the hours after rounds, because all available rooms were busy. Conversations with patients were conducted in the patient room, but telephone calls and other confidential conversations was more problematic. Patients commented that it was easy to hear conversations from the workstation in the patient room when the door was ajar. The location of chairs in front of the workstation was not optimal for the staff, who could feel observed and suboptimal for confidentiality of staff interactions.

Interviews with staff at St. Olavs hospital confirmed that securing confidentiality in open workstations in busy periods was particularly challenging.

Figure 10. St. Olavs hospital workstation, photo and plan

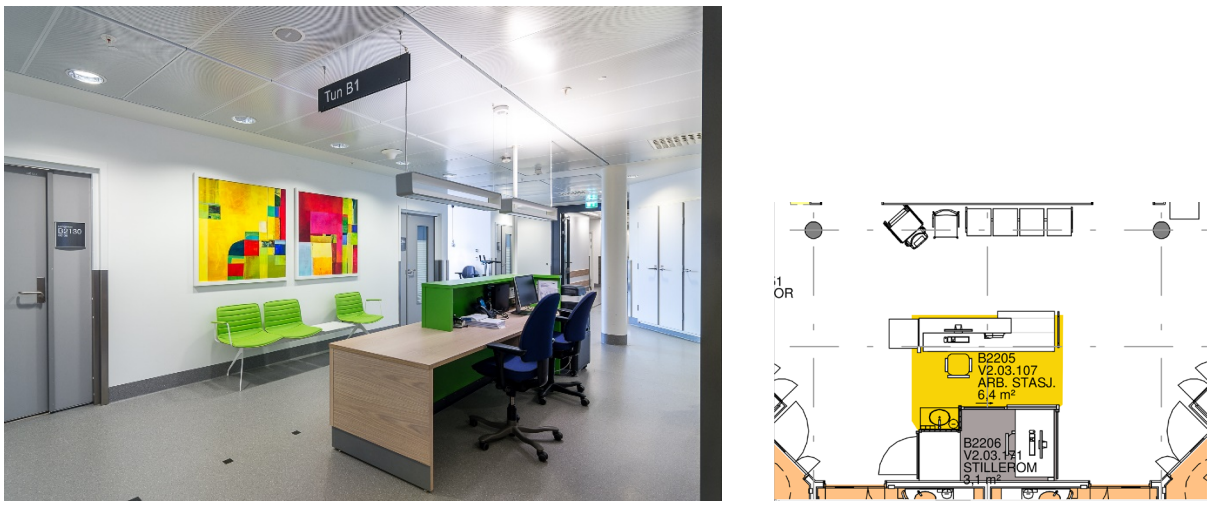

Figure 11. Vesterålen hospital work station. Photo: Svein Erik Tøien – www.setoien.com, plan

Patient rooms

Staff (both hospitals) and patients (Vesterålen) expressed positive experiences with single-bed rooms. Patients said that they were content, that it was calm, easy to sleep, easy to have visitors and to talk to health personnel in confidence. They were content to have a private bathroom. Staff in both hospitals pointed out that single-bed rooms make it easier to secure confidentiality, and that single rooms can be used for examinations, preparing for surgery, etc. Both hospitals confirm that the intention to document more in the patient rooms has not been achieved, mainly due to cultural conditions and existing habits.

In Vesterålen hospital staff experienced that patients stayed more in their rooms compared to the old hospital with multiple-bed rooms. Some patients with longer hospital stays, said that they would like to have a common living room.

In Vesterålen each patient room has a private bathroom. In some rooms the bathroom faces the outer wall, in others it faces the corridor, which makes a variation in the amount of daylight and outer landscape view in the different patient rooms. The doors to the patient rooms have a window with adjustable blinds, and staff can observe patients lying in bed without entering the room and disturbing the sleep. This observation contributed to the patients' health and safety.

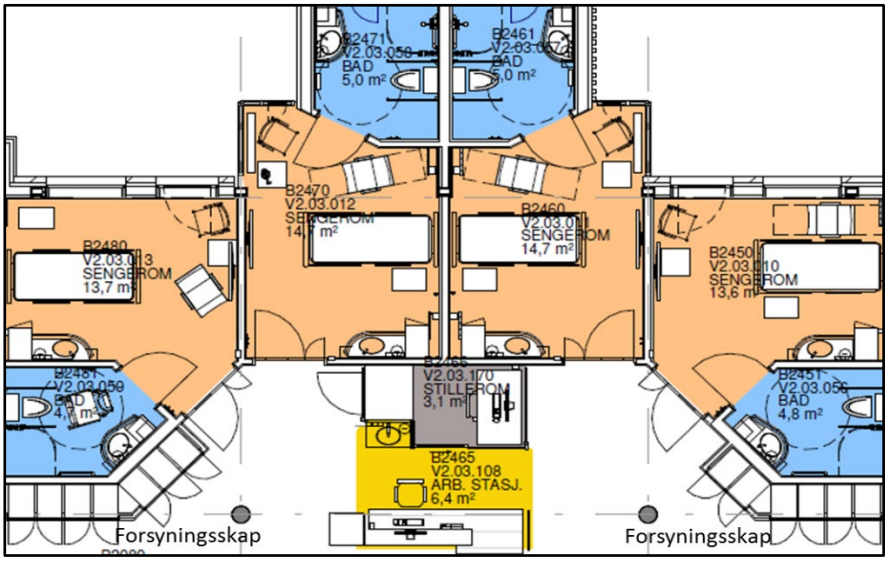

Figure 12. Vesterålen – view of workstation and patient rooms

In the St. Olavs hospital case, 6 of the 8 patient rooms in a bedcluster share bathrooms, and 2 rooms in each cluster have separate bathrooms (including one isolate) Some rooms have bathrooms facing the corridor and others face the outer wall of the room. That makes a variation in the amount of daylight and outer landscape view, due to shorter facade and possible size of windows. There are 4 different room designs, which could be problematic, referring to automatic orientation of nurses in all the different patient rooms and finding right location of supplies. There are small

windows looking into two of the patient rooms from the workstation, with adjustable blinds. Staff said that patients with a particular need to be observed are placed in these rooms.

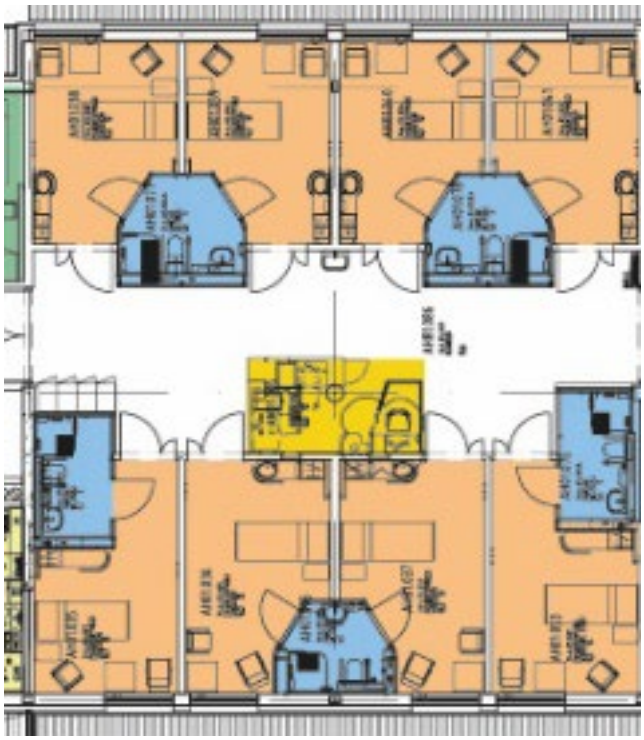

Figure 13. St Olavs hospital bed cluster, workstation and patient rooms

In Vesterålen staff pointed out that they had no outbreaks of gastrointestinal virus infection since they moved into the new hospital with single-bed rooms. This was also the case at St. Olavs hospital. However, at St. Olavs hospital, if there was a case of infectious disease in a room with a shared bathroom, the patient that had not been infected would have to use a bathroom somewhere else in the ward. Staff experienced this as very unpractical and troublesome.

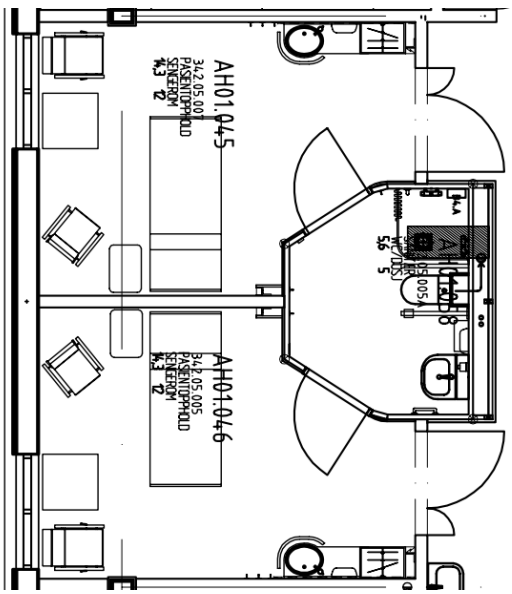

Figure 14. St Olavs hospital, patient room with shared bathroom

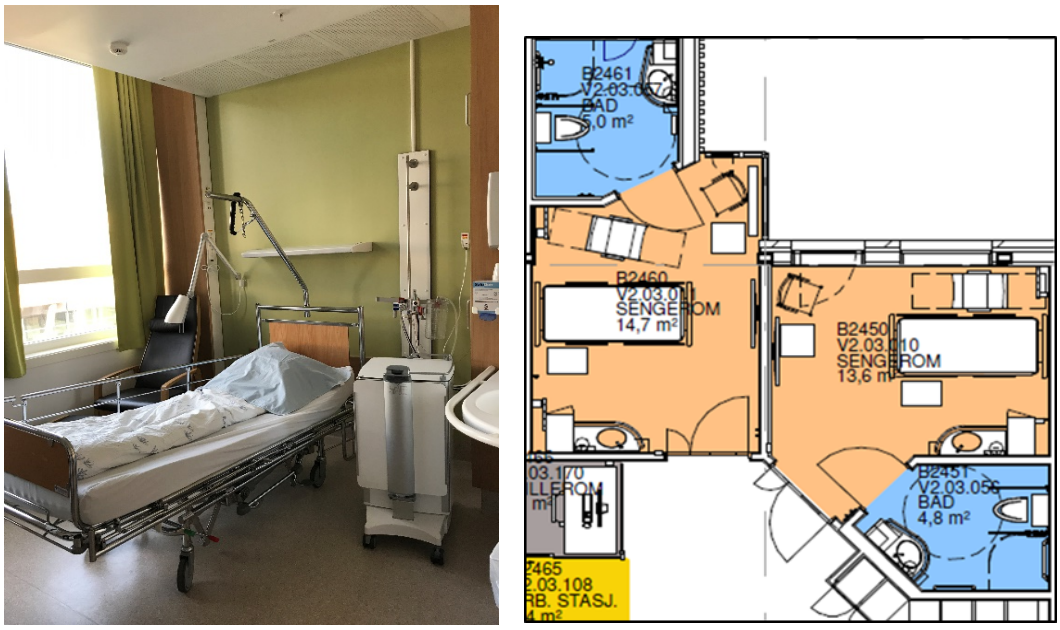

Figure 15. Vesterålen hospital, patient room

Discussion and conclusion

In this paper we have focused on a limited number of factors that are important for the design of functional wards. These factors are: Architectural layouts of wards, the design and place for the workstation, and the patient room and bathroom.

It is important that the ward layout and design of specific areas contribute to achieve the aims of the health services. The design needs to support the quality of patient treatment and care, patient security and safety, and positive experiences with the working conditions for the staff.

Our findings in architectural layout and overall design of wards are that the linear design of wards seems to give a better overview over the ward than the L-shape, which confirms previous research, e.g., [6]; [4].

The distance and visual contact between the workstations and the patient beds vary. The measured walking distances from workstation to patient bed vary from shortest 7,7 m to longest 62,8 m - to furthest patient in neighbouring bed cluster in nighttime. The walking distances from patient bed to common social area, kitchen and dining area are following: The shortest 12,9m and longest 75,2 m. In St. Olavs hospital case, both the distance and visual barrier caused by the turn of pathway make it difficult for the furthest located patients to walk to the dining room. The small social areas located along the ward in Vesterålen are sometimes used for storage of equipment and, according to staff, does not seem attractive for patients to visit.

In both hospital cases there seems to be problems with storage space. A general experience seems to be that there is too little space for equipment and room for daily utilities. Both the problem and the solution could involve a combination of existing or new routines and actual space size and location.

Findings about workstations in both hospital cases are the following: Patients and staff have positive experiences with decentralized workstations. However, there are some important conditions to make them work: Proper capacity and room for computer work across professions, and sheltered workplaces for concentration work and confidential conversations. In busy periods it is challenging to secure patient confidentiality. Specifically, in St. Olavs hospital, the staff would strongly wish a larger sheltered area for confidential work. Thus, the present design seems to challenge communication in certain situations, as in [8].

In evaluations of patient rooms our findings confirm the positive experiences from earlier research, as in [13]. Both patients and staff are satisfied with single-bed rooms. The staff has originally had ambitions to do more documentation work in the patient rooms – this has not been achieved. Nevertheless, multiple other tasks are done here, and private conversations between staff and patients are encouraged. A window in the door to patient rooms gives a possibility to see the patient in the bed without entering the room, and thus enhances patient safety (as also noted in [8]). It has been noted as positive to both patients and staff to observe/be observed without disturbing the patient.

Our evaluations prove that experiences of staff and patients with private bathrooms are more positive than with shared bathrooms, both regarding privacy and containing infections. In St. Olavs hospital the risk of infections because of shared bathrooms is prevented by referring the neighbouring patient to public accessible corridor toilet, which is problematic both because of privacy and extra walking distances for the patient.

Both hospital cases provided results on flexibility and durability of the ward concept, by proving that two medical disciplines can share one ward. In the case of St. Olav, the ward was dividing the three bed clusters and sharing similar design and storage capacities for two disciplines. Vesterålen as well uses the ward for two disciplines: medical and chirurgical.

The combination of presented preliminary findings from evaluations of wards in St. Olavs Hospital and Nordland Hospital Vesterålen will be developed further with addition of data from more case studies. These can form current and future guidelines for best design and layout principles of hospital ward layout, based on recent evidence.

Recommendation to further research

It would be valuable to include evaluations of more hospital cases and in particular recent cases from other countries, and with other ward layout principles, such as centralised workstations and touch down working desks, as seen in the UK.

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