


## Specificity of general zones in large modern European multispeciality hospitals – selected case studies

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**Abstract:** The present paper shows the results of research on general zones in large European multispeciality hospitals. A dozen or so institutions, flagship examples of large contemporary hospitals, were selected for the study. The research focused on internal zones, in particular the reception area linked to the main communication system of the hospital which functions as a public space offering a range of services, and provides the space for communication, waiting and meetings. This work aims to determine design trends in the location and forms of general zones, their characteristics and proportion to other zones in hospitals, architectural features and functional-spatial solutions. The relationships between the shape of the hospital, its internal general zones, and their percentage share in the total building area were examined. Art and greenery in these zones were also investigated, along with the presence of natural lighting, the colours, and the type of finishing materials used in this type of space today. The study revealed noticeable differences between the form of general zones in large contemporary as well as 20<sup>th</sup>-century hospitals. In addition to their form, the arrangement of zones has also changed, and they often do not resemble a hospital space. Art and greenery play an increasingly important role. The general zone is a hospital's essential communication hub, constituting the main public space where people may meet.

**Keywords:** general zones in a large hospital, multispeciality hospital, health care architecture

### 1. Introduction

Large multispeciality hospitals provide a broad spectrum of care. They can be divided into large general hospitals and university hospitals. The features of large multispeciality hospitals include the presence of at least a dozen specialised departments, a large surface area and a significant bed stock (representing several hundred or more patient beds). Hospitals are one element of the health care system that serves the inhabitants of a given area [1].

The buildings selected for research are among the largest hospitals in Europe. Nowadays, such constructions are rarely built, but if they are, they are usually impressive and complex, representing a great challenge for designers. Contemporary multispeciality hospitals largely resemble similar institutions from the second half of the twentieth century, but their form has changed significantly, as well as the method of shaping and arranging spaces – especially general zones. Hospitals built over the last number of years also reflect developments in these spaces. The reception area and main passageways connected with it constitute an accessible public space, which is also a representative part of the institution. The architecture allows for spaces which combine different functions, creating strictly defined zones as well as access to other areas. Their openness makes them suitable as social spaces [2].

## 2. State of research

Large multispeciality hospitals, both university and general, are a subject of research in terms of the architectural and functional solutions applied there [3], [4] as well as individual hospital zones [5]. Scholars also focus on aspects related to the therapeutic environment of the hospital [6]-[11]. This is also of interest in the context of the greenery present in hospitals [12]. Moreover, other issues influencing the hospital environment in terms of comfort are studied. These include the role of daylight [13] and colours [14] in hospital facilities. Wayfinding systems [15] which make it easier to navigate the hospital, thereby reducing anxiety and inducing trust [16], are subject to examination as well. Moreover, recent research focuses on the design of hospital interiors using virtual reality and Evidence-Based Design to maximise the quality of the space [17].

In recent years, research has also focused on art in hospitals, increasingly found not only in general zones but also in wards and patient rooms [7], [18], [19]. Some studies explore art in the context of the effects of sounds and music on health in hospital settings [20]. Hospital planning and design is studied in terms of Evidence-Based Design [21], [22]. Public spaces are explored in relation to the quality of hospital environment, its impact on the physical and psychological comfort of the patients and other visitors [23]-[26], and influence on the relationship between patients and medical staff [27]. Studies embrace not only internal public spaces in hospitals, but also external ones – more specifically their design assumptions and therapeutic benefits [28]. General hospital zones have also been subject to more extensive research, presented in a doctoral dissertation on waiting spaces [29].

A review of the literature on large hospitals has shown that there are many studies on different aspects of the hospital environment and its relationship with user comfort. Beyond that, researchers deal with more specific topics connected with the hospital environment such as art, greenery or the role of light and colour. Some scientists study public spaces in hospitals, focusing on their impact on visitor comfort. However, an initial review of the literature prompts research on public spaces in hospitals that addresses another aspect – internal general zones and their percentage share in all hospital zones. In addition, their shape and how they relate to hospital structure, as well as characteristic features were investigated.

## 3. Methodology

Fourteen hospitals from eight European countries were selected for the study. These are large facilities providing multiple medical services. The group encompasses both large general hospitals and university hospitals. The main selection criterion was the number of

medical specialisations in a given facility. The vast majority are among the largest hospitals in their respective countries. The hospitals studied were built between 2000 and 2020 (the first of the researched facilities was opened in 2007, but the classification also includes the planning and design period, which in the case of this type of establishment takes at least several years until construction work can begin). Other selection criteria included the area of the hospital and the number of beds. The facilities investigated are often characterised by original architectural and spatial-functional solutions. It is also noticeable that their design draws on contemporary research on health care buildings – as evidenced, among other things, by the presence of art and greenery in the facilities. Despite their large scale, the selected hospitals have a less institutional character than similar buildings from the previous century and place greater emphasis on patient comfort. Firstly, various contemporary hospitals in Europe which met the study criteria were taken into consideration. Approximately 40 large multispeciality hospitals in Europe were built between 2000 and 2021. The facilities selected for examination had materials available including drawings, floor plans and similar studies necessary for carrying out research. Hospitals where access to detailed materials was difficult were not included in the detailed study.

After analysing the criteria described above, fourteen hospital complexes which corresponded most closely to the research objectives were chosen. Therefore, the 14 hospitals selected can be perceived as representatives of large contemporary multispeciality hospitals in Europe. Secondly, the arrangement, scale and form of the general zones in these facilities were analysed. The results are graphically presented in Fig. 2, which shows the proportions and location of given zones in the context of the whole hospital establishment. The remaining zones marked in grey are administrative, diagnostic, consultation and operating areas.

Thirdly, the architectural solutions applied in general zones, the form of the zones, prevalent materials, colours, elements of art and greenery were discussed. Attention was also paid to the features and roles of particular zones. Research materials included photographs and information obtained from publications, websites of design offices, hospitals and architectural websites. The average area of the studied complexes of large hospitals was about 117,745 m<sup>2</sup>.

For the purpose of this paper, the author defined a hospital general zone as a publicly accessible space, functioning as a public space where everyone is free to visit. This zone includes a representative entrance hall with a reception desk, information desks, a passageway with seats, a café/restaurant, a pharmacy, various types of shops (grocery, newsagent's, florist's) and services (hairdresser's, beauty parlour), a chapel, etc. It does not include corridors in other parts of the hospital, e.g. in diagnostic areas, outpatient clinics, bed wards and places of a similar nature, where there is usually some form of access restriction. People usually come to these zones for a specific purpose, such as an appointment or examination. Most often their identity is verified, e.g. when they are admitted to a ward or when they come to visit a patient.

Table 1. List of hospitals subject to research

No./ source	Hospital name	Town, country/	Number of storeys/ usable floor area [m <sup>2</sup> ]/ number of beds	Year of establishment
1 [32]-[34]	Hospital Infanta Sofia	San Sebastián De Los Reyes, Spain	2-5 storeys/ 126,790 m <sup>2</sup> 257 beds	2007
2 [35]-[37]	Akershus University Hospital	Oslo, Norway	6 storeys/ 137,000 m <sup>2</sup> 953 beds	2008
3 [38]-[40]	Jeroen Bosch Hospital	Den Bosch, The Netherlands	5-6 storeys/ 170,000 m <sup>2</sup> 1120 beds	2010
4 [41]-[45]	Klinikum Klagenfurt	Sankt Veit im Pongau, Austria	3 storeys/ 145,000 m <sup>2</sup> 1470 beds	2010
5 [46]-[47]	Queen Elizabeth Hospital	Birmingham, UK	10 storeys/ 170,000 m <sup>2</sup> 1231 beds	2010
6 [48]-[49]	Centre Hospitalier de Marne-la-Vallée	Jossigny, France	3 storeys/ 72,000 m <sup>2</sup> 585 beds	2012
7 [50]-[51]	Rey Juan Carlos Hospital	Móstoles, Spain	3-8 storeys/ 94,705 m <sup>2</sup> 570 beds	2012
8 [52]-[53]	Meander Medical Center	Amersfoort, The Netherlands	5-9 storeys / 112,000 m <sup>2</sup> 620 beds	2013
9 [54]-[56]	Can Misses Hospital	Ibiza, Spain	2-5 storeys/ 67,132 m <sup>2</sup> 250 beds	2014
10 [57]-[58]	New Álvaro Cunqueiro Hospital	Vigo, Spain	5 storeys/ 297,000 m <sup>2</sup> 1465 beds	2015
11 [59]-[61]	Hospital Lillebaelt Kolding	Kolding, Denmark	2-9 storeys/ 32,000 m <sup>2</sup> 202 beds	2016
12 [62]-[64]	Landeskrlinikum Thermenregion Mödling	Mödling, Austria	4 storeys/ 54,800 m <sup>2</sup> 338 beds	2019
13 [65]-[67]	Hospital Nova	Jyväskylä, Finland	3-8 storeys / 116,000 m <sup>2</sup> 368 beds	2020
14 [68]-[70]	Rigshospitalet Hospital North Wing	København, Denmark	3-7 storeys/ 54,000 m <sup>2</sup> 200 beds	2020

## 4. Results

### 4.1. Forms, shape and location of general zones

General zones, starting from the reception area, form the main communication routes in the hospital, while also being the most accessible and representative public spaces. They are closely linked to the form of the hospital. Changes in the approach to shaping the form of both the hospital and general zones can be observed in the institutions under study. The most popular layout of a hospital in the late twentieth century was a vertical structure with a “wide foot” or a “podium”, which provided space on the horizontally extended ground floor for diagnostic, treatment and administrative zones, while the ward sections lay vertically above [30]. The first hospital type, distinguished in 50% of the facilities under examination, was developed on the basis of similar assumptions. The main difference is that the so-called “podium” occupies from 1 to 3 storeys above which are mostly wards or areas with similar

functions. However, they are not structured like a high tower, but as fragmented low pavilions located above the podium in a more horizontal manner. Modern buildings featuring this structure usually have a linear layout as well [31], which also determines the shape of the general zone. Obtaining a legible and clear functional division in large hospitals, which facilitates movement around the building for all groups of users, is possible especially with a band-shaped arrangement of the hospital. It also allows the complex to be further developed while maintaining the functional transparency of the facility [16].

The second type of a hospital observed among the examined institutions is also linear and represents a combination of ridge and mono-block (with atria and courtyards) layouts. Fully mono-block structures (Centre Hospitalier de Marne-la-Vallee) and pavilion layouts (Can Misses Hospital) are the rarest. Regardless of the spatial layout, contemporary general zones are linear. In half of the hospitals included in the study, this zone was between one and two storeys high. 21% of the facilities had a three-storey zone and in 29% of them the height of this space ranged between 4 and 6 storeys. The common feature of the general zone in the hospitals studied here was good natural lighting via skylights or full roof and partial wall glazing (especially in the case of high glazed entrance atria) In some cases, good lighting is provided by courtyards covered with greenery which also provide relaxing views from general zones. One example of this form of the general zone is presented by Jeroen Bosch Hospital, where the greenery merges directly with the main communication zone, which is the general zone of the hospital.

The general zone is located in the centre of the complex, forming the main axis (axes) of communication and composition. It is usually the main hub of the site linked with other parts of the hospital, i.e. specialised spaces with controlled access. General zones account for almost 1/10 of the total space of the hospital complex. In their immediate vicinity, groupings of bed wards are located on the upper floors.

### SHARE OF GENERAL AREAS IN THE SURVEYED HOSPITALS

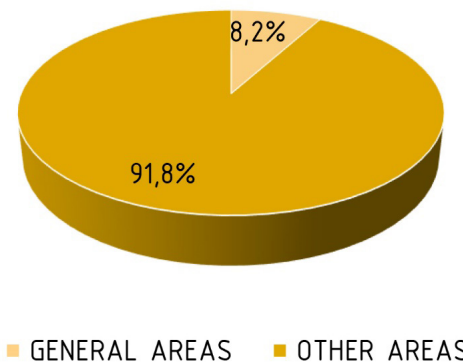


Fig. 1. Share of internal general spaces compared with the total area of the researched multispeciality hospitals. *Elaboration by R. Strojny 2022*

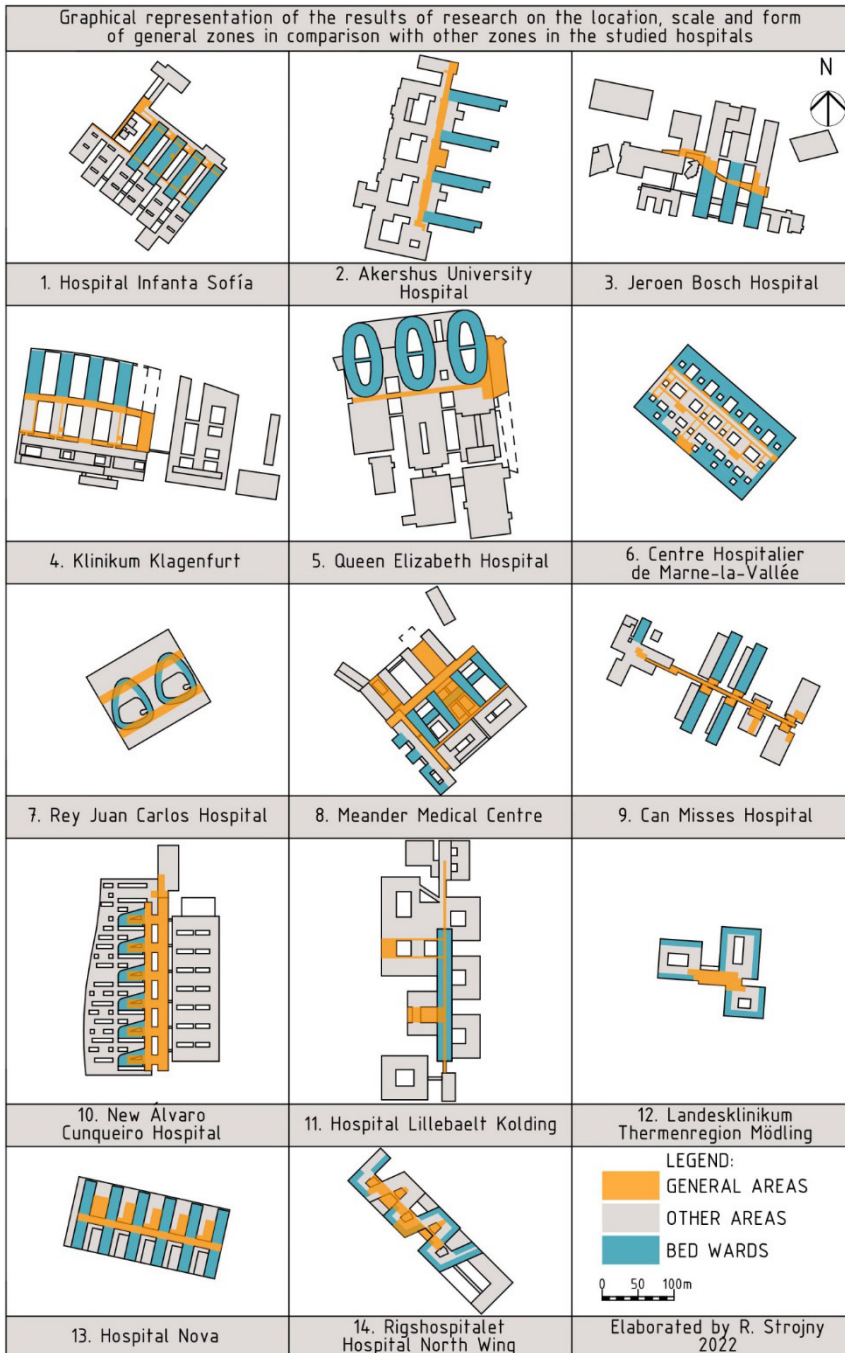


Fig. 2. Graphical representation of the results of research on the location, scale and form of general zones in comparison with other zones in the studied hospitals. The layouts are presented in proportion to each other. *Elaborated by R. Strojny 2022*

#### 4.2. Colour scheme, materials, art elements in general zones

Grey, beige and white colours prevail in the researched facilities. This colour scheme is often broken by blue, green, orange and yellow accents. General zones are usually finished in natural materials such as wood, stone and terrazzo. The general zone in Rey Juan Carlos Hospital is an example of this combination of materials and colours, but it stands out from other hospitals because it is a very elegant space, with simple geometric shapes, austere in form, without embellishment – the main accent is on the material finish and appropriate choice of furniture.



Fig. 3. Summary of selected general zones in the examined hospitals. (1 – Akershus University Hospital/ C.F. Møller, Phot. Jørgen True/Studie-E, 2 – Jeroen Bosch Hospital/ EGM Architecten, Phot. EGM Architecten, 3 – Queen Elizabeth Hospital/ BDP, Phot. BDP, 4 – Rey Juan Carlos Hospital/ Rafael de La-Hoz, Phot. Alfonso Quiroga, 5 – Meander Medical Center/ atelier PRO architecten, Phot. Dirk Verwoerd, 6 – Hospital Lillebaelt Kolding/ Schmidt Hammer Lassen Architects, Phot. Helene Mikkelsen, 7 – Hospital Nova/ JKMM Architects, Phot. Tuomas Uusheimo). *Illustrations published with the kind permission of the owner*

Many studies on colour and light have revealed their influence on human behaviour, mood and concentration. Cool colours (such as green, blue) promote relaxation and calmer activities, while warm colours (red, orange, yellow) stimulate physical and social activities. In contrast, colours such as beige and grey limit attention. Colour in the public space of a hospital can also be an element facilitating orientation and navigation within the building [14]. In addition to colours, views from different zones are also essential. According to a study by Serbian researchers, it is important to provide views on the outside areas of the hospital, not

only for safety, but also psychological reasons. Constant access to the outside world reduces feelings of isolation and claustrophobia [28].

In the facilities created in the last five years, general zones are characterised by the inclusion of art in many forms. These include art installations, the form of lighting, seating and similar elements of small architecture, as well as colourful graphics. Sculptures can also be found in some hospitals. According to research by the curator of art in health care Mary Grehan, art in the hospital should be balanced so that it engages and stimulates users, without being provocative, bearing in mind varying degrees of emotional sensitivity [19].

### **4.3. Formation of general zones and functional links with other parts of the hospital**

Furthermore, hospital public spaces are often embellished with greenery (e.g. trees in pots), which fosters cosiness in a given zone. Greenery has a positive effect on stress management, especially when spending time in hospital – for patients, visitors and staff alike [12]. Seats arranged in rows are rarely used. Today, they are often individually designed for a specific hospital. This is illustrated by the seats at the Hospital Nova, being wooden benches with comfortable oval-shaped backs. Wooden sculptural compositions and the shape of lighting provide additional accents in that hospital. In the Rigshospitalet Hospital North Wing, art comes in the form of a spiral staircase and colourful ornaments beneath some flights of steps.

Despite the large scale of the hospital and its general zone, such architectural and design solutions often make the space cosier and more friendly for patients and other users. They also make a facility seem less of an institution, which was one of the main features of 20<sup>th</sup> century hospitals. Most contemporary general zones of large hospitals do not resemble a hospital interior, but look more like the inside of a gallery or hotel lobby. These spaces often can resemble shopping arcades with cafés, restaurants, shops (e.g. grocery shops), florists, kiosks and even exhibition spaces. These areas play a very important role as places where people can meet and socialise, and as such there are many clusters of seats there, not only in waiting areas. Besides, information desks and waiting areas can be found around this zone. Nearby, chapels and prayer rooms are located too. In some hospitals built in recent years, chapels are divided into zones for different faith communities, for example at Jeroen Bosch Hospital (The Netherlands, 2010) and Queen Elizabeth Hospital Birmingham (UK, 2010).

The growing importance of public spaces in hospitals is linked to the desire for integration with urban structures. These spaces are shaped as shopping arcades offering services. They can also take the form of squares. In the case of outdoor spaces, these are most often gardens and courtyards with art elements. Adequate lighting of the public zones influences hospital forms, resulting in more fragmented hospital layouts with fewer storeys [16]. General zones in hospitals usually begin with a spacious reception hall. The linear general zone may also be divided into one or more places by glazed atria. This is noticeable in the Meander Medical Center, among others, with its clearly accentuated main entrance and generous glazing. This large-scale space contains many clusters offering various places to sit. It is also a kind of communication hub for the entire establishment. A similar entrance hall can be found at Queen Elizabeth Hospital, with mainly white and blue accents. The high entrance hall distinguishes also Lillebaelt Kolding Hospital, where the atmosphere is additionally invigorated by big flower pots with trees surrounded by seats.



The examined general zones usually constitute a hospital's central public axis of communication around which public functions are concentrated. In this hierarchy, they are followed by diagnostic areas, the ED and outpatient clinics, which have separate passageways accessed from the general zone and require undergoing access control. Only after passing through the general zone and then the internal passageway can one reach the hospital's medical facilities such as diagnostics, outpatient clinics etc. In addition to the services and public functions directly linked to the general zones, the space on the ground floor usually provides access to outpatient care, diagnostics, rehabilitation etc. At certain intervals, the general zone has access to vertical communication that connects it to upper floors where bed wards, operating theatres and the administrative area tend to be located (Fig. 4).

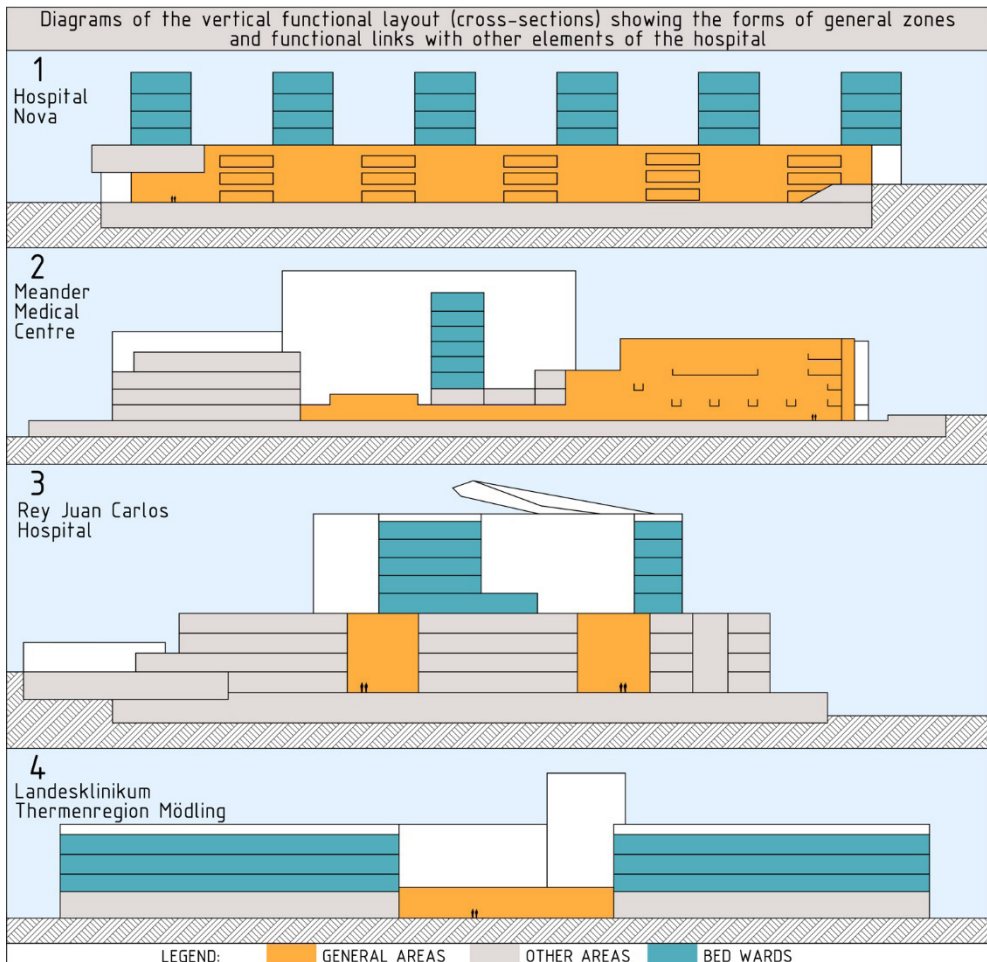


Fig. 4. Diagrams of the vertical functional layout (cross-sections) showing the forms of general zones and functional links with other elements of the hospital. *Elaborated by R. Strojny in 2022*

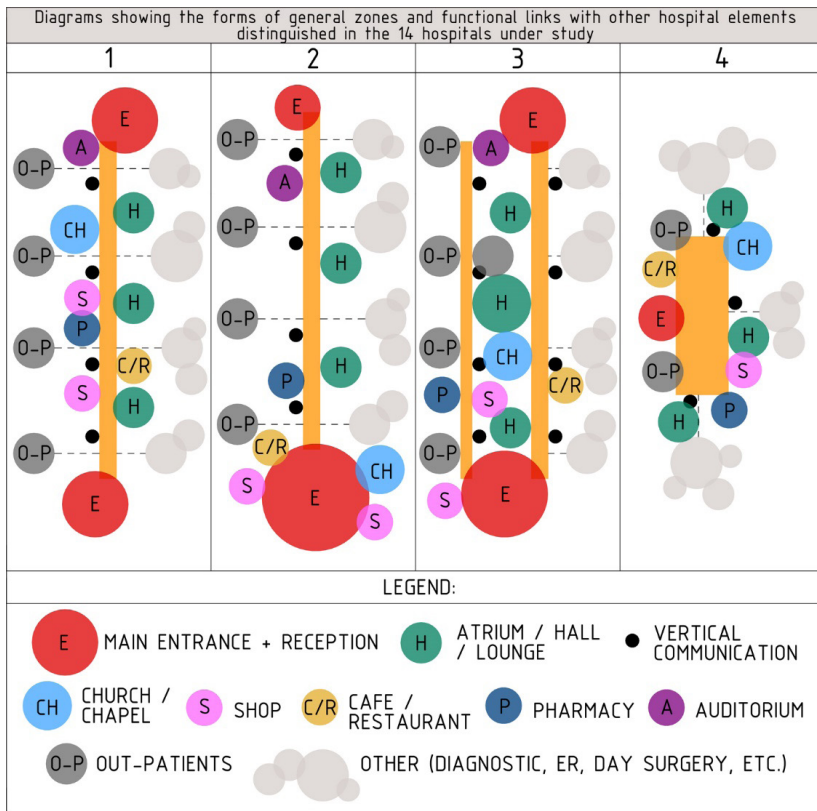


Fig. 5. Diagrams showing the forms of general zones and functional links with other hospital elements distinguished in the 14 hospitals under study. *Elaborated by R. Strojny in 2022*

Regarding the form of general zones and their links with individual functions of the facility, four solutions were distinguished among the 14 hospitals researched (Fig. 5). The first three solutions are clearly linear. In the first layout, the general zone begins and ends with a similar-sized entrance hall with a reception area. Along the general zone are the previously mentioned public functions (shops, café, etc.) and vertical communication. Perpendicular to the main axis of the general zone, there are passages to specific parts of the establishment. Most often, one side of the axis leads to zones for outpatient care, while the other side to zones for the ED, diagnostics, rehabilitation etc. Vertical communication provides access from the general zone to the higher parts of the facility with bed wards, operating theatre, administration etc. This is the layout of Akershus University Hospital in Oslo, among others (Fig. 6).

The second layout of the general zone differs from the first in that the proportions of the entrance areas at both ends are different. In this case, there is one main hall, much larger than the other one, and also much larger than the entire passageway that makes up the whole general zone. It can assume the form of a tall glazed atrium. The third layout consists of at least two passageways between which are located both public functions and services such as ambulatory care etc. This type of solution is most often found in clearly horizontal hospitals with a low-rise structure. As well as vertical communication, spacious green atriums are arranged along the general zones in order to maximise light.

The last layout differs considerably from the above in that it is not clearly linear and can be found in slightly smaller hospitals. In this case, public functions are located around a central general zone. It is linked in several places to other parts of the complex.

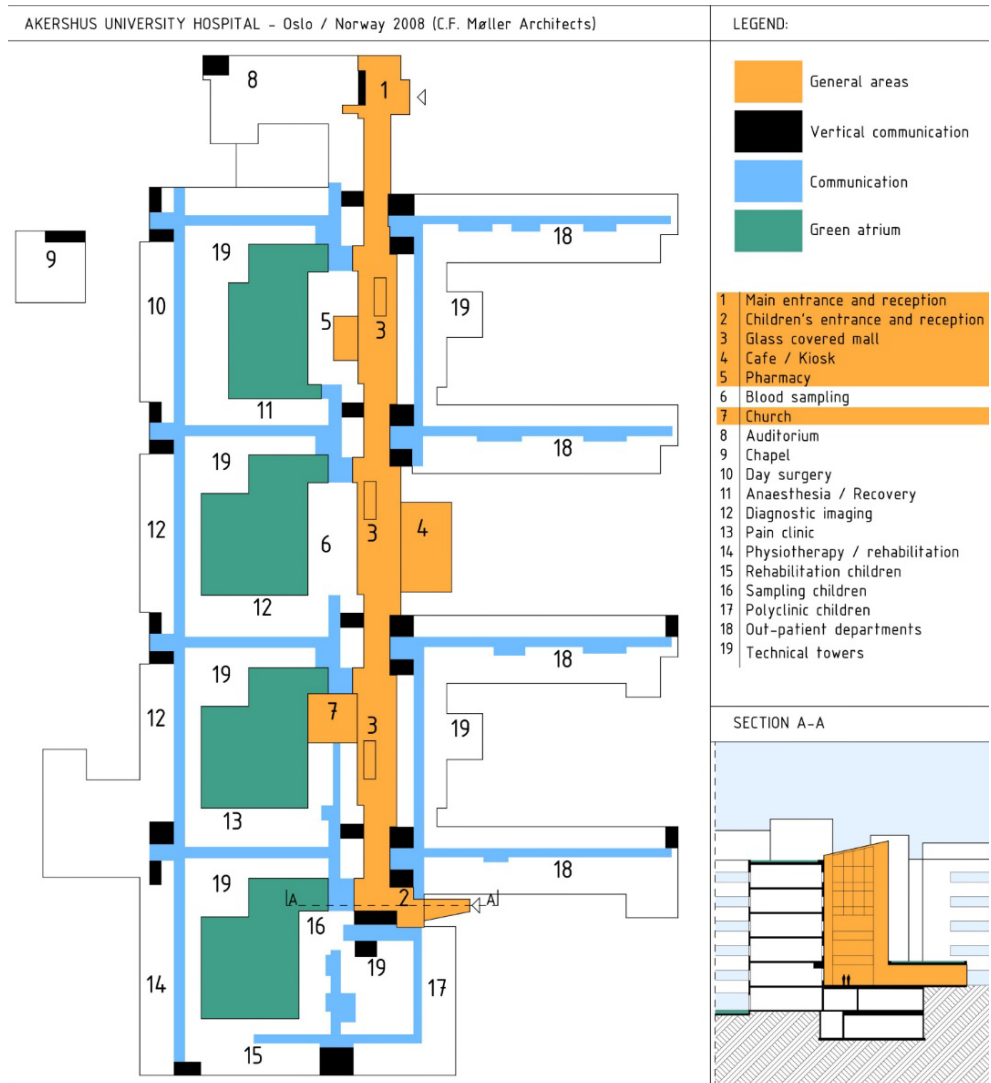


Fig. 6. Simplified ground floor plan of Akershus University Hospital in Oslo presenting how the general zone connects with other parts of the hospital and a section through the entrance area showing its proportions. *Compiled by the author from material on Akershus University Hospital from C.F. Møller's website 2022*

#### 4.4. Features of modern general zones

Compared to hospitals of the 20<sup>th</sup> century, modern general zones in large multispeciality hospitals differ significantly. Above all, in contemporary developments, proportions, human scale and the key role of daylight have transformed the aura of these spaces. This also applies

to the form of the “hospital street”, which can now resemble a shopping arcade or a hotel lobby. The perception of this space has changed in particular with a much bolder approach to the extensive use of natural materials such as wood and stone. Greenery can also be found increasingly often, not only outside in the atriums, but also inside the building. How the general zones are arranged, apart from the materials, the role of daylight and greenery, also involves well-chosen colours and art elements that make it easier to navigate the building.

The height of these zones ranges between one and four storeys so that their scale is not too overwhelming. The linearity of general zones does not mean, however, that they are always simple long passages. Contemporary general zones can also have undulating forms or change their width and height throughout, depending on functional and compositional factors.

Table 2. Main features of the general zones in the hospitals researched

No./ source	Hospital name	General zone characteristic
1 [32]-[34]	Hospital Infanta Sofia	4-storey linear general zone, well-lit, predominance of the white colour, natural materials: wood, stone, plaster
2 [35]-[37]	Akershus University Hospital	6-storey linear general zone, well-lit, predominance of white and wood tones, natural materials: wood, terrazzo, plaster
3 [38]-[40]	Jeroen Bosch Hospital	2- storey curved linear general zone, well-lit, mainly white and wood tones, coloured accents (yellow, orange), views of green courtyards, main materials: plaster, terrazzo, wood
4 [41]-[45]	Klinikum Klagenfurt	1-2 storey linear general zone, well-lit, colourful accents, views of green courtyards, predominant materials: plaster, PVC flooring, glass
5 [46]-[47]	Queen Elizabeth Hospital	3-storey general linear zone, well-lit, mainly white with coloured accents (green, blue), materials: plaster, terracotta, steel elements
6 [48]-[49]	Centre Hospitalier de Marne-la-Vallée	1-storey extended linear general zone, mainly white with coloured accents, materials: glass, resin flooring, PVC lining, steel elements
7 [50]-[51]	Rey Juan Carlos Hospital	4-storey linear general zone, well-lit, predominance of grey and brown tones, main materials: stone, glass, wood
8 [52]-[53]	Meander Medical Center	2-6 storey extended linear general zone with glazed atria, well-lit, predominance of white and wood tones, coloured accents, main materials: wood, terracotta, glass
9 [54]-[56]	Can Misses Hospital	1-storey linear general zone, well-lit, predominance of white with coloured accents, main materials: glass, stone, steel elements
10 [57]-[58]	New Álvaro Cunqueiro Hospital	1-2 storey linear general zone, well-lit, mainly white and wood tones, main materials: plaster, wood, stone, glass
11 [59]-[61]	Hospital Lillebaelt Kolding	1-2 storey linear general zone with glazed entrance atrium, well-lit, predominance of white and wood tones, main materials: glass, terracotta, wood, steel elements
12 [62]-[64]	Landeskrlinikum Thermenregion Mödling	1-storey centralised general zone, well-lit, predominance of white with coloured accents, main materials: glass, terrazzo, wood
13 [65]-[67]	Hospital Nova	3-storey linear general zone with local atria, well-lit, mainly grey and wood tones, coloured accents, main materials: terrazzo, wood, glass, art elements (wooden installations, form of lighting and seating)
14 [68]-[70]	Rigshospitalet Hospital North Wing	3-storey linear general zone, well-lit, mainly white with coloured accents, main materials: plaster, stone, wood, steel elements, art elements (art installations, coloured graphics)

## 5. Conclusions

The conducted research revealed a trend towards a linear structure for general zones in large multispeciality hospitals in Europe. This arrangement is related to a change in the shape of hospitals in the 21st century – from vertical (popular in the late 20<sup>th</sup> century) to horizontal forms today. General zones occupy almost 1/10 of the total hospital area. This is the primary area which, in addition to its communication role, provides space for reception, information, interpersonal contact and other services.

Regardless of the hospital's form, the general zone in large complexes is linear. Moreover, the materials used to finish contemporary hospitals have undergone an observable change, especially in the general zones. A large proportion of natural materials, such as wood or stone, can be noticed there. Elements of greenery, which humanise the hospital interior, are increasingly popular. Artistic elements play an important role both in general zones and wards, which is particularly evident in hospitals built during the last five years. The architectural solutions and interior design of the examined zones illustrate the evolution in the approach taken by European hospitals from the 20<sup>th</sup>-century form of “machines for treating the sick” to hospitals that are patient-friendly, adapted to a more human scale and prioritising patients' not only physical but also psychological comfort, as evidenced by art in hospitals and the increasing role played by greenery.

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