

Comparison of expandable hospital competitions in Turkey and USA and space programs



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ABSTRACT

The reason behind this article is the idea that “Expandable Hospital Competitions” are significant architectural events due to their organization in two different countries. Additionally, the research topic becomes much important due to the differences in “Hospital Design Standards” arising from the lapse of time as almost half a century since such competitions are organized at different times. The first competition, called “Expandable Hospital,” is organized in Turkey in the year 1975, while the second competition is named “Small Hospital-Big Idea,” which was organized in the USA in the year 2011. Due to such a year gap, the research becomes more multi-dimensional, with significant differences in the competition space programs. At the same time, there have been some improvements socially, general health conditions due to the changes in welfare and communication conditions, etc., hospital organization, medical practices, pharmaceutical manufacturing, medical devices, and medical equipment. All of such factors have changed the space standards that affect the hospital organization in the long year gap. Based on such developments, this study aims to identify the differences between hospital competitions and space programs under the existing conditions through the performance of comparison.

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1. Introduction

Several factors related to the growing population in the developing countries increase the need for “expandable hospitals” within the health system. In addition to population increase, such factors are environmental pollution, change in diseases, increase in occupational diseases, fast urbanization, improvement in economic, technological, cultural settings, and medical methodologies. The pace of changes and developments introduces the idea of an “expandable hospital” based on the increase in the diversity of time-dependent user requirements and priorities within the framework of use flexibility. The increase in populations due to war and migrations that cannot be calculated for certain, and restructuring highly prioritize the need to build new and expandable hospitals.

The concept of “flexibility” is introduced with the occurrence of fast and uncontrolled developments in

the developing countries, the idea of long-term planning in the hospital architecture due to the health care of society, and the associated change in spatial uses based on the developments in-hospital use.

The expansion and flexibility based approach in hospital designs is directly related to the changes in social development. The expansion concept in hospitals has a positive impact on the development of “space programs” that show fast change.

While the reflection of change requirements on building and space programs and integration of prior planning of the opportunities to expand and add into architectural activities provides flexibility in spatial use, it also has benefits in finding the convenience of installation, fitting, and fixtures.

As a result of the development based on such organizational change, the spatial reflections on the hospital building bring “flexibility and variability,” “addition and expandability,” “need for the new building,” and “spatial development requirements.” Even such an irresistible need for change is not met; there are some difficulties in demolishing and re-building where the hospital use is not sufficient under any circumstances. In terms of the obligatory uninterrupted continuation of social healthcare, the hospitals shall keep up with such developments through a planning approach methodology. Where

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there are not any solutions towards such organizational change and innovation requirements, namely the spatial needs are not met, the social healthcare sector experiences major challenges and difficulties such as demolishing and re-building the hospital facilities and disruptions in time-financial resources and uses.

Therefore, the developed and developing countries organize “expandable hospital competitions” to find planning solutions, which might be utopic and real, to such problems based on spatial use flexibility since it is not possible to stop the developments in-hospital use. Hence, the “Expandable Hospital Architectural Project Competition” in Turkey in the year 1975 (Dergisi, 1982) and “Small Hospital-Big Idea” in the United States of America in the year 2011 were organized for such purposes.

Regardless of the differences in both competitions concerning their programs, their bed capacities are more or less the same. The reasons for program differences are that “Small Hospital-Big Idea” brought the space programs beyond the existing circumstances and introduced therapeutic hospital concept that saves labor force, financial resources, and time such as e-hospitals (telemedicine, telemetry) and robot use in medical practices (Da Vinci, RoboDoc, Nurse Assist Robots) with an approach to leave diagnosis in outpatient

clinics to health centers or micro clinic as a completely innovative and radical perspective for hospital planners and society through a competition.

The competition program is called “Small Hospital-Big Idea.” The U.S.A did not specifically include the clinic space (outpatient clinics) since the hospital is originally a secondary general hospital that is considered to treat the patients diagnosed at the primary health centers or micro clinics. Such hospitals were deemed as having the facilities and staff mainly related to treatment and patient care. Under the definitions of competition program, the hospital was considered to work through the exchange of information with the Regional Medical Centers via internets such as automation, robot use, and telemedicine, which would bring the idea of being beneficial in the healthcare sector under the most economical status through meeting the deficit of specialist doctors and staff as well as with the information and support of other hospitals.

As given in Fig. 1, the primary level includes health centers while the second level is comprised of state hospitals, and the tertiary level constitutes bigger hospitals with advanced healthcare levels such as medical faculty hospitals.

All of the hospitals and healthcare centers under the healthcare system in Turkey provide outpatient examinations of patients starting from the morning in addition to diagnosis and treatment.

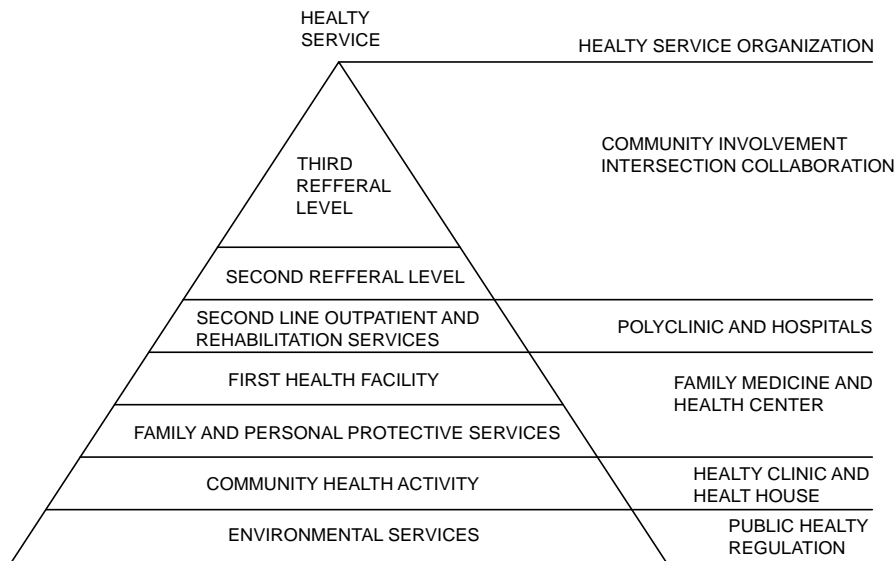


Fig. 1: Place of hospitals in the healthcare service provision model (Aydin, 2001)

The competition dated from 1975 in Turkey is originated around half-century ago and is still considered as an old-dated competition with major functional deficiencies in its hospital use standards and hospital use under the space program. A comparison and evaluation can only be possible if the program of such competition is updated with the existing hospital standards. Therefore, we need to approach the subject matter towards its compliance with the existing design standards.

According to “Guideline for Minimum Design Standards in the Health Care Facilities of Turkey

2010”, which was prepared by the Republic of Turkey, Ministry of Health together with a large team in 2010 with the approach at the level of hospital planning institute, there have been significant improvements in the bed unit designs and the number of beds per rooms, and individual comfort standards of patients concerning the room dimensions and sizes.

In 2010, the preamble of this design standards guideline mentioned the necessity to introduce new minimum design standards since the hospitals' space are not sufficient in terms of hospital use facilities as

they were 25-30 years ago and noted that American Architectures Union, Health Care Facilities Design Guideline, 2006 were taken into consideration accordingly (AIA, 1996).

The Republic of Turkey, Ministry of Health prepared such comprehensive "Guideline for Minimum Design Standards in the Health Care Facilities of Turkey 2010" in consideration with several sources, research and regulations of TSE (Turkish Standards Institute), Ministry of Health Quality Standards, American Disabled Action (ADA) and Joint Commissioning International (JCI) (TCSB, 2010).

As the subject matter of this article, the comparison of the competition programs of 2011 organized in the USA and of 1975 in Turkey can only be possible after their adaptation to the existing standards, which would implement the effects of design standards within the half-century on the type and size of spaces, the new 2010 hospital design standards on the spatial organization. Such an application would eliminate the incompatibility of building program under the competition of 1975 since both competition programs organized in different countries at different times as "Small Hospital Type Program" in Turkey and "Conventional Small Hospital Type Program" in the USA in terms of architectural programming were chosen as space programs within the scope of this study.

This study considered that "the Expandable Hospital Space Programs" in both of these countries are compatible and conventional type, and the programs were elaborated as listed, which both allowed to compare the space programs, respectively.

The main aim of this study is to analyze the expandable hospital programs that are supposed to have similar bed capacities and program characteristics—except for some details. The objective in both competitions about the "small hospital-type" program initiatives based on the standards and functional space programs is to establish updated space programs following the program analysis and to compare them, respectively. Hence, the evaluation of building programs would be possible to perform upon the establishment of departments given under the space programs from a functional aspect and identification of the reasons for their use.

2. Definition of expandable type hospital

In both of the competitions, the concept of the expandable hospital is comprised of the idea of converting a 100-bed hospital into a general hospital with more bed capacity as 200 or 250 beds with the addition of extensions.

In general, the competition is a hospital project design competition by including additional spaces and mostly a bed block. As a result of designing space setups with the Modular Coordination concept, it allows planning interior space changes in the

repetitive space sizes with the interior organizations based on developments. Such characteristics correspond to the variability, and the hospital becomes a space that can meet with the new functions through the interior arrangements.

Hospitals as the main building block of healthcare systems are generally defined as "the places that allow the doctors to examine the patients, bring medical specialists together, and allow them to work together with the auxiliary staff with required medical tools and equipment in their use spaces." However, nowadays, hospitals have switched to more complex operation systems, which they ensure therapeutic and protective healthcare services for individuals as a part of Social and Health Organization with their functioning, and they track the patients with their follow-up systems. Additionally, hospitals have become a center that provides training for individuals interested in research and health (Tülbentçi, 2015).

According to the World Health Organization, hospitals are "in-patient facilities where healthcare services grouped as observation, diagnosis, and rehabilitation are provided, and the patients are treated for a long or short-term (WHO, 1992).

The idea of planning expandable hospitals is still valid as the discovery of ideal hospital design.

In the planning phase of the hospital, it is very difficult to identify the dimension, form, capacity, and departments that would expand. Regardless of the decision given in the preliminary planning phase about the direction and way of expansion, which is a good preliminary decision, it becomes almost impossible to know the additional departments and facilities and their associated capacities and sizes in the long term. The demolition and reconstruction of some facilities and buildings in long intervals of 40-50 years might be a temporary solution. The expandable hospital competitions have become a subject matter to answer architectural problems regarding hospital expansion. The building programs of such competitions can barely be performed in a two-phased and descriptive matter. On the other hand, the expansions in the other long-term stages might be limited with the expansion direction and area. The most important reasons for such a challenge are that it is based on social, economic, technological, and geographical factors with multiple variables. The reasons that affect hospital expansion in terms of department and capacity are as follows (Aydın, 2001):

- Urbanization, migration, and population increase rate
- Change in disease patterns
- Development in treatment methods
- Developments in pharmaceuticals manufacturing (Aydın, 2001)
- Medical devices technology and its development
- Development of hospital information and automation systems.

The abovementioned hospital information and automation systems are comprised of the use of internet access technologies such as the e-health system, telemedicine, telemetry, and artificial intelligence, in addition to the use of robots such as RoboDoc and Da Vinci.

It has already been very difficult to identify the cultural, physical, and technological effects of such multi-dimensional variables with potentially different rates and use capacities on the expansion and development of hospitals through the reflection on hospital building.

To solve such and similar hospital expansion issues, the expandable hospital competitions are organized that would possibly have 200-250-bed capacity hospitals upon their expansions from 100-bed capacity. Such hospitals have 100-bed capacities with the departments given under the competition programs (Dergisi, 1982).

Hospital Departments: In the planning phase, the hospital departments are organized by their capacity and organization system based on the hospital type and size in consideration of the number of users and features of use and facilities. The arrangements shall identify the characteristics where all hospital functions are foreseen to be as well as the

connection and correlation of “department-unit-space” from the functionality perspective.

In other words, the type, objectives, sizes of departments and units, location and relations, status in the hospital organization, spatial requirements, actions, users such as doctors and patients, and medical tools and devices shall be determined in the planning of the hospital. The related information covers the subject of Planning-Programming. Together with these planning-programming characteristics, the hospital programs are mainly prepared by an expert team in cooperation with the ministry of health, universities, and planning institutes through considering the existing examples, documentation, and hospital standards. The preparation of hospital programs shall be considered within the framework of the hospital. Planning and based on such planning decisions, they shall be organized by the medical needs and characteristics of the region that they would provide services. The diagram showing the hospital departments and units with their functional relations is given in Table 1.

The scheme showing the functional relations between the hospital departments and units are given in Fig. 2.

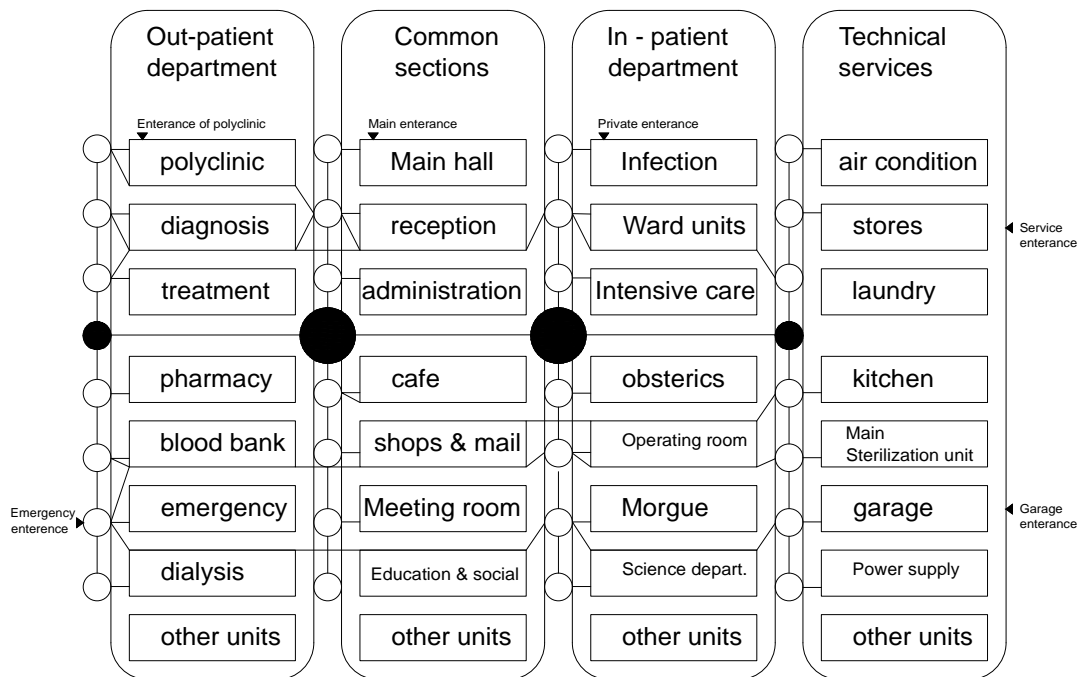


Fig. 2: Diagram with the functional correlations of hospital departments and units

The elaboration Space programs in hospitals are mainly comprised of four main departments, as can be seen in Fig. 2 –outpatient, common and administrative department, in-patient, and technical–support department. The departments are detailed as follows:

- a) **Out-patient department:** Polyclinics, Diagnosis Units, Pharmacy, Emergency Treatment–Communication, Blood Banks.
- b) **Administration and common department:** Main Hall and Reception, Waiting Area, Staff

Service Areas, Café–Food Hall and Shops, Conference Room, Security–Control Centre, Communication and Switchboard, Ambulance, and Patient Transfer.

- c) **In-patient department:** Patient Wards and Delivery Rooms, Patient Admission Unit, Operation Room–Preparation and Intensive Care, Central Sterilization Unit, Morgue, and Pathology.
- d) **Support and technical services department:** Material Delivery and Loading Unit, Hospital Kitchen, Laundry, Bio–Medical Engineering, Heating–Ventilation Units, Renewable Energy

Centres, UPS, and Landscape Maintenance (Tülbentçi, 2015).

Out-patient department: This department includes the diagnosis and treatment units, polyclinics, emergency service, and outpatient care units, as well as a blood bank.

Polyclinics are the places where diagnosis and treatments are performed and are directly connected with the patient admission and waiting room.

Treatment units include physiotherapy, orthopedics, and rehabilitation, radiotherapy, chemotherapy, and hemodialysis. Such departments are indicated as the "Universal Care Unit" under the competition held in the USA. Since Turkey did not have such a department in the competition program of 1975, an additional hemodialysis department was included, respectively.

The diagnosis and imaging department is comprised of departments used by the outpatients and inpatients like laboratories, radiology, ultrasonography, magnetic resonance (MR), computerized tomography (CT), angiography, EKG, cystoscopy, and endoscopy. Among all of such departments, MR and CT were added under the program, as they were not present in 1975. This department is directly related to the polyclinics, inpatient, diagnosis, treatment, emergency, and outpatient units. The polyclinic space included within this department is not included under the competition program of the USA, and the duties of such diagnosis are given to Regional Medical Centres and Micro Clinics. In Turkey, all hospitals of different types and sizes have polyclinics.

Administration and common departments: In general, in hospitals, this department is responsible for the general administration, health board, accounting, purchases, and sales. The size of the administrative department may vary depending on the capacity of the hospital. Together with e-health admission areas, purchase, and payment units, both the inpatients and outpatients should visit such administrative areas for their admission, approval, health board, and accounting procedures.

This department also includes the reception, e-patient admission and waiting area, administrative units, hospital control center, security, café and shops, ATM, staff food and recreational areas, conference room-lobby, communication and switchboard, ambulance and patient transfer units. The spaces such as café, conference rooms, etc., were added as they were not included in the building program of 1975.

In-patient department: This department is comprised of the patient ward and delivery units, operation room, operation preparation and intensive care, central sterilization unit, pathology, and morgue units.

Patient Care Units: Such units generally have 25 beds where in-patients are provided with care and treatment. The patient ward used to have a hotel room layout with WC and sink. In the past, such units were generally comprised of ward type rooms without any bedrooms as well as of some rooms with bathrooms. Those units also have a nursing station, rooms for doctors, nurses, and ward nurses, its laboratory, a daytime room for the visitors, and spaces such as WC-bathroom. The number of beds in the patient room layout might be one, two, three, four, and six-bed rooms. In addition to 1-bedded rooms for the temporary bed use due to common diseases, seasonal patient increase, small operations, and for acute treatments, the arrangement of 2 and 3-bedded rooms would be an appropriate approach for the small hospitals with few numbers of beds in terms of bed number shares of patient care units and flexibility in use for the bed distribution. Since the 100-bedded expandable hospital as the subject matter is within the scale of the small hospital due to the program scope, a patient care unit bigger than 1 or 2 beds more than 25 that would be bigger and divisible rather than a 25-bedded unit would be taken into consideration for a proportional number of beds. The statistics regarding usage in the general hospitals of Turkey also supports this idea together with the average patient bed usage in the patient care units. The bed distribution rates in the bedded units at the in-patient medical facilities in Turkey are as follows (TCSB, 2002; Karakaşlı, 2010).

Table 1: Bed distribution rates for the healthcare institutions in Turkey and the respective average number of beds in the 100-bedded hospital units (Karakaşlı, 2010)

Surgical Diseases	20.3%	(20 bedded unit in a 100-bedded hospital)
Internal Diseases	19.8%	(20 bedded unit in a 100-bedded hospital)
Gynaecological Diseases	2.6%	(13 bedded unit in a 100-bedded hospital)
Pediatrics	8.5%	(9 bedded unit in a 100-bedded hospital)
Chest Diseases	5.6%	(6 bedded unit in a 100-bedded hospital)
Orthopedics and Traumatology	5.1%	(5 bedded unit in a 100-bedded hospital)
Mental Disorders	4.8%	(5 bedded unit in a 100-bedded hospital)
Ophthalmology	3.2%	(3 bedded unit in a 100-bedded hospital)
Ear Nose Throat Diseases	3.1%	(3 bedded unit in a 100-bedded hospital)
Other Patient Care Units (Karakaşlı, 2010)	17%	(17 bedded unit in a 100-bedded hospital)

The hospital space programs should be prepared in consideration of the bed usage rates in the patient care units. It would be much convenient to plan bed units suitable for flexible use in accordance with the bed-sharing rate considering that no unit under a 100-bedded hospital can correspond to the rate of a

25-bedded patient care unit. Hence, the nursing stations of such hospitals might be considered to have wider counters that would provide services to two or more units. The operating rooms should be planned as a department in the way of separate floors or blocks that would not be walked through

and would be kept sterilized in terms of usage and sterilization. The connections of the emergency unit and patient care unit should be ensured from elevator corridors as controlled.

This department is comprised of general surgery, septic, and aseptic operating rooms, delivery room, and surgery units with casting rooms for orthopedics. The number of operating rooms is determined based on the bed and usage capacity of the hospital.

Operating rooms are close to emergency service and patient care units, whereas having second-degree relation with the blood bank, pathology laboratory, and morgue. Additionally, the operating rooms should be arranged at the closest distance with the intensive care and central sterilization units.

The operating room department is comprised of doctor-nurse asepsis location, final staff preparation, doctor-nurse relaxation area, patient arrival, patient preparation, and anesthesia unit as well as operating rooms, which are all closely connected to the central sterilization, laboratory, and intensive care units (Tülbentçi, 2015).

Support and technical services department: This department includes supply admission and loading, general and administrative storage rooms, kitchen and food hall, laundry, Bio-Medical Engineering, heating and ventilation units, renewable energy centers, ups, and landscape maintenance units that provide support services to the hospital. The units located at the technical service and support units like laundry and kitchen are mainly planned to be located in the basement to leave the spaces on the ground and upper floors to much-prioritized spaces that would be mainly used by the patients (Arcan, 1980).

Table 2 shows the sizes of the main departments in hospitals around Turkey (Karakaşlı, 2010). Statistics of General Hospital Departments in Turkey;

As can be seen from the main program department, the in-patient department is the biggest department that affects the hospital at the most in expansion with 30.4%. Therefore, the patient care department might be designed in a way that would be possible to add in the expansion of the hospital.

3. Comparison of program information under the competitions in terms of planning and programming

3.1. Building program preparation for S.S.K. expandable hospital architectural project competition

The space program of the expandable hospital competition of Turkey organized in 1975 does not exactly match with the existing use conditions since the program was analyzed after a long time out. The deficiencies under the space program at the time also cover a planning-programming process where

new spaces are designed in accordance with the existing standards and needs.

Table 2: Distribution rates of hospital department sizes based on the general hospital department statistics of Turkey (Karakaşlı, 2010)

Out-patient Department	16 %
Administrative and Common Areas	6.8 %
In-patient Department	30.4 %
Support and Technical Services	18.6%
Circulation Spaces	28.2%

The most important aspect in planning is to properly add the missing spaces into the updated program upon their identification in the new objectives and tasks during the review of time out building program. This means the re-coordination of organization data that belong to the units in the space organization. The update of the space program that is prepared in accordance with the new uses can be considered as a preparation activity required for good results in the new designs.

The decisions taken in every step of planning would be reflected in the planning process as development, change, and renewal from the spatial aspects. In case of any renewal, the previous steps should be checked retrospectively, which indicates the dynamism of the process. Each step is correlated along this process. A negative circumstance in one step would affect the other. Therefore, it is vital to perform careful space analysis in the preparation of hospital programs to minimize the potential problems in other phases (Aydm, 2001).

The architectural planning concept is a process since the planning in architecture is the complete decisions regarding systematically gathering and integrating the architectural data based on the functions, and leading and evaluating the architectural activities to reach the desired objectives. The phases that constitute such processes include the preliminary planning decisions, programming, design, application, use, and evaluation phases (Arcan, 1980).

In other words, the arrangements in programming as a part of the planning process are evaluated with the approach of building-department-unit and space area analyses based on the building expansion levels.

The programming data that are taken into consideration within the scope of Hospital Planning are as follows (Lohfert, 1973).

- **Area data:** Spatial, volumetric dimension, and standards required for the actions in the space (Uzunoglu, 2014).
- **Capacity data:** Qualities and numbers of people that would use the space (day/patient, year/surgery, etc.)
- **Function flow data:** Organization of work areas, function tracking order, improvement of use, time demands, etc.
- **Organizational data:** Organization style of the hospital.

- **Operation cost data:** Sorting based on cost analysis; economic cost limitations.
- **Development-flexibility data:** Opportunities to conform to future spatial expansion and spatial use changes.
- **Personnel data:** Use and number of personnel at the facility.
- **Equipment data:** Functional and technological characteristics of medical tools and equipment.
- **Social data:** Social data in the area of the facility (Tülbentçi, 2015).

Based on such data, the acquisitions in case of a systematic approach towards programming are as follows:

- Harmonization between programming and design period
- Promotion of standardization and industrialization
- Facilitation of project methodology like systematic design
- Handling with the problems that type hospital programs lose their validity
- Use of facilities provided by the standardization in the development of fixed quality plan and programs

- Tackling problems with programming methods and information through the elimination of the lack of qualified labor force by facilitating regional, national, and particularly international cooperation in the information exchange (Arcan, 1984).

In the hospital planning process, it is vital to know the spatial standards and program the building spaces accordingly.

This matrix, which is created with the physical-spatial characteristics of user need criteria, including the performance characteristics among the aforementioned building system components, provides the spatial standards of hospital use in general.

In the evaluation of hospital designs, spatial use evaluations can be performed based on such standards. Such evaluations are performed together with the success order of positioning and functional connections among hospital departments and units. Fig. 3 shows the determination of spatial standards in the spaces given under the building program based on the physical characteristics and user-need criteria (Uzunoğlu, 2014)

		CRITERIONS OF USERS REQUIREMENTS		SAFETY		SUITABILITY PRODUCTIVITY		COMFORT		OTHER USAGE FACTORS																
				. FIRE PROTECTION	. PHYSICAL SUITABILITY	. CHEMISTRY-BIOLOGY-RADIATION	. ELECTRICITY - FITTING	. INNER SPACE	. OUTER SPACE	. SUITILITY-TO ACTION	. PSYCHOLOGY	. SOCIAL	. PHYSICAL - SPATIAL	. STRENGTH	. RELIABILITY	. PRACTICABILITY	. CONTROLLABILITY	. FLEXIBILITY-CONVERTABILITY	. CARE & DURABILITY							
1	BUILDING	PHYSICAL SPATIAL SYSTEMS	OPTIMIZATION	ENVIRONMENT SYSTEM	TRANSPORTATION SYSTEM	ENERGY INFRASTRUCTURE	DECISIONS OF SETTLEMENT	IN-OUT DOOR SPACES	STRUCTURAL SHAPE	HEATING-AIR CONDITIONING	NATURAL-ARTIFICIAL LIGHTING	DATA COMMUNICATION SYSTEM	USE OF SPACE	EQUIPMENT-FITTING SYSTEM	STANDARDS											
2	DIVISIONS																									
3	SUB DIVISIONS																									
4	UNITS																									
5	SPACES																									
6	ACTION AREA																									
7	SINGLE ACTION																									

Fig. 3: Determination of spatial standards in the spaces given under the building program based on the physical characteristics and user-need criteria (Uzunoğlu, 2014)

Wehrly (1972) described space performance standards as performance statements adopted a standard by standards issuing agency-typical standards agencies are, e.g., American National Standards Institute and Turkish National Standard Institutes (Wehrli, 1972).

Standard (origin. French) means a model or model that can be taken as a basis based on the specific criteria and regulations suitable to use.

Within the scope of our subject matter, the objective is to prepare the program of "S.S.K. Expandable Type Hospital Architectural Project Competition" organized in the year 1975 in Turkey based on the existing standards in terms of planning

concept and to elaborate the space program of "Small Hospital-Big Idea" competition organized in the year of 2012 in the USA. Through such a programming approach, this research aims to compare the planning correlation of both competitions conducted in different countries at different times through the programming approach and to reflect the differences and similarities in their spatial programs.

During such analysis, the comparison and evaluation are only possible to perform upon ensuring their program by choosing the conventional space program among the program details in America since there is a major time gap

between the competition in America in the year of 2011 and competition in Turkey in the year of 1975.

In the performance of such evaluations, firstly, the space program of Turkey in 1975 should comply with the existing hospital space program. Consequently, the space program components that are missing and required to be updated until now from the physical, social and technological aspects should be identified, and an approach should be established to create a new hospital program. The various factors based on the hospital design standards of the 1970s and existing standards should be identified. The most appropriate approach seems to perform a programming technique. As a result of such analyses, the objective would be the identification of similarities and differences in the

hospital programs conducted in two different countries at different times.

3.2. Identification of the building program space from the winner project of expandable hospital competition

3.10m room axis and general hospital design axis can be used as a hospital design standard in the hospital competition and application projects during the 1970s. Fig. 4 shows the building floor plans and program space size from the winner project of the expandable hospital competition. As can be seen from the competition project plans, the design forms and associated hospital building mass are established through the arrangement of project unit area modules (Dergisi, 1982).

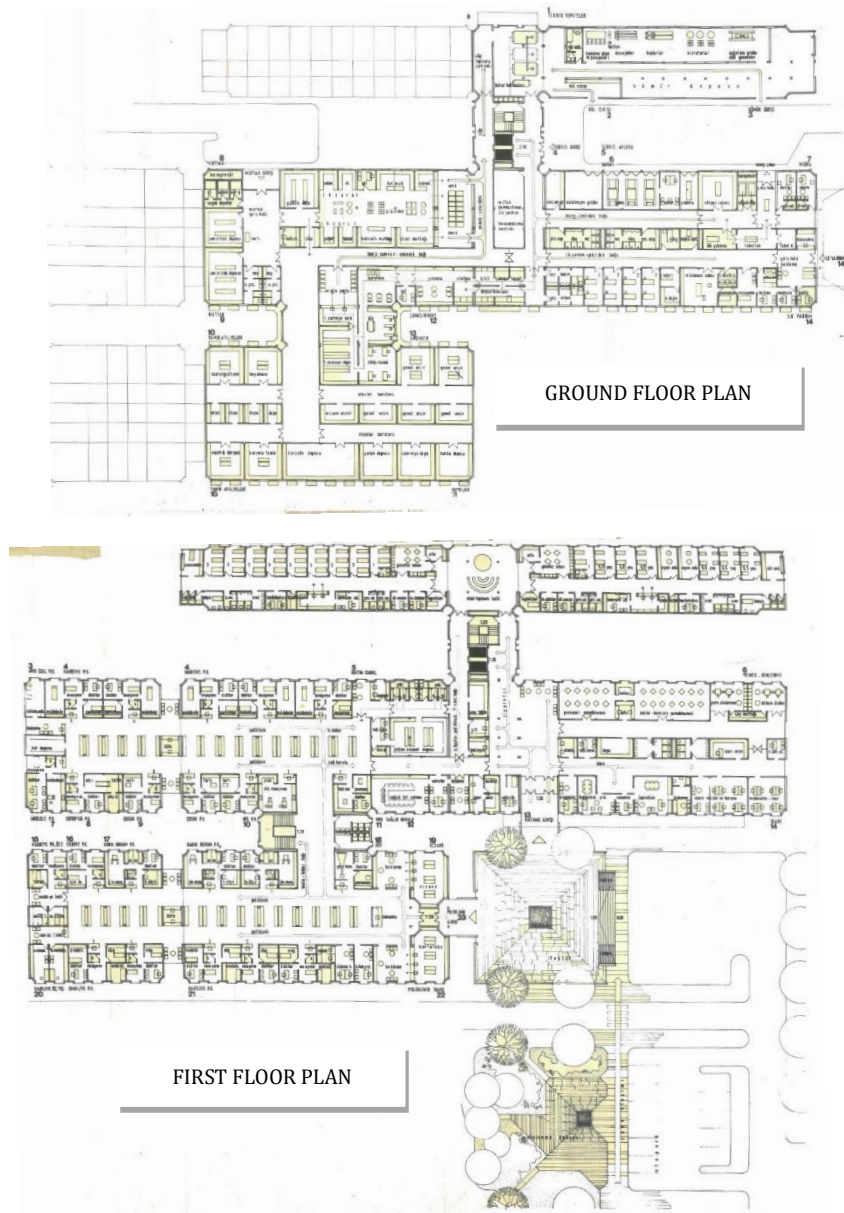


Fig. 4: Expandable hospital competition floor plans from the competition in Turkey in the year 1975 (Dergisi, 1982)

Such a 3.10 m hospital axis module was a hospital design standard used in Turkey based on the hospital room sizes during the 1970s. In 1971, this

patient room standard was used in the same dimensions for the project called “Nicosia-Cyprus General Hospital Architectural Project,” designed by

SİSAG Co. Ltd. (Dergisi, 1982). The patient rooms are shown in Fig. 5, as built-in in accordance with the standards of that time, had smaller spaces generally without any bathroom. Nowadays, the dimensions have changed upon the approval of wider axis rooms under “Guideline for Minimum Design Standards in the Health Care Facilities of Turkey 2010” and “hotel room type” as implemented by the Turkish Ministry of Health by 2010. Hence, the minimum size of hospital rooms has become 3.60m, and the minimum design module unit that might be used in the existing competitions can have an area of $3.60\text{ m} \times 3.60\text{ m}=12.96\text{ m}^2$.

The description of such standards, according to the 2010 minimum design standards, is given in the spaces given as examples under Table 3 (TCSB, 2010). Fig. 6 shows the elaboration of the lower-upper floors of units on the 3.60 m axis used in the existing standards based on the modular coordination principles (Arcan, 2000).

According to the 2010 Hospital Design Standards given in Fig. 5, the Modular Coordination Table eligible for space program analysis (Arcan, 2000).

Wehrli (1972) defined Modular Coordination as follows: A method of applying dimensional control so that parts, components, and assemblies from diverse sources can be assembled in a building with a minimum of waste.

Considering Fig. 5, which shows the design “modules” with unit spaces ($3.60\text{ m} \times 3.60\text{ m}=12.96\text{ m}^2$) based on the Modular Coordination principles in accordance with their upper and lower area units, this module organization and sizes also provide space sizes based on the explanation of modules in the similar competition programs. The module is given under Fig. 6 ($3.60\text{ m} \times 3.60\text{ m}$), and similar sizes are the most used area values. Fig. 7 shows polyclinic space planning in the existing standards-based on modular coordination principles (Görken, 2018).

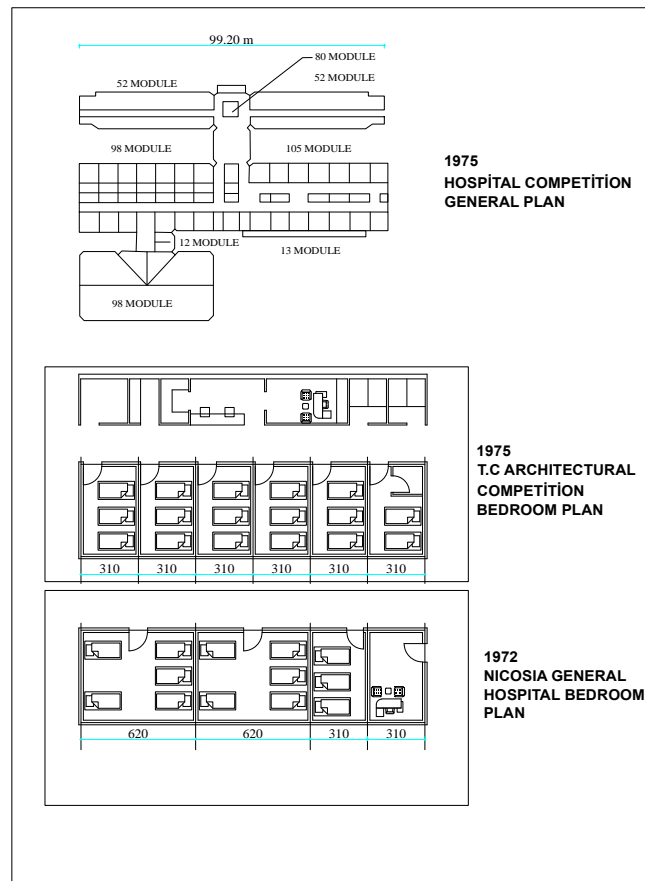


Fig. 5: Former area standard in 3.10 m axis used for the expandable hospital competition and Nicosia-Cyprus General Hospital (Dergisi, 1982)

Table 3: Areas of various hospital units and presentation with module sizes in accordance with “the guideline for minimum design standards in the health care facilities of Turkey 2010” (TCSB, 2010)

General Polyclinic Examination	13 m ²	(within 1 module area), (TCSB, 2010)
Polyclinic Intervention	24 m ²	(within 2 module area), (TCSB, 2010)
Patient Room with One Bed	24.90 m ²	(within 2 module area), (TCSB, 2010)
Operating Room	42-52 m ²	(within 4 module area), (TCSB, 2010)

Fig. 6 provides the design of General Polyclinic Examination spaces with size and dimensions given in the applicable standards based on the 13 m^2 ($3.60\text{ m} \times 3.60\text{ m}=12.96\text{ m}^2$) modules (TCSB, 2010).

As can be seen from such standards, the hospital designs are generally planned according to their Modular Coordination characteristics based on similar size and repetitive module sizes.

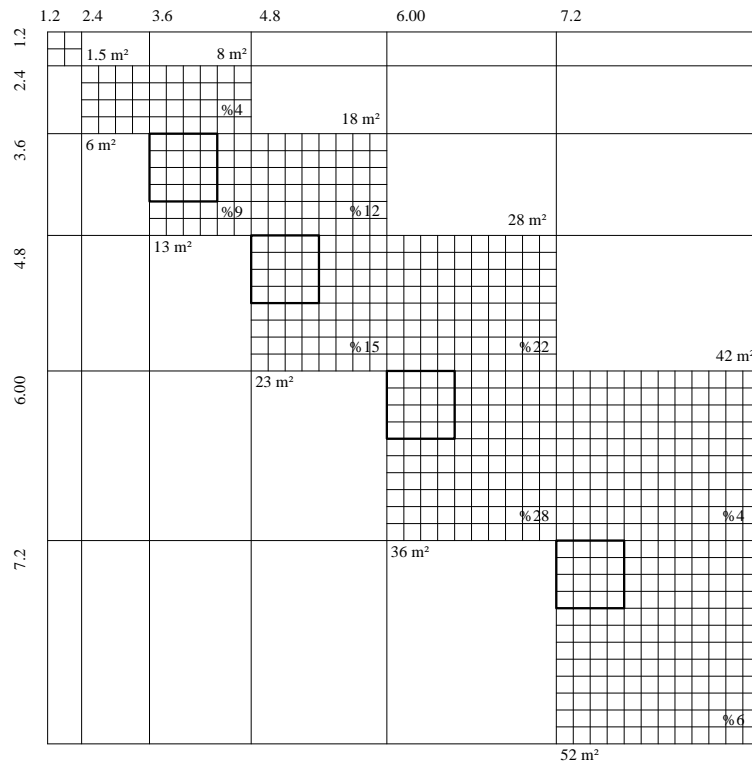


Fig. 6: Elaboration of the lower-upper floors of units on 3.60 m axis used in the existing standards based on the modular coordination principles (Arcan, 2000)

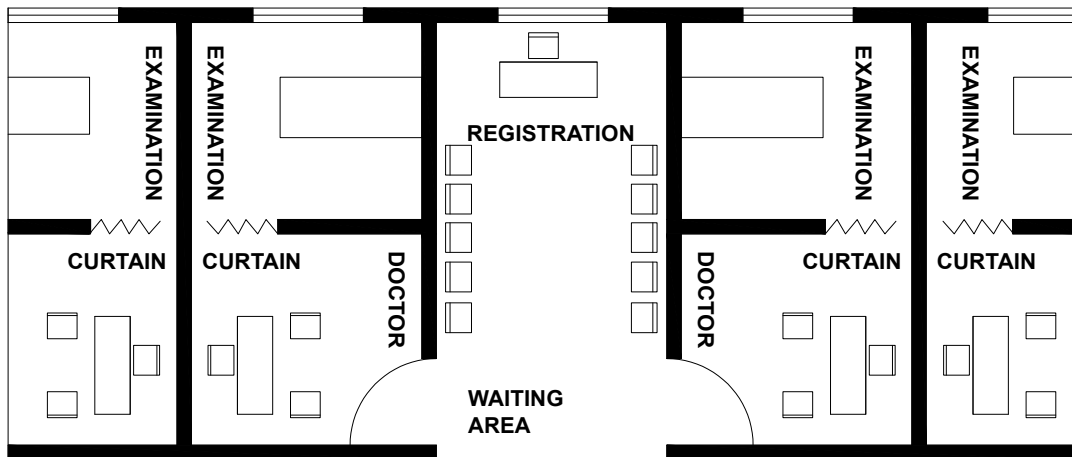


Fig. 7: Polyclinic space planning in the existing standards-based on modular coordination principles (Görken, 2018)

In consideration of the winner project of the Expandable Hospital Competition of 1975, which was designed in accordance with the modular coordination principles, the recurring space dimensions were applied in the design.

Such area sizes are comprised of square meter modules as (3.10 m × 3.10 m=9.61 m²). The design units with the same size and spaces and the plane area of each floor given in the competition project were calculated together with the modules of the related floor, which provides the area size of hospital floors. It is possible to calculate the total building space (including the circulation space) of the winner project in accordance with the design standards of 1975.

The former area standard, which was smaller, can be converted into 1.35 times bigger hospital

standards (12.96 m²/9.61 m²=1.35). According to such area characteristics, the unit area use has become bigger and more convenient in Turkey. Generally, it is possible to multiply the hospital areas in the former design standards with *1.35% (standard-based expansion rate coefficient=*1.35%) to find the corresponding values in the existing building space programs.

According to the winner project of the Expandable Hospital Competition, the building area in the 1975 design standard is a total of 13,012 m² as 1,354 modules. Table 4 shows the identification of the present area from the winner project of the 1975 Expandable Hospital Competition by multiplying the area value with *1.35.

Table 4: Identification of the present area from the winner project of the 1975 expandable hospital competition by multiplying the area value with *1.35

Calculation of Total Building Area		
Basement Area	445 module x 9.61 m ² =	4,277 m ²
Ground Floor Area	497 module x 9.61 m ² =	4,776 m ²
First Floor Area	412 module x 9.61 m ² =	3,959 m ²
Total Building Area	1,354 module	13,012 m ²
13,012 m ² x 1.35=17,566 m ² (Expansion rate in the applicable standards=1.35)		
(Total competition building area including the circulation area is 17,566 m ²)		

Where the total building area from the competition project is converted into SB 2010 (Ministry of Health) hospital design standards, the former axis value as 3.10 m would become 3.60m as the new minimum unit axis value (3.60 m × 360 m=12.96 m²), and the area of competition project with the multiplication of 1.35 according to the present standards as 13,012 m² × 1.35=17,566 m², which refers to the area of competition project in terms of present standards. 13012 m² × 1.35=17,566 m² (expansion rate in present standards=1.35) (total building area of competition project with relation to the existing standards 17,566 m²). The spaces that were not included in the 1975 hospital programs and are present in the existing hospital programs are in Table 5. Since such new functions and areas were not present under the previous building program, it reflects the spaces that are required to be added to the total building space.

Table 5: Total building area in the present standards by adding the missing department and unit areas that are required to be present according to the expandable hospital competition

Spaces to be Added Under the Existing Expandable Hospital Program	
Cafeteria	490 m ²
Conference Room	167 m ²
MR+CT Unit	167 m ²
Haemodialysis Unit	150 m ² (Görken, 2018). Available at the 100-bedded general hospitals in Turkey
IT System	56 m ² at the hemodialysis unit
Security	56 m ²
Landscape	89 m ²
Renewable Energy	89 m ²
Bio-Medical Engineering	56 m ²
Total Area	1,320 m ² (total additional area)
1320m ² x 1.35=	1,782m ² (1.35 is net area coefficient)
(the present total additional space area including the circulation area=1,782 m ²)	
17,566 m ² +1,782 m ² =	19,348 m ²
(Total building space program area including the circulation areas 19,348 m ²)	

Therefore, the areas required for the present are 1320m², and where such value is multiplied with the net area coefficient as 1.35, the total area of updated spaces is 1,782m². Where the building areas of the competition program and an additional area that is not present now are added, the present building space program area is calculated as 19,348m².

$$17,566 \text{ m}^2 + 1,782 \text{ m}^2 = 19,348 \text{ m}^2$$

Total building area based on the present standards, including the circulation areas 19,348m².

$19,351\text{m}^2/19,348\text{m}^2=1.00015$, which means the calculation difference of such values with the area given under Table 6 is 1.5 in ten thousand (19,351m² is the total building area of expandable hospital given under the comparison of Table 6).

As a result of such area calculations, since the difference is slight from the area given under the competition program of Turkey in 1975 with a 1.00015% tolerance difference, it is acceptable within the tolerance value by the total building area under the comparison table.

Consequently, the Expandable Hospital area updated in accordance with the 2010 Design Standards Guideline is found as 19,351m².

Table 6 provides a comparison for building-department areas in consideration with the winner project of the competition in 1975 and updated additional spaces.

4. Results

The spaces, which were not a part of the competition organized in Turkey in the year 1975, were added into the building program so that they are present in the hospital programs concerning the new functions within the hospital upon the medical developments of the last half-century. At that time, there were not any medical technologies such as “telemedicine, telemeter or DaVinci surgery method” with direct internet access and associated infrastructure spaces. Such new use spaces are 1320 m², and the total area of unavailable spaces that must be present today is found by multiplying the area with *1.35 (net area coefficient) as identified under Table 7. Table 7 reflects the missing spaces and units that are required according to the existing use standards, together with their locations in the hospital departments. Table 8 provides a comparison among the department sizes of the expandable hospitals by Statistics on Turkey General Hospital Departments. According to Table 8, the space program areas of out-patient, administration, and support services departments under the Small Hospital-Big Idea competition of USA (2011) had the smallest areas, whereas the area of the in-patient department had the biggest. In the competition held in Turkey in 1975, the space program areas of outpatient administration and service departments had the highest area during the in-patient as the smallest. Additionally, the polyclinic, blood bank, control center, HVAC, and technical services, together with the renewable energy areas, were not present under the space program. A part of such energy areas might be placed on the terrace roofs.

The spaces that were not present in the Expandable Hospital Competition in Turkey in 1975 are added under the space program in accordance with the existing uses.

Consequently, the programs of both countries were given in Table 6, together with their similarities and differences. Although such competitions were held in different countries at different times, the space program differences that

might present due to the applicable conditions are reflected comparatively.

Table 6: Comparison of the USA and Turkey expandable hospital competition programs with the existing present standardized building-department-unit area (Dergisi, 1982)

Comparison of Two Conventional Hospital Programs (2011, U.S.A and 1975, TURKEY'S COMPETITIONS).			
Small Hospital-Big Idea Competition, 2011, U.S.A.)		(Expandable Hospital Competition, 1975, Turkey)	
1. Out-Patient Care Department		1-Out-Patient Department	
1.1. Clinics	0 sf/0 m ²	Clinics	17,044 sf/1,584 m ²
1.2. Diagnostic Unit	14,332 sf/1,332 m ²	Diagnostic Unit	11,255 sf/1,046 m ²
1.3. Treatment Unit	2,640 sf/245 m ²	Treatment Unit	1,614 sf/150 m ²
1.4. Pharmacy	3,000 sf/279 m ²	Pharmacy	3,594 sf/334 m ²
1.5. Emergency	13,800 sf/283 m ²	Emergency	6,273 sf/583 m ²
1.6. Blood Bank	0 sf/0 m ²	Blood Bank	1,388 sf/129 m ²
Subtotal:	33,772 sf/3,139 m ²	Subtotal:	41,168 sf/3,826 m ²
2. Administration & Common Department		2-Administration & Common Department	
2.1. Administration & Main Entrance	4,548 sf/423 m ²	Administration: & Main Entrance	7,984 sf/742 m ²
2.2. Public Amenities:	2,500 sf/232 m ²	Public Amenities:	2,776 sf/258 m ²
2.3. Staff Amenities:	1,550 sf/144 m ²	Staff Amenities:	3,820 sf/355 m ²
2.4. Cafeteria, Food Court & Shops:	5,575 sf/518 m ²	Cafeteria, Food Court & Shops:	5,574 sf/518 m ²
2.5. Communication, Switchboard & IT:	500 sf/47 m ²	Communication, Switchboard & IT:	1,625 sf/151 m ²
2.6. Conference Room:	1,800 sf/167 m ²	Conference Room:	1,797 sf/167 m ²
2.7. Control Centre:	0 sf/0 m ²	Security-Control Centre:	1,044 sf/97 m ²
2.8. Ambulance and Garage:	300 sf/28 m ²	Ambulance and Garage:	2,077 sf/193 m ²
Subtotal:	16,773 sf/1,559 m ²	Subtotal:	26,696 sf/2,481 m ²
3. Inpatient Department		3-Inpatient Department	
3.1. Acute, Critical Care & Delivery Units	79,193 sf /7,360 m ²	Acute, Critical Care & Delivery Units	38,897 sf/3,615 m ²
3.2. Admission Unit:	0 sf /0 m ²	Admission Unit:	2,313 sf/215 m ²
3.3. Operating Room, Pre-Op & Inten. Care:	27,891 sf/2,592 m ²	Operating Room, Pre-Op & Inten. Care:	15,742 sf/1,463 m ²
3.4. Central Sterilisation Department:	5,360 sf/498 m ²	Central Sterilisation Department:	2,313 sf/215 m ²
3.5. Morgue & Pathology:	2,660 sf/247 m ²	Morgue & Pathology:	2,776 sf/258 m ²
Subtotal:	115,104 sf/10,697 m ²	Subtotal:	62,042 sf/5,766 m ²
4- Support & Technical Service Department		4- Support & Technical Service Department	
4.1. Loading, Materials Manage. & Storage	5,200 sf/483 m ²	Loading, Materials Manage. & Storage	5,552 sf/516 m ²
4.2. Food Service:	2,500 sf/232 m ²	Food Hall:	6,015 sf/559 m ²
4.3. Laundry:1,500	1,495 sf/139 m ²	Laundry:	4,282 sf/398 m ²
4.4. Bio-Medical Engineering:	600 sf/56 m ²	Bio-Medical Engineering:	602 sf/56 m ²
4.5. HVAC & Technical Services:	0 sf/0 m ²	HVAC & Technical Services	5,789 sf/538 m ²
4.6. Renewable Energy Centre-Saving & UPS	0 sf/0 m ²	Renewable Energy Centre-Saving & UPS	1,044 sf /97 m ²
4.7. Landscape:	1,000 sf/93 m ²	Landscape:	1,044 sf/97 m ²
Subtotal:	10,800 sf/1,003 m ²	Subtotal:	24,328 sf/2,261 m ²
Total Department Gross Area: (DGSF):	176,449 sf/16,398m ²	(DGSF):	154,234 sf/14,334 m ²
Net to Gross Area/Net Area Coefficient		1.35	1.35
Total Building Gross Area (BGSF)		238,206 sf/22,137m ²	208,216 sf/19,351 m ²
(114 Beds U.S.A)/(119 Beds Turkey)BGSF/Bed		2,090 sf/194m ²	1,750 sf/163 m ²

Table 7: Program description of the expandable hospital competition organized in Turkey per departments based on the applicable standards

1.2. MR+CT Unit	167 m ² Added to Diagnostic Unit (not present before)
1.3. Haemodialysis Unit	150 m ² Added to the Treatment Department (not present before)
2.4. Cafeteria	490 m ² Added to Admin.-Common Depart. (not present before)
2.5. IT System	56 m ² Added to Admin.-Common Depart. (not present before)
2.6. Conference Room	167 m ² Added to Admin.-Common Depart. (not present before)
2.7. Security	56 m ² Added to Admin.-Common Depart. (not present before)
4.4. Bio-medical Engineering	56 m ² Added to Technical Serv. Depart. (not present before)
4.6. Renewable Energy	89 m ² Added to Technical Serv. Depart. (not present before)
4.7. Landscape	89 m ² Added to Technical Service Department (not present before)
Total Area	1,320 m ² x 1.35 (net area coefficient)=1,782 m ² (total additional space area required within the applicable hospital programs)

Table 8: Comparison of the expandable hospital competition programs by their building-department areas based on the Turkish General Hospital Statistics

Hospital Depart. And Areas:	TURKEY	U.S.A	TURKEY
	General	Small Hospital-	Expandable
	Statistics:	Big Idea	Hospital
1-Out-patient Department	16 %	14.2% (3,139 m ²)	19.8% (3,826 m ²)
2-Admin. and Common Department	6.8 %	7.1% (1,559 m ²)	12.8% (2,481 m ²)
3-In-patient Department	30.4 %	48.3% (10,697 m ²)	29.8% (5,766 m ²)
4-Support and Tech. Services	18.6 %	4.5% (1,003 m ²)	11.7% (2,261 m ²)
5-Circulation Areas:	28.2 %	5.9% (5,739 m ²)	25.9% (5,017 m ²)
6-Total Hospital Area	100 %	100% (22,137 m ²)	100% (19,351 m ²)

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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