FUNDAMENTALS OF CANCER TREATMENT SERVICE DESIGN - CONSIDERING THE HEALING ENVIRONMENT CONCEPT: A GUIDELINE PROPOSAL FOR TURKEY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

İLKAY CANKURTARAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
BUILDING SCIENCE IN ARCHITECTURE

JANUARY 2020

Approval of the thesis:

FUNDAMENTALS OF CANCER TREATMENT SERVICE DESIGN - CONSIDERING THE HEALING ENVIRONMENT CONCEPT: A GUIDELINE PROPOSAL FOR TURKEY

submitted by **İLKAY CANKURTARAN** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Building Science in Architecture Department, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** __________________

Prof. Dr. F. Cânâ Bilsel
Head of Department, **Architecture** __________________

Assoc. Prof. Dr. Mehmet Halis Günel
Supervisor, **Architecture, METU** __________________

Examining Committee Members:

Prof. Dr. F. Cânâ Bilsel
Architecture, Middle East Technical University __________________

Prof. Dr. Celal Abdi Güzer
Architecture, Middle East Technical University __________________

Assoc. Prof. Dr. Mehmet Halis Günel
Architecture, Middle East Technical University __________________

Assoc. Prof. Dr. Adnan Aksu
Architecture, Gazi University __________________

Assist. Prof. Dr. Zeynep Çiğdem Uysal Ürey
Architecture, Çankaya University __________________

Date: 30.01.2020

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Surname: İlkay Cankurtaran

Signature:

ABSTRACT

FUNDAMENTALS OF CANCER TREATMENT SERVICE DESIGN - CONSIDERING THE HEALING ENVIRONMENT CONCEPT: A GUIDELINE PROPOSAL FOR TURKEY

Cankurtaran, İlkay
Doctor of Philosophy, Building Science in Architecture
Supervisor: Assoc. Prof. Dr. Mehmet Halis Günel

January 2020, 311 pages

Cancer, the second leading cause of death both globally and in Turkey, has become a priority among today's health problems. With the development of early diagnosis and modern treatment methods, designing appropriate and flexible healthcare facilities to integrate those achievements and ensure high quality treatment has become an essential design problem. Additionally, although there is a widespread belief that patients are uninterested in their surroundings due to the gravity of their illnesses, a considerable number of studies have introduced the 'healing environment concept' as a substantial input for healthcare architecture, stating that a great majority of patients are closely interested in and deeply affected by the architectural environment in healthcare facilities.

The aim of this thesis is to present a design guide for cancer treatment services that is compatible with both the healing environment concept and the medical applications, health manpower, and cultural habits of Turkey. In this context, studies conducted on the healing environment concept have been analyzed, the legislations of some selected countries for cancer treatment service design have been assessed, and finally, all the data have been filtered and combined with the medical applications and preferences in Turkey's healthcare system.

The resulting design principles are revealed according to the criteria of general settlement principles, internal function relations, medical necessities, patient and family/visitor experience, healthy working environments, interior design, social interaction and privacy, safety, and landscape design and outdoor relations. To strengthen the findings, proposed plans, diagrams and schematic drawings have been used in the narrative.

Keywords: Healthcare Architecture, Healing Environment, Radiation Oncology Design, Chemotherapy Design, Inpatient Care Design

ÖZ

İYİLEŞTİRİCİ ÇEVRE BAĞLAMINDA KANSER TEDAVİ SERVİSLERİ TASARIM İLKELERİ: TÜRKİYE İÇİN BİR KILAVUZ ÖNERİSİ

Cankurtaran, İlkay
Doktora, Mimarlık
Tez Danışmanı: Doç. Dr. Mehmet Halis Günel

Ocak 2020, 311 sayfa

Dünyada ve Türkiye'de ikinci ölüm nedeni olan kanser, bugünün sağlık sorunları arasında bir öncelik haline gelmiştir. Günümüzde erken tanı ve modern tedavi yöntemlerinin gelişimi ile birlikte, bu gelişmelerin sağlık yapılarına entegre edilmesi noktasında, yüksek kalitede tedavi hizmeti verebilecek uygun ve esnek bina çözümlerinin oluşturulması önemli bir tasarım problem haline gelmiştir. Bu duruma ek olarak, hastaların, hastalıkları nedeniyle fiziksel çevrelerine karşı duyarsızlaşacakları gibi genel bir kanı olmasına karşın; söz konusu kullanıcıların büyük çoğunluğunun sağlık tesislerinin mimarisine yakından ilgi duyduğunu ve bundan etkilendiğini belirten birçok çalışma, 'iyileştirici çevre' kavramını sağlık mimarisinde önemli bir girdi durumuna getirmiştir.

Bu tez çalışmasının amacı, kanser tedavi servisleri planlaması ile ilgili, iyileştirici çevre kavramının getirdiği prensipleri dikkate alan ve Türkiye'deki tıbbi uygulamalar, sağlık insan gücü ve kültürel alışkanlıklar ile uyumlu bir tasarım rehberi sunmaktır. Bu bağlamda, iyileştirici çevre kavramı üzerine yürütülen çalışmalar analiz edilmiş; seçilmiş birtakım ülkelerin kanser tedavi servisleri tasarımı ile ilgili mevzuatı değerlendirilmiş; ve son olarak, tüm bu veriler Türkiye'nin sağlık sistemindeki uygulamalar ve yönelimleri ile birlikte süzgeçten geçirilerek, analiz edilip bir araya getirilmiştir.

Çalışma sonucunda ortaya çıkan tasarım ilkeleri; genel yerleşim prensipleri, iç fonksiyon ilişkileri, tıbbi gereklilikler, hasta ve aile/ziyaretçi deneyimi, sağlıklı çalışma ortamları, iç tasarım, sosyal etkileşim ve mahremiyet, güvenlik, ve peyzaj tasarımı ve dış mekan ilişkileri kriterleri altında sunulmuştur. Çalışmada ayrıca, anlatıma destek olmak ve güçlendirmek adına öneri planlar, diyagramlar ve şematik çizimlerden yararlanılmıştır.

Anahtar Kelimeler: Sağlık Mimarisi, İyileştirici Çevre, Radyasyon Onkolojisi Tasarımı, Kemoterapi Tasarımı, Yataklı Servis Tasarımı

To my pretty little *yavrimu*

ACKNOWLEDGEMENTS

I owe my deepest gratitude to my supervisor, Assoc. Prof. Dr. M.Halis Günel, for his guidance, insight and encouragement throughout the study. It has been a great pleasure and honor to work with him. I also thank my thesis committee members, Prof. Dr. C. Abdi Güzer and Assoc. Prof. Dr. Adnan Aksu for their constructive criticism and suggestions.

I would like to thank Derya Döker, Didem Bahar and Melda Ulusoy for their friendship, empathy, and great sense of humor. I also thank Leslie Demir for her help throughout my thesis.

I would like to express my special thanks and love to my family, Zehra Güryay and Sami Güryay, for their continuous encouragement, patience and support without them, this project would not have been possible.

Finally, I must express my very profound gratitude to my caring, loving, and supportive husband, Birol Cankurtaran. Your encouragement and emotional support when times got rough were much appreciated. It was a great comfort and relief to know that you were there and ready for any help throughout this long journey.

And my little daughter… You are my lodestar, my vitality. Although you’ve given me a hard time while I’ve been writing this thesis, even from my belly, your kicking has always made me laugh and given me the morale to continue. I love you.

My thanks go to all the people who have supported me to complete this thesis directly or indirectly.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS

ANCCA	Asian National Cancer Centers Alliance
APOCP	Asian Pacific Organization for Cancer Prevention
BSC	The Black Sea Countries Coalition on Breast and Cervical Cancer Prevention
CABE	Commission for Architecture and the Built Environment
cfa	clear floor area
CT	Computed Tomography
EMF	Electromagnetic Field
ESGO	European Society of Gynecologic Oncology
IARC	International Agency for Research on Cancer
IOM	Institute of Medicine
IPRI	International Prevention Research Institute
KETEM	Cancer Early Diagnosis, Screening and Education Centers (“Kanser Erken Teşhis, Tarama ve Eğitim Merkezleri”)
MECC	Middle East Cancer Consortium
MH	Ministry of Health
MRI	Magnetic Resonance Imaging
PTSD	Post-Traumatic Stress Disorder
PTSS	Post-Traumatic Stress Symptoms
SCHEER	Scientific Committee on Health, Environmental and Emerging Risks
TAEK	Turkish Atomic Energy Authority (“Türkiye Atom Enerjisi Kurumu”)
UICC	Union for International Cancer Control
WCLS	World Cancer Leaders’ Summit
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1. Argument

The world has opened its eyes to the threat of cancer as a disease annually afflicting more than 14 million people, with about 8 million annual deaths (World Health Organization, 2018). This means that one of every six deaths is due to cancer. In addition, the February 2018 report of the World Health Organization indicated that the number of new cases is expected to increase by 70% within the next two decades. Cancer affects all countries of the world, regardless of income level (Chan, 2014). Therefore, realization of this threat among global political circles and civil society is growing.

Cancer is costly. The foremost burden is the human cost, as it involves suffering and harrowing experiences for both patient and family. Moreover, cancer has a societal cost, comprising the loss of enormous human potential, while treatment of the increasing number of patients has a considerable economic impact (Forman & Ferlay, 2014). For this reason, the issue of cancer control, which is a more comprehensive concept than oncology has emerged with the utilization of extensive actions for preventive measures, early detection, treatment, education, and the organization of healthcare services. Based on these actions, national cancer control programs shaped in several countries in the second half of the 20th century. Great advancements in the understanding and treatment of cancer have modified the landscape of cancer control and led to significant improvements in the quality of the treatment and care that cancer patients receive (National Health Service, 2007).

In this context, providing appropriate healthcare facilities that ensure easy access to high quality cancer care constitutes an essential design problem. However, academic studies on healthcare architecture have not advanced at the same pace as medical studies. The literature on the design of cancer treatment services is mostly limited to the architectural design regulations of some high-income countries such as Australia, Canada, the United Kingdom, and the United States. It has not yet been possible to obtain relevant data from Russia, a country that has been struggling with high rates of cancer for many years. Moreover, standards regarding healthcare design in middle- and low-income countries such as Romania and Brazil have also not been accessed, if they even exist.

Cuba, on the other hand, is one of the countries that need to be addressed in particular. Although the level of income is lower in Cuba than in many other countries, including Turkey, Cuba has made a name for itself worldwide in cancer control. Cuba’s early approach to the challenge of increasing cancer mortality was based on the fundamental understanding that cancer care cannot be carried out by trained physicians and nurses alone; rather, an institutional framework should be established for the task. The Cuban cancer control system was launched in the 1960s and there were already specialized cancer hospitals by 1970 (Lage & Romero, 2018). Eventually, the first version of the National Program for Cancer Mortality Reduction was published in 1985 (Lage & Romero, 2018). The establishment of a primary care network as well as a national biotechnology industry with the capacity to provide both medicines and diagnostic systems are among the outstanding characteristics of cancer control in this country. Today, Cuba is well-known for its advanced cancer treatment techniques and vaccines. Unfortunately, despite Cuba's awareness of cancer control, no studies or publications on Cuban healthcare architecture have been found in the literature.

In Turkey, studies related to cancer control started in the 2000s and the National Cancer Control Program was published in 2008 for the first time (MH, 2016b). The budget allocated to researching cancer control in Turkey has been expanded since then and there are various action plans in force. In this context, the number of cancer care centers has increased; and these centers, belonging to the Ministry of Health and universities are grouped in terms of the Turkey Cancer Control Program as comprehensive oncology centers, oncology diagnosis and treatment centers, and oncology service units (MH, 2016b). On the other hand, in terms of the planning principles of these cancer care centers, the situation is particularly challenging in Turkey. The Turkish legislation regarding cancer treatment service design is extremely inadequate and also contains contradictions in terms of the propositions that need to be discussed. Therefore, there is a need for a cancer treatment service design guideline that is consistent with today's medical applications, technological developments, health manpower, and the cultural habits of Turkey.

The quality of the physical environment affects a patient's overall experience (National Health Service, 2007). In addition, the weakened physical and psychological conditions of cancer patients and their extended treatment periods over multiple visits to healthcare facilities increase the importance of the physical environment. Although there is a common belief that patients are interested in their surroundings, being focused instead on their illnesses, the study conducted by Lawson and Phiri (2003) revealed that the vast majority of patients are highly sensitive to and articulate about the architectural environment in healthcare facilities. In recent years, many studies have been done on healing environments, and important results have been obtained, which made the healing environment concept a necessity rather than a choice for hospitals. However, only a limited number of studies focused on oncology environments and their psychosocial effects on cancer patients. Moreover, the majority of abovementioned standards and guidelines on healthcare architecture are very abstract regarding the provision of a healing environment. In conclusion, special attention needs to be given to both the provision of modern equipment and the overall physical environment in which treatment is delivered to obtain a healing environment.

1.2. Objectives

The main objective of this thesis is to present a design guide for healthcare architects for cancer treatment services that is compatible with the medical applications, health manpower and cultural habits of Turkey, as well as with the healing environment concept. Although the main objective to obtain an architectural guideline specific to Turkey, the suggestions offered in the thesis may be adopted by other countries since cancer treatment applications are medically similar around the world and there are no distinctions between countries in terms of the architectural design principles of the healing environment concept. The other objectives of the thesis are:

- to analyze the conducted studies on the healing environment concept and present the relevant design principles,
- to analyze and evaluate the legislations of Australia, Canada, the United Kingdom, the United States and Turkey regarding cancer treatment service design; and
- to establish a series of criteria that will include all themes of the healing environment concept and the issues in the examined standards.

1.3. Procedure

The first stage of this study is a literature survey. It is based on articles, books, and other publications related to the topic at hand. The literature survey provides background information about the issue, relevant standards, and similar studies conducted on this subject. Background information is presented along with a general overview of the area from which the problem is drawn. Thereafter, the legislations of Australia, Canada, the United Kingdom, the United States and Turkey on cancer treatment services are investigated. These legislations are analyzed and evaluated according to the topics of general settlement principles, internal function relations, treatment areas, clinical support areas, staff areas, and public patient areas. The outcome is presented in Appendices A, B and C for chemotherapy departments, radiation oncology departments and inpatient care services, respectively.

As the final step, design principles of the above-mentioned cancer treatment services are examined and discussed in terms of the conducted studies regarding the healing environment concept and the examined standards while considering the medical practices, health manpower and cultural characteristics of Turkey. The topics of general design principles, internal function relations, medical necessities, patient and family/visitor experience, healthy working environments, interior design, social interaction and privacy, safety, and landscape design and outdoor relations are addressed.

1.4. Disposition

This report comprises five chapters. The first chapter, serving as an introduction, presents the topic of the study together with the background information and objectives of the thesis. It concludes by providing a roadmap for following chapters.

The second chapter presents a literature survey of the subject. It provides brief information on cancer care, cancer treatment services in healthcare facilities, and the healing environment concept.

In the third chapter, the study material and methodology are described within two subsections. The first covers the necessary descriptions, the thinking behind the choice of examined legislations, and the list of studies used on the healing environment concept to be used. The second subsection describes the methodology and operational procedure used to assess the material.

The fourth chapter presents the analysis and guideline proposal on the design principles of chemotherapy departments, radiation oncology departments, and inpatient care services in terms of general settlement principles, internal function relations, medical necessities, patient and family/visitor experience, healthy working environments, interior design, social interaction and privacy, safety, and landscape and outdoor relations, respectively. In the last chapter, the concluding remarks of the study are presented, and issues for further research are highlighted.

CHAPTER 2

LITERATURE SURVEY

2.1. Cancer Care

Cancer, along with other physical disorders, is a disease that must be treated while considering its social, material and spiritual implications (Ministry of Health [MH], 2013). According to the Word Cancer Report 2014 (World Health Organization [WHO], 2014), there are four key elements in terms of the fight against cancer:

1. prevention,
2. early detection and diagnosis,
3. treatment, and
4. palliative care.

It is widely recognized that the most important control strategy for cancer in the 21st century is protection and early diagnosis (MH, 2013). Therefore, it is very important to determine carcinogenic substances and to take the necessary measures in time for the preservation of health (MH, 2013). Some lifestyle choices are identified as keys to reducing the incidence of cancer (WHO, 2014). For instance, high rates of tobacco-related cancer deaths prompted an international treaty on supporting smoking cessation (WHO, 2014). Moreover, excessive alcohol usage and avoidable exposure to sunlight, physical inactivity, unhealthy diets and obesity are all linked to various types of cancer (WHO, 2014). Therefore, overcoming such habits is important in order to avoid cancer in the first place. Additionally, the primary prevention of certain cancers caused by infection can be achieved through vaccination, and some regulatory measures for reducing pollutants in the workplace or the environment have been proven to diminish or eliminate some cancer types (WHO, 2014). Early diagnosis, on the other hand, can reduce morbidity and mortality from tumors by revealing premalignant or early stages of disease (WHO, 2014).

There has been continuous improvement in the survival of cancer patients thanks to modern treatment techniques (Djulbegovic et al., 2008). With the latest developments, treatment success rates have reached 80-85% in pediatric cancers and 70% in adult cancers (Kutluk, 2017). There are many different types of cancer treatment. The treatment that a patient receive depends on the type of cancer and how far it has grown (National Cancer Institute, 2017). The cancer treatments administered to patients are primarily as follows:

- surgery,
- radiation therapy (or radiotherapy), and
- chemotherapy (American Cancer Society, 2015a).

In addition, recent medical developments have led to relatively new treatment methods such as:

- immunotherapy,
- hormone therapy,
- targeted therapy, and
- stem cell transplantation (National Cancer Institute, 2017).

Treatments may be used alone or in combination depending on the type and stage of cancer, the tumor characteristics, and the patient's age, health, and preferences (American Cancer Society, 2016a). Although some cancer patients receive only one form of treatment, definitive improvement is usually targeted by administering two or more treatments at the same time (National Cancer Institute, 2017).

Surgery in cancer treatment basically means the removal of the cancerous tissue from the body, especially if the cancer seems to be localized (National Cancer Institute, 2015b). If the surgeon deems necessary, he or she may remove the cancerous tissue along with nearby tissue or all of the affected body part (American Cancer Society, 2017). Radiation therapy entails the use of high-energy beams or particles to kill cancer cells; it may be delivered from a source outside the body (as in external beam radiation) or internally (e.g., brachytherapy) (American Cancer Society, 2016a). Radiation, by damaging cell DNA, leads cells to stop reproducing or to die (Department of Health [DH], 2013a). Radiotherapy is a major treatment modality. According to the Australasian Health Facility Guidelines [AHIA] (2016c), approximately 48% of cancer-diagnosed patients are given radiation during their treatment.

Systemic therapies (e.g., chemotherapy, hormonal therapy, immunotherapy, and targeted therapy) employ drugs that travel through the bloodstream, potentially affecting all parts of the body, and work using different mechanisms (American Cancer Society, 2016a). For example, chemotherapy drugs generally attack cells that grow quickly, such as cancer cells (American Cancer Society, 2016a). Immunotherapy, which is also called biological therapy or biotherapy, is a kind of cancer treatment that helps patients' immune systems fight cancer (American Cancer Society, 2015b). Hormonal therapy works by either blocking or decreasing the levels of the body's natural hormones, which sometimes act to promote cancer growth (American Cancer Society, 2016a). Targeted drugs are newer therapies that work by attacking specific molecules on cancer cells (or nearby cells) that normally help cancers grow (American Cancer Society, 2016a).

Stem cell transplantation is a treatment method that is applied after patients are treated with very high doses of chemotherapy or radiation therapy, which almost completely destroy blood-forming stem cells (American Cancer Society, 2016b). Therefore, stem cell transplants do not treat cancer directly (National Cancer Institute, 2015a). Rather, they enable patients to recuperate from heavy radiation treatment, chemotherapy, or both (National Cancer Institute, 2015a). Transplants could be autologous, in which stem cells come from the same person; allogenic, in which stem cells come from a matched donor; or syngeneic, in which stem cells come from the patient's identical twin (National Cancer Institute, 2015a).

2.1.1. Emotional and Psychosocial Effects of Cancer

> A diagnosis of cancer hits you like a punch in the stomach. Other diseases may be just as life-threatening, but most patients know nothing about them. Everyone, however, knows that cancer means pain, horrible treatments and – though no longer quite the unmentionable 'Big C' of twenty-five years ago – early death. Cancer does kill of course – but fear, compounded by ignorance and false knowledge – is a paralysing attack in its own right. The myth of cancer kills as surely as the tumors (Jencks, 1995:9).

Simply hearing a doctor say "cancer" can profoundly affect an individual. A cancer diagnosis launches a long journey that affects the patient's physical well-being, mental health, and associations with friends and family, which may create serious suffering of the mind and spirit (Grassi, Holland, Johansen, Kosh & Fawzy, 2005). Therefore, cancer, like other physical disorders, is a disease that must be tackled with attention towards its social, material and spiritual aspects (MH, 2013).

Early detection and improved treatment techniques have changed our understanding of cancers, ranging from diseases that have often been uniformly fatal in a matter of weeks or months to a number of diseases that may be curable, are treatable, and may entail long-term survival (Institute of Medicine [IOM], 2008). Nevertheless, cancer involves both serious chronic conditions and acute life-threatening diseases (IOM, 2008). Typically, the treatment is extremely physically challenging for patients, comprising some combination of chemotherapy, surgery, radiation, or other approaches for months or years (IOM, 2008). Even after treatment has been completed and the cancer is absent, serious residual or side effects of treatments can permanently affect the functioning of the heart, lungs, kidneys, neurological system and other organs, which requires ongoing monitoring of the health of cancer survivors and numerous adjustments in their daily lives (IOM, 2008).

Therefore, it is not a surprise that serious mental health issues are common among cancer patients, such as anxiety disorders and depression (Spiegel & Giese-Davis, 2003; Carlsen, Jensen, Jacobsen, Krasnik & Johansen, 2005; Hegel et al., 2006; Jacobsen & Andrykowski, 2015; Stanton, Rowland & Ganz, 2015). Studies have reported the presence of post-traumatic stress disorder [PTSD] and post-traumatic stress symptoms [PTSS] in adults and children diagnosed with cancer and in the parents of those children (Kangas, Henry & Bryant, 2002; Bruce, 2006). These mental health issues contribute to the functional deterioration of family, work, and social life as well as poor medical treatment adherence and negative medical outcomes (Katon, 2003).

Factors that affect the presence of emotional distress and mental health problems in an oncology setting include:

- biological problems,
- side effects of medication,
- reactions to chemotherapy,
- changes of body image,
- lack of information or skills needed to manage the illness,
- loss of self-reliance,
- fear of suffering,
- confrontation with death,
- family members' reaction to the disease,
- pre-existing family problems,
- disruptions in work, school, and family life,
- death of other patients,
- logistic and financial problems, and
  personality factors (pessimism, inclination to think of life as uncontrollable, etc.) (Capuron et al., 2001; IOM, 2008; Trill, 2012; CancerQuest, 2018).

Additionally, it has been contended that innovations in medicine such as X-rays, computed tomography [CT], or magnetic resonance imaging [MRI] prioritize images over the body and its experience. In the end, patients become "virtual" and "vanish" behind the pictures (Blaxter, 2009). Machines and images may be alienating or may create a feeling of disincarnation for patients, reinforcing the already objectionable effects of hospitals (Blaxter, 2009). Throughout his or her diagnosis and treatment period, a cancer patient faces this situation considerably often since the disease is very difficult to treat without the help of these innovations. Frank (1992:83) states that:

> Real diagnostic work takes place away from the patients; bedside is secondary to screen side. For diagnostic and even treatment purposes, the image of the screen becomes the 'true' patient, of which the bedridden body is an imperfect replica, less worthy of attention. In the screens' simulations, our initial certainty of the real (the body) becomes lost in hyperreal images that are better than the real body.

Though family and friends provide significant emotional and logistical support, and take care of patients' personal and nursing needs (Hayman et al., 2001; Kotkamp-Mothes, Slawinsky, Hindermann & Strauss, 2005), those caregivers often do so at great personal expense, with adverse health effects such as depression and an increased risk of premature death (Schultz and Beach, 1999; Kurtz, Kurtz, Given & Given, 2004). According to the study of Schultz and Beach (1999), caregivers supporting a spouse and reporting stress from doing so are 63% more likely to die within four years than others of their age. Moreover, the studies of Segrin et al. (2005, 2007) reveal that the mental health of the partners of women with breast cancer (mainly husbands) is positively correlated with the fatigue, depression, anxiety, and symptom distress of the patients, and that these effects are bidirectional.

A meta-analysis of 58 studies conducted between 1980 and 1994 showed that patients with cancer were notably more depressed than the general population, with that depression frequently coexisting with anxiety and pain (Spijker, Trijsburg & Duivenvoorden, 1997). Over the last few decades, several studies have shown that psychosocial diseases, especially anxiety and depressive disorders, are present in 30-40% of cancer patients (Massie, 2004; Grassi et al., 2005; Trill, 2012). A further 25-

30% of patients display minor psychosocial conditions such as nervous mood, health anxiety, and demoralization, which are not identified in nosology but need to be clinically addressed (Massie, 2004; Grassi et al., 2005).

Untreated psychosocial conditions such as anxiety and depression have critical implications for patients' and caregivers' health (Massie, 2004; Grassi et al., 2005). The main consequences of psychosocial morbidity in cancer patients can be listed as follows:

- Increased length of stay in the hospital (Nordin & Glimelius, 1999; Prieto et al., 2002; Stommel, Given & Given, 2002),
- Maladaptive coping and abnormal illness behavior (Grassi, Rosti, Lasalvia & Marangolo, 1993),
- Reduced compliance with treatment (Nordin & Glimelius, 1999; DiMatteo, Lepper & Croghan, 2000; Stommel et al., 2002),
- Increased risk of suicide (Henrikkson, Isometsa, Hietanen, Aro & Lönnqvist, 1995; Hem, Loge, Haldorsen & Ekeberg, 2004; Van der Lee et al., 2005; Cathcart, 2006),
- Increased risk of tumors' ability to grow and spread (National Cancer Institute, 2018),
- Reduced efficacy of chemotherapy (Walker et al., 1999),
- Reduced quality of life (Parker, Baile, de Moor & Cohen, 2003),
- Increased risk of recurrence and death (Spiegel, Bloom, Kraemer & Gottheil, 1989; Watson, Haviland, Greer, Davidson & Bliss, 1999; Goodwin, Zhang & Ostir, 2004; Cohen et al., 2012),
- Increased psychosocial morbidity in the family (Grassi et al., 2005),
- Traumatic grief in the family (Grassi et al., 2005),
- Additional somatic problems, such as sleep difficulties, fatigue, and pain (Spitzer et al., 1995; American Psychiatric Association, 2000),
- Higher rates of unhealthy behaviors such as smoking, a sedentary lifestyle, and overeating (IOM, 2008), and

- Increased risk of having lower social functioning, more disability, and greater overall functional impairment (Spitzer et al., 1995; Katon, 2003).

Such research results demonstrate the importance of psychosocial factors in receiving the needed care, adhering to the treatment plan, maintaining positive living standards, and dealing with the disease and recovery. In this regard, although patients' and caregivers' emotions, behaviors, and social relationships are generally ignored or not evaluated in healthcare and are considered as "soft science" (IOM, 2008), the health of an individual is determined by dynamic relations comprising biological, behavioral, psychological, and social factors (IOM, 2001). This conclusion is compatible with the health definition of the World Health Organization (2014:1), which says that "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

2.1.2. Cancer Care in Turkey

In Turkey, cancer is the second leading cause of death at the rate of 19.7%, which means nearly one in five deaths (Table 2.1.) (Turkish Statistical Institute, 2016). Therefore, Turkey is one of the top six countries with the highest spending on cancer care among the European Union countries (MH, 2016b). If necessary measures are not taken, the issue of cancer has the potential to create serious risk for the healthcare system in the long term, because the disease requires significant medication and treatment costs that may affect the financial structure of the Turkish healthcare system (MH, 2016b). To minimize those negative impacts and risks in a reasonably short time, the Cancer Institute of Turkey was established in 2014 as an efficient corporate structure to lead the fight against cancer (MH, 2016b). With significant contributions of both the Cancer Institute and the Ministry of Health, comprehensive studies have been carried out as follows:

- Tobacco Control Action Plan,
- Alcohol Control Action Plan,
- Obesity Fighting and Control Program,

Table 2.1. *Distribution of death causes, Turkey (Turkish Statistical Institute, 2016)*

	2015		2016	
	Deaths	**(%)**	**Deaths**	**(%)**
Total	**397,037**	**100.0**	**408,782**	**100.0**
Cardiovascular diseases	159,194	40.1	162,876	39.8
Malignant and benign tumors	79,160	19.9	80,577	19.7
Respiratory diseases	43,821	11.0	48,532	11.9
Alimentation and metabolic diseases	19,803	5.0	20,330	5.0
Nervous system and sense organ diseases	19,114	4.8	19,923	4.9
External injury and poisoning	18,936	4.8	18,136	4.4
Other	57,009	14.4	58,408	14.3

- Asbestos Control Strategic Plan,
- National Radon Mapping,
- Tanning Room and Solarium Regulations,
- Monitoring and Evaluation Studies on the Health Effects of Electromagnetic Fields,
- Cancer Reports, and
- Epidemiological Research (MH, 2016b).

In Turkey, cancer screening is performed by Cancer Early Diagnosis, Screening, and Training Centers ("Kanser Erken Teşhis, Tarama ve Eğitim Merkezleri" [KETEMs]) (MH, 2016b). These facilities carry out screening programs, especially for breast, cervix, and colorectal cancers, based on the principle of "Early diagnosis saves lives!" (MH, 2016b). Currently, there are over 200 KETEMs, with at least one in each province (MH, 2016b, 2018). The screening of cervical and breast cancers is carried out in various ways (letter, telephone) by inviting women to receive the necessary examinations and tests (MH, 2016b).

Palliative care is mandatory for people with cancer or other fatal chronic diseases (MH, 2016b). Due to the traditional Turkish family structure, the need for palliative care services did not arise for a long time (MH, 2016b). However, in parallel with the country's changing demographics, the need is showing itself more and more every day (MH, 2016b). In 2010, a project named Palya-Türk was prepared, and pilot studies have been started on palliative care services (MH, 2016b). Within the scope of the project, Home Care Services was established in 2010 and training modules for palliative care were developed by experts (MH, 2016b). In addition to those actions, Turkey has relations and activities with the following international groups:

- International Agency for Research on Cancer [IARC],
- Scientific Committee on Health, Environmental and Emerging Risks [SCHEER],
- The Black Sea Countries Coalition on Breast and Cervical Cancer Prevention [BSC],
- Middle East Cancer Consortium [MECC],
- Union for International Cancer Control [UICC],
- World Cancer Leaders' Summit [WCLS],
- International Prevention Research Institute [IPRI],
- Asian National Cancer Centers Alliance [ANCCA],
- Asian Pacific Organization for Cancer Prevention [APOCP],
- The International Electromagnetic Field [EMF] Project of the WHO, and
- European Society of Gynecologic Oncology [ESGO] (MH, 2016b).

In Turkey, as in many countries, cancer care services are carried out in the healthcare facilities of the Ministry of Health, universities, and the private sector (MH, 2011a). In particular, oncology services are provided at:

- Training and research hospitals belonging to the Ministry of Health,
- Training and research hospitals belonging to universities,
- Service hospitals belonging to the Ministry of Health, and

- Private hospitals (MH, 2011a).

The identification and distribution of these institutions is necessary in order to ensure the correct planning of cancer care services (MH, 2011a). In Turkey, although private hospitals are not subject to any classification, cancer care centers of hospitals belonging to the Ministry of Health and universities are grouped in terms of the Turkey Cancer Control Program (MH, 2016b) as follows:

- Comprehensive oncology centers,
- Oncology diagnosis and treatment centers, and
- Oncology service units.

<u>Comprehensive oncology centers</u>: These facilities have advanced knowledge and set-ups in the field of cancer care, are able to contribute to the formation and implementation of the National Cancer Policy, and are expected to train experienced medical personnel for the centers (MH, 2016b). In Turkey, 15 hospitals belonging to the Ministry of Health and 17 university hospitals meet the minimum criteria of comprehensive oncology centers (Table 2.2.) (MH, 2011a & MH, 2018).

<u>Oncology diagnosis and treatment centers</u>: These are facilities that can play an active role in the delivery of standard cancer care services to the public with professionals in the field of oncology (MH, 2016b). In Turkey, 31 hospitals belonging to the Ministry of Health and 27 university hospitals meet the minimum criteria of oncology diagnosis and treatment centers (Table 2.3.) (MH, 2011a & 2018).

<u>Oncology service units</u>: These are facilities that are under the supervision of a non-oncologist who is trained in chemotherapy practice; they particularly deliver chemotherapy, play an active role in the provision of supportive therapies, and are located in peripheral regions (MH, 2016b). Oncology service units are available in 100 hospitals belonging to the Ministry of Health in Turkey (MH, 2018). Unfortunately, the names and numbers of hospitals with oncology service units belonging to universities could not be obtained.

Table 2.2. *List of comprehensive oncology centers belonging to the Ministry of Health and universities (MH, 2011a & 2018)*

	City	Ministry of Health	University
1	Adana	Adana Şehir Hastanesi	Çukurova Üniversitesi Tıp Fakültesi
2	Ankara	Ankara Şehir Hastanesi	Gazi Üniversitesi Tıp Fakültesi
		Ankara Dr. Abdurrahman Yurtaslan Onkoloji Eğitim ve Araştırma Hastanesi	Hacettepe Üniversitesi Tıp Fakültesi
		Ankara Gülhane Eğitim ve Araştırma Hastanesi	Ankara Üniversitesi Tıp Fakültesi
3	Antalya	Antalya Eğitim ve Araştırma Hastanesi	Akdeniz Üniversitesi Tıp Fakültesi
4	Bursa	Bursa Ali Osman Sönmez Onkoloji Hastanesi	Uludağ Üniversitesi Tıp Fakültesi
5	Diyarbakır	Diyarbakır Gazi Yaşargil Eğitim ve Araştırma Hastanesi	Dicle Üniversitesi Tıp Fakültesi
6	Erzurum	Erzurum Bölge Eğitim ve Araştırma Hastanesi	Atatürk Üniversitesi Tıp Fakültesi
7	Gaziantep		Gaziantep Üniversitesi Tıp Fakültesi
8	İstanbul	İstanbul Kartal Dr. Lütfi Kırdar Eğitim ve Araştırma Hastanesi	Marmara Üniversitesi Tıp Fakültesi
		İstanbul Bakırköy Dr. Sadi Konuk Eğitim ve Araştırma Hastanesi	İstanbul Üniversitesi Cerrahi Tıp Fakültesi
		İstanbul Okmeydanı Eğitim ve Araştırma Hastanesi	İstanbul Üniversitesi Onkoloji Enstitüsü
		İstanbul S.B. Marmara Üniversitesi Pendik Eğitim ve Araştırma Hastanesi	
9	İzmir	İzmir Katip Çelebi Üniversitesi Atatürk Eğitim ve Araştırma Hastanesi	Ege Üniversitesi Tıp Fakültesi
			Dokuz Eylül Üniversitesi Tıp Fakültesi
10	Kayseri	Kayseri Şehir Hastanesi	Erciyes Üniversitesi Tıp Fakültesi
11	Konya		Selçuk Üniversitesi Meram Tıp Fakültesi
12	Samsun	Samsun Eğitim ve Araştırma Hastanesi	On Dokuz Mayıs Üniversitesi Tıp Fakültesi

Table 2.3. *List of oncology diagnosis and treatment centers belonging to the Ministry of Health and universities (MH, 2011a & 2018)*

	City	Ministry of Health	University
1	Adıyaman		Adıyaman Üniversitesi Tıp Fakültesi
2	Afyon		Afyon Kocatepe Üniversitesi Tıp Fakültesi
3	Ankara	Ankara Atatürk Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesi	
		Ankara Dışkapı Yıldırım Beyazıt Eğitim ve Araştırma Hastanesi	
		Ankara Numune Eğitim ve Araştırma Hastanesi	
4	Aydın	Aydın Atatürk Devlet Hastanesi	Adnan Menderes Tıp Fakültesi
5	Balıkesir	Balıkesir Devlet Hastanesi	Balıkesir Üniversitesi Tıp Fakültesi
6	Çanakkale	Çanakkale Devlet Hastanesi	
7	Denizli	Denizli Devlet Hastanesi	Pamukkale Üniversitesi Tıp Fakültesi
8	Edirne		Edirne Üniversitesi Tıp Fakültesi
9	Elazığ	Elazığ Eğitim ve Araştırma Hastanesi	Fırat Üniversitesi Tıp Fakültesi
10	Eskişehir	Eskişehir Yunus Emre Devlet Hastanesi	Osmangazi Üniversitesi Tıp Fakültesi
11	Gaziantep	Gaziantep Dr. Ersin Arslan Eğitim ve Araştırma Hastanesi	
12	Hatay	Hatay Devlet Hastanesi	Mustafa Kemal Üniversitesi Tıp Fakültesi
13	Isparta		Süleyman Demirel Üniversitesi Tıp Fakültesi
14	İstanbul	İstanbul Bağcılar Eğitim ve Araştırma Hastanesi	
		İstanbul Eğitim ve Araştırma Hastanesi	
		İstanbul Haydarpaşa Eğitim ve Araştırma Hastanesi	
		İstanbul Şişli Etfal Eğitim ve Araştırma Hastanesi	
		Ümraniye Eğitim ve Araştırma Hastanesi	

	City	Ministry of Health	University *(Continued)*
15	İzmir	İzmir Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi	
16	Kahraman-maraş	Kahramanmaraş Necip Fazıl Şehir Hastanesi	Sütçü İmam Üniversitesi Tıp Fakültesi
17	Kocaeli	Kocaeli Devlet Hastanesi	Kocaeli Üniversitesi Tıp Fakültesi
18	Konya	Konya Eğitim ve Araştırma Hastanesi	Selçuk Üniversitesi Tıp Fakültesi
19	Kütahya	Kütahya Dumlupınar Üniversitesi Evliya Çelebi Eğitim ve Araştırma Hastanesi	
20	Malatya	Malatya Eğitim ve Araştırma Hastanesi	İnönü Üniversitesi Tıp Fakültesi
21	Manisa	Manisa Devlet Hastanesi	Manisa Üniversitesi Tıp Fakültesi
22	Mersin	Mersin Şehir Hastanesi	Mersin Üniversitesi Tıp Fakültesi
23	Muğla		Muğla Üniversitesi Tıp Fakültesi
24	Ordu		Ordu Üniversitesi Tıp Fakültesi
25	Rize	Rize T.C. Sağlık Bakanlığı Recep Tayyip Erdoğan Üniversitesi Eğitim ve Araştırma Hastanesi	Rize Üniversitesi Tıp Fakültesi
26	Sakarya	Sakarya Üniversitesi Eğitim ve Araştırma Hastanesi	Sakarya Üniversitesi Tıp Fakültesi
27	Sivas	Sivas Numune Hastanesi	Cumhuriyet Üniversitesi Tıp Fakültesi
28	Şanlıurfa	Şanlıurfa M. Akif İnan Eğitim ve Araştırma Hastanesi	Harran Üniversitesi Tıp Fakültesi
29	Tekirdağ	Tekirdağ Devlet Hastanesi	Tekirdağ Üniversitesi Tıp Fakültesi
30	Trabzon	Trabzon Kanuni Eğitim ve Araştırma Hastanesi	Trabzon Karadeniz Üniversitesi Tıp Fakültesi
31	Tokat		Gaziosmanpaşa Üniversitesi Tıp Fakültesi
32	Van	Van Eğitim ve Araştırma Hastanesi	Van Yüzüncü Yıl Üniversitesi Tıp Fakültesi
33	Zonguldak		Karaelmas Üniversitesi Tıp Fakültesi

It can be observed from Figure 2.1. that the percentages of university and private hospitals providing cancer treatment in the field of radiation oncology are generally increasing in terms of total service over the years (MH, 2016a). However, it is also clear that the city hospitals (or campus hospitals) operating under the Ministry of Health, which have been opened in recent years or will be in service in the near future, will change these percentages in favor of the Ministry of Health. Almost all of those new hospitals are planned as comprehensive oncology centers and include treatment devices and options such as linear accelerators, brachytherapy, tomotherapy, CyberKnife, and Gamma Knife.

In Turkey, healthcare facilities offering cancer care show serious differences in terms of physical environment. One of the reasons for this is thought to be the lack of national architectural standards. There are almost no legal regulations regarding areas that provide radiation oncology and chemotherapy services, except for common areas such as operating rooms and patient bedrooms, which are considered in the same way as for other medical branches. The topic is only addressed in guidelines issued by the Ministry of Health in 2010. In that document, there are only two statements regarding the issue:

(1) It is stated that accelerator rooms and cobalt chambers should be at least 60 and 41 square meters, respectively, including the compartment walls (MH, 2010).
(2) It is noted that a mold room should be established for radiotherapy departments (MH, 2010).

The accuracy of these statements in the guidelines is questionable because the total area of the compartment walls can reach up to 60 square meters in order to ensure radiation safety. In addition, the legislation does not provide any explanation for the general establishment principles and internal functional relationships of cancer treatment units. Moreover, the institution responsible for radiation safety in Turkey, the Turkish Atomic Energy Authority (“Türkiye Atom Enerjisi Kurumu” [TAEK]),

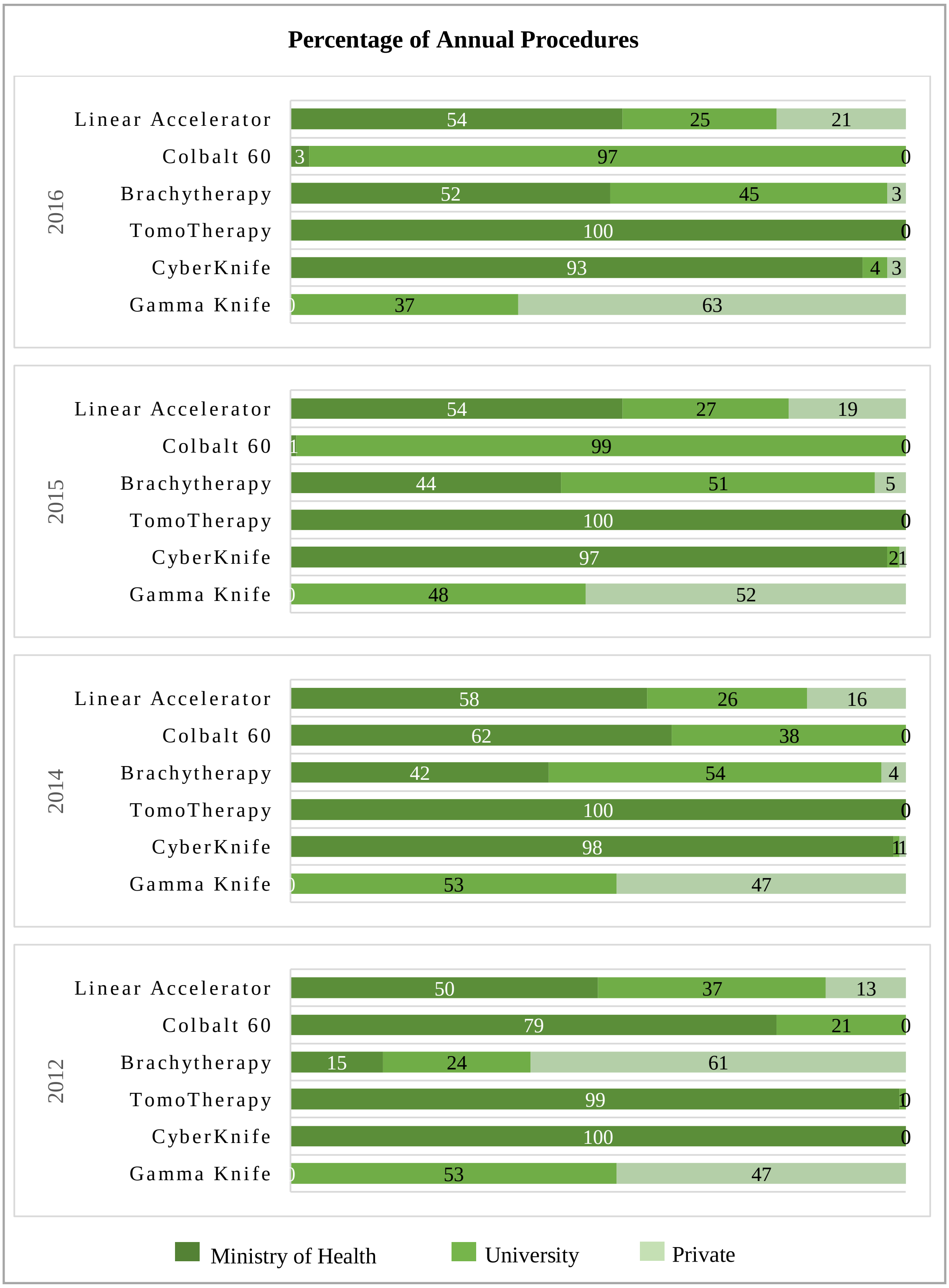


Figure 2.1. Sectoral distribution of radiation oncology device procedures: numbers by years (MH, 2016a)

provides no legislation to guide the planning stages of those medical units architecturally before installation.

For those reasons, the departments such as radiotherapy and chemotherapy of the hospitals affiliated with the Ministry of Health and universities are usually designed based on generally accepted policies, and, as there are no legal regulations, they are not deeply discussed in terms of patient and staff comfort. On the other hand, in private hospitals, this issue is widely addressed as a marketing strategy, which leads to more aesthetically pleasing designs and interiors. However, the difference in comfort between public and private hospitals is gradually decreasing, as is the case with new healthcare facilities such as the city hospitals (or campus hospitals) of the Ministry of Health. Spacious waiting areas with natural light, information desks located in the waiting areas, and well-designed treatment rooms represent significant progress in terms of offering the comfort and communication opportunities that patients and their relatives desire (Figures 2.2., 2.3., and 2.4.) (Edvardsson, Sandman, & Rasmussen, 2006; Eceoğlu, 2010).

Figure 2.2. Chemotherapy rooms of Acıbadem Altunizade and Adana City Hospitals, respectively (Source: personal archive)

Figure 2.3. Radiotherapy rooms of Acıbadem Altunizade and Ankara City Hospitals, respectively (Source: (1) Acıbadem official website & (2) personal archive)

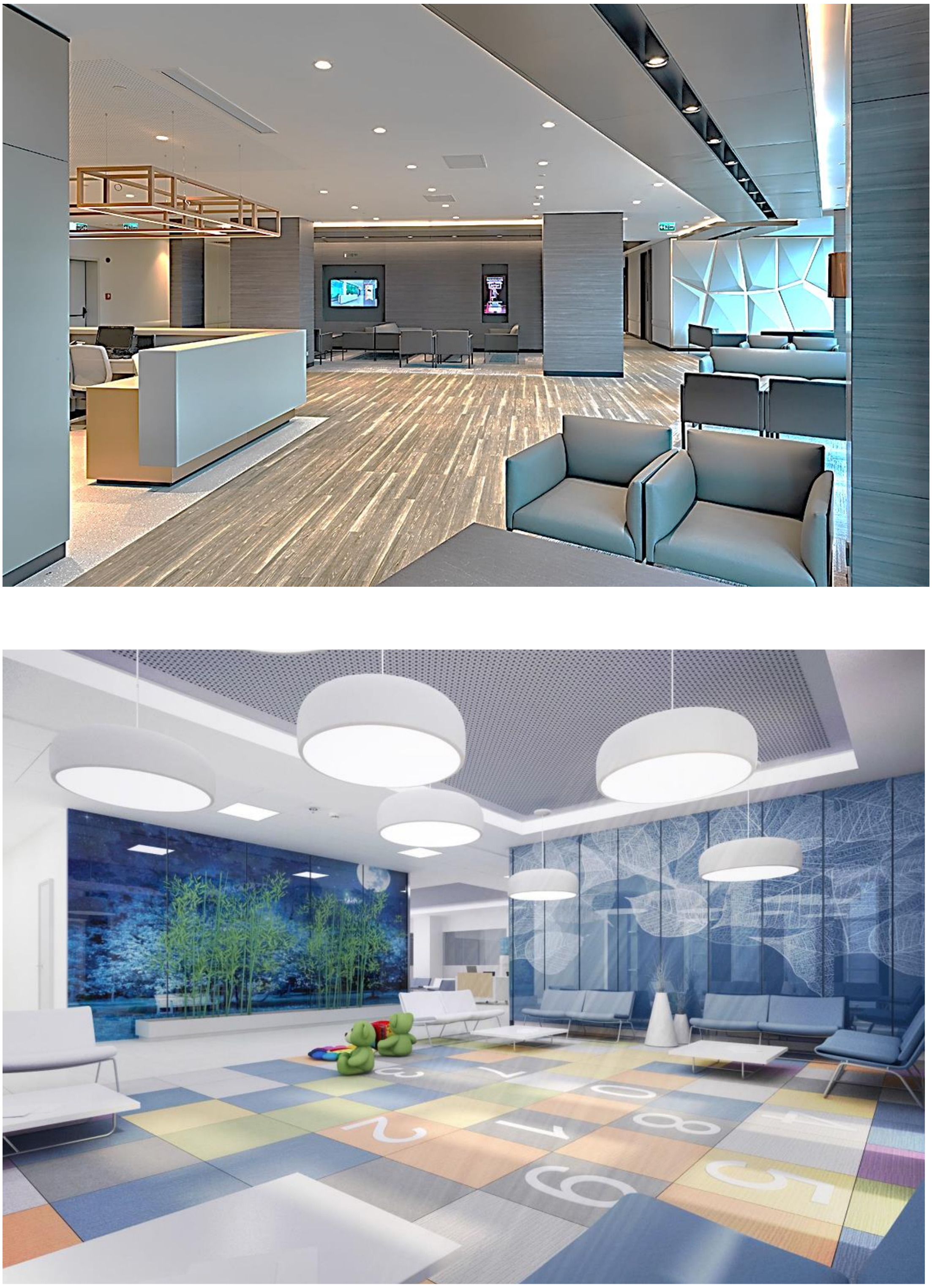


Figure 2.4. General waiting areas of Memorial Bahçelievler and Kocaeli City Hospitals, respectively (Source: (1) Memorial official website & (2) Personal archive)

2.2. Cancer Treatment Services in Healthcare Facilities

Cancer care can be grouped as (1) diagnosis and (2) treatment. The diagnostic services of cancer care in healthcare facilities are generally delivered in outpatient clinics and nuclear medicine departments. Besides that, cancer treatment services are mainly applied in:

- surgical service,
- chemotherapy departments,
- radiation oncology departments, and
- inpatient care services.

2.2.1. Surgical Service

Surgical oncology is performed in standard operating rooms, which are usually a part of the main surgical service (Department of Health [DH], 2013a). Patients come from different routes to the surgical service, some of which are emergencies that require urgent surgery (AHIA, 2016b). Therefore, surgical services should be associated with the emergency unit, imaging department, inpatient care services, and laboratory service (DH, 2004; AHIA, 2016b) (Figure 2.5.). In addition, it is important that the service be linked to obstetric care, day surgery, and a heliport/helipad (AHIA, 2016b; Canadian Standards Association [CSA], 2016). Furthermore, a biomedical engineering unit and pharmacy departments should be in close proximity to the service (DH, 2004; CSA, 2016).

To minimize the stress of the patients, relatives, and staff, the transfer of patients between these units should be quick, direct, and separate from public corridors and elevators (AHIA, 2016b). It is preferred that the sterilization unit and material management be in the same area as the surgical service regarding the connection of dirty and clean corridors or elevators (DH, 2004).

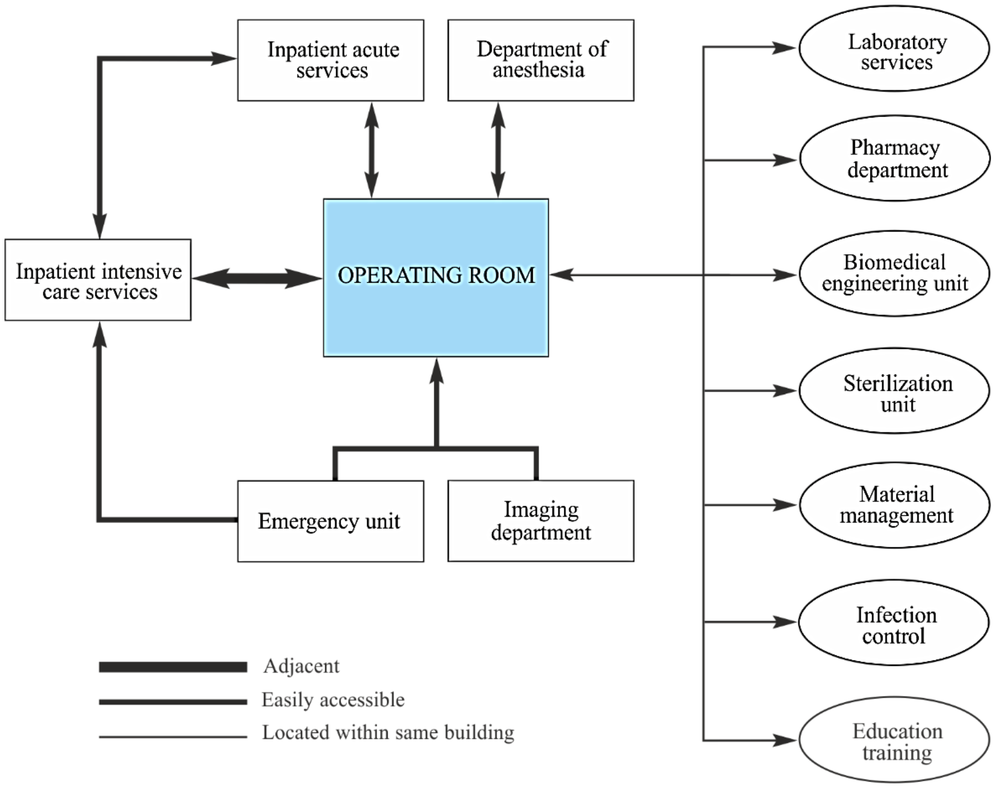


Figure 2.5. Sample diagram of surgical service and other related units (DH, 2004)

The design of the surgical service should be flexible to accommodate the daily variations in surgical caseload and enable the adoption of new technologies and healthcare models (AHIA, 2016b). The surgical service should provide specific areas in order to meet the needs of the surgery staff, the patients, and their relatives, which are mainly:

- reception and admission,
- waiting for patients and visitors,
- preoperative holding and preparation,
- induction and associated procedures,
- surgery,
- recovery holding,
- clinical support functions,

- administrative functions,
- staff offices and amenities, and
- education and research functions (DH, 2004; AHIA, 2016b; CSA, 2016; Department of Veterans Affairs [DVA], 2016b) (Figure 2.6. and Figure 2.7.).

2.2.2. Chemotherapy Department

Chemotherapy is the use of drugs to treat cancer. A typical chemotherapy treatment regimen can last for up to six months with the patient returning at frequent intervals for treatment (DH, 2013a). Procedures range from 15 minutes to 10 hours or longer, and the patient usually leaves the facility after treatment within the same day (DH, 2013a).

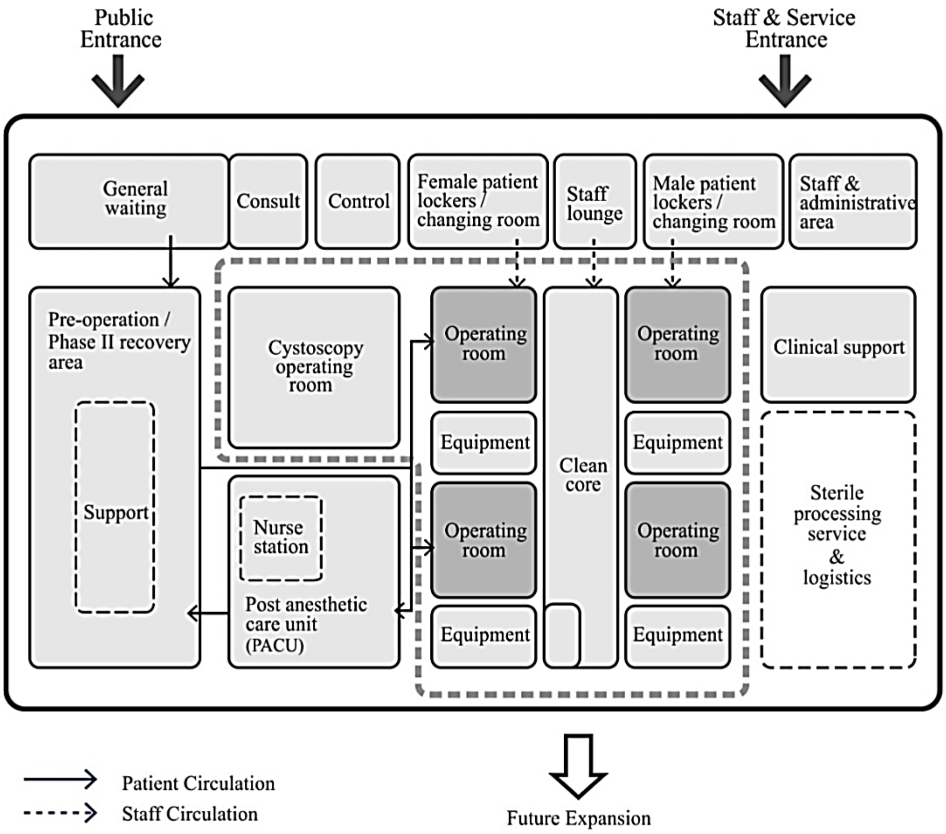


Figure 2.6. Sample functional diagram of a surgical service (DVA, 2016b)

Figure 2.7. The surgery room of Acıbadem Altunizade Hospital, İstanbul (Source: Acıbadem official website)

Therefore, the unit's location should be determined according to ease of way-finding, privacy, dignity, and accessibility for patients with disabilities and those in wheelchairs or on stretchers (DVA, 2009; AHIA, 2016c; CSA, 2016). Chemotherapy departments are thus generally located on the ground floor to enable direct access from parking areas and public transportation as much as possible due to the weakened physical and psychological conditions of cancer patients and their extended treatment over multiple visits (DVA, 2009; DH, 2013a; The Facility Guidelines Institute [FGI], 2014; AHIA, 2016c; CSA, 2016).

Although issues of patient privacy and dignity mean that chemotherapy departments are formed as stand-alone units, direct connections with particularly the pharmacy department are essential to provide direct delivery of chemotherapeutic drugs (DH, 2013a; CSA, 2016). The components of a chemotherapy unit can be listed as follows:

- entry/waiting,
- patient education/counseling rooms,
- examination modules,

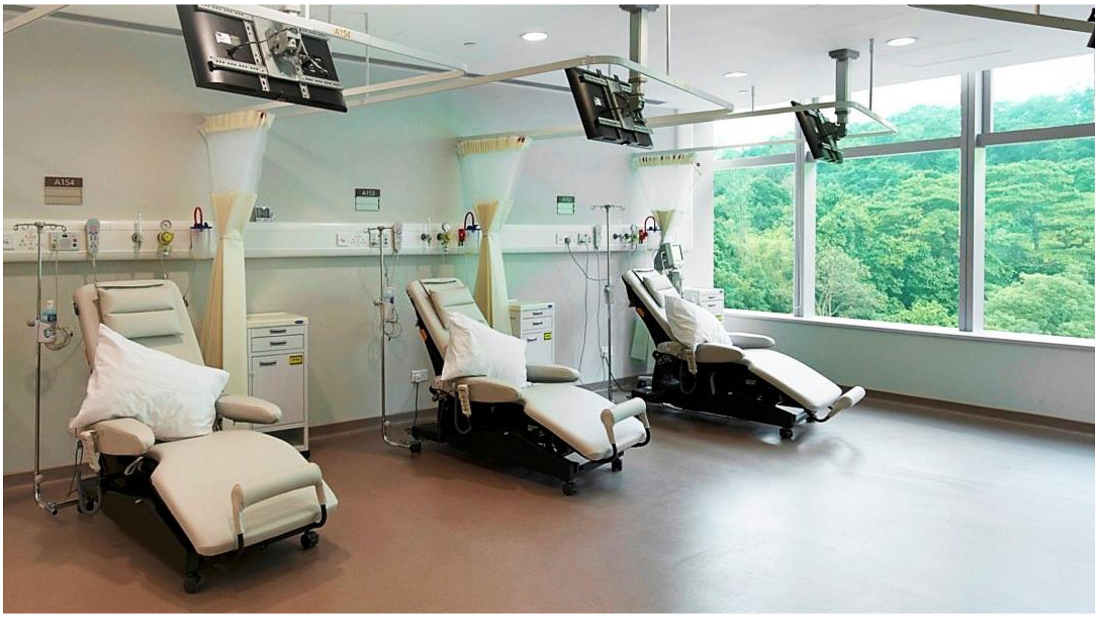


Figure 2.8. The chemotherapy arena of Gleneagles Hong Kong Hospital (Source: Gleneagles Hong Kong Hospital official website)

- chemotherapy treatment rooms,
- satellite pharmacy,
- clinical support areas, and
- offices (DVA, 2009; DH, 2013a; CSA, 2016).

2.2.3. Radiation Oncology Department

Radiotherapy is a clinical application that employs radiation to treat cancer (DVA, 2008). Two types of radiotherapy are available, which are (1) external radiotherapy and (2) internal radiotherapy (or brachytherapy) (DVA, 2008). External radiotherapy is performed by applying high-energy beams directed towards the patient by a machine source from outside the body (DH, 2013a) (Figure 2.9.). Internal radiotherapy, more commonly referred to as brachytherapy, employs the use of low-level radioactive implants (seeds) in the form of a liquid, capsule, or intravenous injection into the patient's body, inside or near the tumor (DH, 2013a; DVA, 2008).

Figure 2.9. The external radiotherapy room of Southwestern Vermont Medical Center (Source: Google Images)

The patient who receives radiotherapy is first assessed for the suitability of treatment to the patient according to medical tests and CT simulation results (AHIA, 2016c). Subsequently, the treatment plan of the patient is determined in which type of treatment, dosage, number of treatment sessions, areas to be treated are confirmed (AHIA, 2016c). Patients may attend as day case patients (outpatients) or are admitted as stay-in-hospital patients (inpatients), depending on the type of their treatment (DH, 2013a).

The radiation oncology department is located on the ground level or usually underground due to radiation shielding specifications and the ease of installation and maintenance of specialized and heavyweight equipment (AHIA, 2016c). Moreover, the location of the department should enable direct access from parking areas and public transportation to ease access for weakened patients attending their treatments over multiple visits (DVA, 2008; DH, 2013a; FGI, 2014; AHIA, 2016c; CSA, 2016). Regarding this, like the chemotherapy department, the unit's location should be determined according to ease of way-finding, privacy, dignity, and accessibility for patients with disabilities and/or wheelchairs/stretchers (DVA, 2008; AHIA, 2016c; CSA, 2016).

Although radiation oncology is generally a stand-alone unit to ensure privacy for patients and their families, it should have direct connections particularly with the medical imaging department, nuclear medicine department, surgical service, inpatient care services, and outpatient oncology clinics (DVA, 2008, 2016a; MH, 2010; DH, 2013a; FGI, 2014; AHIA, 2016c; CSA, 2016). The spatial organization of the radiation oncology department is predicated on functional zones, which are mainly:

- public areas including entry, reception, and waiting,
- patient care/treatment areas,
- clinical support areas comprising outpatient clinics, treatment planning rooms, imaging rooms, and patient holding areas, and
- staff offices and amenities (DVA, 2008, 2016a; DH, 2013a; AHIA, 2016c; CSA, 2016).

2.2.4. Inpatient Care Services

Inpatient care services, which make possible overnight stays for patients, are provided for the observation of cancer patients for treatment-related symptoms and the progress of treatment (DVA, 2011; DH, 2013b). These services could be either at acute care or intensive care level according to the patient's condition (DH, 2013b). Moreover, some brachytherapy applications require a special type of inpatient care service, involving specialized shielded bedrooms (DH, 2013a).

Generally, inpatient care services are located above or adjacent to the diagnostic and treatment units of a healthcare facility (DH, 2013b). In addition, intensive care services are prioritized to be closest to the surgical service and emergency department, whereas long-stay acute beds could be located more distantly (DH, 2013b). Being a large component of healthcare facilities, the departmental relationship of inpatient care services depends on the distance from diagnostic and treatment units, and the location and quantity of access points (DH, 2013b). Moreover, oncology inpatient services, as discrete and specialist wards, require direct access to chemotherapy and radiotherapy departments as treatment units and to nuclear medicine and radiology departments as diagnostic units (DH, 2013b).

Inpatient care services are planned as clusters of rooms (DVA; 2011; DH, 2013b; AHIA, 2016a). Each cluster has its own clinical support and staff and public areas (DVA, 2011; DH, 2013b; FGI, 2014; AHIA, 2016a; CSA, 2016). Patient rooms are generally located on the perimeter of a floor to permit natural light and views (DVA, 2011; DH, 2013b).

Figure 2.10. Inpatient care service of Anadolu Sağlık Merkezi, Gebze (Source: personal archive)

2.3. Healing Environment Concept

Healthcare buildings are considered as public space due to being interface areas in which people from all strata appear, meet with others, and interact (Torricelli, Setola & Borgianni, 2013). Therefore, they are places where new social needs emerge (Torricelli, Setola & Borgianni, 2013). In this context, it is necessary to surrender the concept of healthcare buildings as places separate from city life and accept them as self-sufficient, sustainable, and constantly evolving "civic architecture" products (Curtis, Gesler, Priebe & Francis, 2009). Although healthcare buildings are public spaces, they deliver private and intimate experiences (Høybye, 2013). The individual sense of curing is definitely not steady; it changes with a building's capacity to induce a sense of care in a homely environment and the experience of progress in treatment (Høybye, 2013). In this regard, a healthcare building is not characterized by its structure, but instead by the interrelation of practice and space (Høybye, 2013). Therefore, healthcare buildings are never complete and are under construction continuously due to their inhabitants' abovementioned relations (Ingold, 2000).

There has generally been a consensus that patients and their relatives would not focus on the architecture of their environment, because they think too much about their illness and are not aware of their surroundings (Lawson & Phiri, 2003). However, as revealed by the work of Lawson and Phiri (2003), the vast majority of patients are highly sensitive to and articulate about the architectural environment of healthcare facilities. While most hospital visitors may receive the personal attention of a physician, nurse, or therapist for only a few minutes a day, they generally spend many hours waiting in their beds or treatment areas (Lawson & Phiri, 2003). This makes them even more susceptible to the influence of the environment (Lawson & Phiri, 2003).

Cancer patients experience this situation very frequently (Martin, Nettleton, Buse, Prior & Twigg, 2015). A diagnosis of cancer is a very emotionally disturbing experience for a person and it increases the individual's awareness of his or her body

(Leder, 1990). In the treatment process, the patient feels removed from the center of everything and from his own individuality (Martin et al., 2015). Within that period, while the body of the patient is being treated, the personality of the patient disappears behind the imaging results and test reports (Martin et al., 2015). This causes the patient to be impacted by an embodied interaction with the material environment and become vulnerable to his surroundings (Keswick, 1995).

The opinion that the environment affects well-being and health was first portrayed in the time of Hippocrates (Weiss & Lonnquist, 2000). In accordance with Hippocrates, Florence Nightingale saw the source of healing inside individuals by providing them with an environment where nature itself could act upon them (Nightingale, 1859). However, those individual works did not draw a great deal of attention at the time.

In the last few decades, though, there is growing emphasis on the importance of the concept of a healing environment, which promotes the designing of healthcare environments that support individuals' health (Edvardsson, Sandman & Rasmussen, 2005; Lawson, 2010; Høybye, 2013). There is a significant amount of research focusing on the issue, generally interested in the effect of environmental elements in healthcare spaces on the well-being of inhabitants by considering different variables in the physical surroundings with reference to patient outcomes such as patient safety (Brown & Gallant, 2006), psychosocial well-being (pain reduction, stress, depression, etc.) (Beer & Higgins, 2000; Ulrich, Quan, Zimring & Joseph, 2004; Hagerman et al., 2005; Walch et al., 2005; Malenbaum, Keefe, Williams, Ulrich & Somers, 2008; Ulrich et al., 2008), and recovery (Ulrich, 1984; Beauchemin & Hays, 1998; Francis & Glanville, 2001). Moreover, there are some studies extending the comprehension of the link between environmental exposure and well-being results, in which healing is conceptualized as relief from distress and the reinstating of integrity, with the assistance of the environment and the discovery of meaning and wholeness (Egnew, 2005).

Those studies reveal that some design issues under the control of architects can lead to substantial improvement of many factors such as the quality of life, satisfaction, length and compliance of treatment, efficacy of medication, and the sleeping patterns of patients (Rogers, 1970; Watson, 1985; Lawson, 2010; Lawson & Phiri, 2003). For instance, Timmermann, Uhrenfeldt, and Birkelund (2013) explore the aesthetic relationship between the human and the physical environment and argue that the aesthetic qualities of the physical environment have an overall effect on human senses, bodies, thoughts, and emotions and therefore are important for human health.

In this regard, the physical space is under no circumstances value-neutral or silent (Edvardsson et al., 2006). Despite the fact that the meaning of being in certain physical conditions varies somewhat among staff and patients, it affects them all (Edvardsson et al., 2006). The environment reflects the value (or lack of it) of the people within it at a symbolic level (Edvardsson et al., 2006). Edvardsson et al. (2006: 195) note that:

> Even seemingly small and insignificant things like a dust ball under the bed, an empty hook where no one had bothered to hang a painting, the location of the unit, and/or a vase with wilted flowers carried symbolic meanings of caring and uncaring, shamefulness, stigma, death and dying, meanings strongly shaping the experience of providing or receiving care.

In the interview-based study of Edvardsson, Rasmussen, and Riessman (2003), it was revealed that experiences in hospital wards regarding the physical and psychosocial environment significantly affect the identity construction and care experiences of the wards' inhabitants. Whether the space is perceived as healing or horrifying, those experiences dominate the actual results of care and continue to stimulate strong feelings years after the fact (Edvardsson et al., 2003).

Hospitals are stressful environments for healthcare staff, patients, and patients' families (Martin, 2000). From a comprehensive perceptive, being in an oncology-related hospital environment makes inhabitants more sensitive to messages of caring and uncaring (Edvardsson et al., 2006). The physical surrounding encompasses and influences both care-giving activities and patients' experiences (Kerfoot & Neumann, 1992; Edvardsson et al., 2005). Therefore, the physical environment of an oncology-related space not only constitutes the place where caring takes place but also forms an integral part of the care (Edvardsson et al., 2006). That is done by affecting people in such a subtle but strong way that they may not ever be actively aware of the penetrating messages of minding and ignorance, disgrace and social value, chances to connect, and possibilities to move concentration away from themselves (Kerfoot & Neumann, 1992; Edvardsson et al., 2005, 2006).

The relief of patients' suffering is a key objective of cancer medicine (Best, Aldridge, Butow, Olver & Webster, 2015). Hence, optimal care of cancer patients includes the management of physical, social, spiritual, and psychological health and aims at alleviating suffering (Best et al., 2015). Best et al. (2015) defined spiritual suffering as an individual and environed phenomenon that is difficult for the sufferer to articulate, characterized by estrangement, triviality, and hopelessness. It is multidimensional and usually has an unwanted negative quality (Best et al., 2015). However, healthcare specialists may not be able to recognize or may refuse to recognize patient distress because of Western medicine's biopsychosocial paradigm that ignores spirituality (Rodgers & Cowles, 1997; Arman, Rehnsfeldt, Lindholm, Hamrin & Eriksson, 2004; Best et al., 2015). Patients can wait for attention that is never coming, or simply expect that the staff are too occupied to hear them, which causes a feeling of the absence of a "safe space" where sufferers can discuss their fears (Strang, 1997; Moore, Chamberlain & Khuri, 2004). Therefore, the healing experience is dynamically linked to the rehabilitation process in cancer patients, which goes beyond the active therapy course (Høybye & Tjørnhøj-Thomsen, 2014). In this regard, the sense and procedure of healing is affected not only by the interactions between patient and doctor but also the experience in healthcare environments (Høybye & Tjørnhøj-Thomsen, 2014).

Within the relevant literature on this issue, some studies have focused on the relation between organizational culture and work satisfaction. The satisfaction and treatment results of patients are influenced by staff satisfaction (Norbergh, Hellzén, Sandman & Asplund, 2002; Edvardsson et al., 2005). Moreover, a sense of community and humor between patients and staff creates a healing atmosphere in oncology-related healthcare spaces (Gates, 1991). In addition, the design of wards can affect interactions (McAllister & Silverman, 1999). For instance, the development of community among inhabitants can be enabled by a physical environment and institutional approach that promotes social interaction (McAllister & Silverman, 1999).

By looking at all the above-mentioned data, it can be concluded that designing a healthcare facility is a complex process that requires functional and psychological components to be considered together, from small spaces such as wards and treatment rooms to the wider "civic" settings in which the healthcare building is located (Gesler, Bell, Curtis, Hubbard & Francis, 2004; Aripin, 2007). In the design process, besides planning the appropriate areas for the services, the requirements imposed by the Ministry of Health within the framework of the relevant legislations must be fulfilled (Aripin, 2007). It would appear that most healthcare designers pay less attention to the psychological elements of a healing environment during the effort to comply with the explicit directives (Aripin, 2007). Moreover, modern hospitals that are designed and equipped with technology cause anxiety, depression, and stress, which, as stated in many scientific publications, affect the health of patients and staff negatively (Malkin, 1991; Schweitzer, Gilpin & Frampton, 2004).

In a time of excessive concern about increased costs of medical care, improving treatment outcomes through the efficient use of limited resources has become a cornerstone of health practices and processes (Rubin, Owens & Golden, 1998). In this context, if the environment in which the patients are treated has a significant effect on the course of their diseases, it is important to determine which factors can give more satisfactory results under what conditions (Rubin, Owens & Golden, 1998). At this point, the concept of evidence-based design comes to the forefront, which is a way of work that emphasizes credible evidence to guide design (Cama, 2009). Unfortunately, the architectural profession, which is far behind health science professions in terms of utilizing research findings, continues to work with a deficient knowledge base (Verderber, 2010). Design decisions are often based on half-educated assumptions, intuition, or copies of "what has been done before" (Verderber, 2010). However, an increasing number of designers and clients working in the field of healthcare architecture have begun to appreciate the positive outcomes that can be achieved by blending evidence-based research with their own work patterns (Verderber, 2010).

The concept of a healing environment has become the key point for architectural layouts regarding evidence-based design when healthcare facilities are being planned or constructed (Ormenisan, 2014). Studies on the issue vary in size and scope. Some of them are multi-factorial and some considerably more parametric. Some of them focus on certain factors, such as the work of Roger Ulrich showing the impact of views on post-surgery recovery rates (Ulrich, 1984). While some of them are small and limited, others present investigations that are more comprehensive.

For instance, Lawson and Phiri (2003) analyzed the healing environment concept and designed a tool called ASPECT (A Staff and Patient Environment Calibration Tool), which is widely used in the United Kingdom, Australia, Ireland, Singapore, Malaysia, and New Zealand (Lawson, 2010). According to ASPECT, the healing level of an environment in a healthcare facility should be assessed under eight main headings, which are:

- privacy, company, and dignity,
- views,
- nature and outdoors,
- comfort and control,
- legibility of place,
- interior appearance,
- facilities, and

- staff (Lawson, 2010).

In another study, Edvardsson et al. (2005) present a tentative theory offering a conceptual basis to assess healthcare facilities as being supportive care environments. Within the scope of the study, the following five categories are recognized that encourage experiences of finding oneself in a friendly and safe environment; being seen, recognized, and cared for; and being able to benefit from beauty and communicate with others:

- experiencing welcoming in the environment,
- recognizing oneself in the environment,
- creating and maintaining social relations in the environment,
- experiencing a willingness to serve in the environment, and
- experiencing safety in the environment (Edvardsson et al., 2005).

Many other studies have examined the design of healthcare facilities from patient, personnel, and family perspectives. Although the resulting conclusions of these studies are itemized under different headings, they are collected and re-combined here with respect to the subject matter and summarized below under the topics of:

- natural light and lighting design,
- access to views,
- privacy and company,
- sense of control,
- interior design, art and music,
- landscape design,
- social amenities,
- accessibility and way-finding,
- universal design, and
- entrance and waiting room design.

2.3.1. Natural Light and Lighting Design

The effect of daylight on patients is not a new discovery. In the nineteenth century, Florence Nightingale (1859) noted the need for natural light for patients with the aim of improving nursing services. After that, numerous studies have shown that daylight has an important impact on an individual's well-being, both physically and psychologically (Markus, 1967; Todd, 2007; Lawson, 2010). The dramatically powerful effect of daylight on the circadian rhythm (the 24-hour rhythm of biology) has been known for many years (Aripin, 2007). In addition, Campbell, Kripke, Gillin, and Hrubovcak (1988) indicate that light is the most significant environmental input to control body function after ingestion. Similarly, the Commission for Architecture and the Built Environment [CABE] (2004) clearly states that access to natural light is one of the critical factors affecting the healing of patients. According to various studies, viewing nature and sunlight through a window has a positive effect on the anxiety, pain, stress, and hospitalization period of patients (Ulrich, 1984; Beauchemin & Hays, 1998; Ulrich, Simons & Miles, 2003; Eceoğlu, 2010). Studies by Schweitzer et al. (2004) revealed that the presence of visible light in indoor environments affects the physiological response, attitude, and visual needs. In this respect, Morriss (2001), Evans (2003), Bower (2005), and Andritsch et al. (2013) have proved that increased length of stay and conditions of depression, pain, fatigue, and nervousness are triggered by limited exposure to sunlight.

For cancer patients, being in an oncology-related healthcare space means being forced into a territory of cancer and upcoming death, which contains fear, pain, and gradual loss of control and dignity (Edvardsson et al., 2006). Moreover, as mentioned before, the radiation oncology department is located on the ground floor or usually an underground level by virtue of the radiation shielding specifications and for easy installation and maintenance of specialized heavy equipment (AHIA, 2016c). Hence, walking the tiring stairs down to the radiotherapy room has powerful existential meaning for cancer patients, representing a mental and physical downfall or a slow approach to death (Edvardsson et al., 2006). Edvardsson et al. (2006) found that

Figure 2.11. SCCA Proton Therapy ProCure Center, USA (Source: Google Images)

radiotherapy patients use metaphors to describe those treatment units such as “the tomb”, “the catacombs”, “the underworld”, and “the waiting room of death”. Therefore, the presence of natural light would permit an opportunity to initiate different ways of thinking and shift the focus away from patients, while having positive value as an escape from the metaphor of darkness in a symbolic way (Edvardsson et al., 2006). One leukemia patient from the study of Høybye (2013:444) says that:

> I always try to get them to give me a bed by the window. It’s such a huge difference to have the light shining in and you can watch the life outside. Well, it may not be a whole lot you can see, but just the view of a treetop makes a

> world of difference to me. Last time I was in [for treatment] was this couple of pigeons in the tree outside the window. I spent hours watching them from my bed.

Natural light could offer restorative benefits to others, as well, such as medical staff and office workers (Aripin, 2007; Andritsch et al., 2013). In a study conducted by Mroczek, Mikitarian, Vieira, and Rotarius (2005), 70% of the participating medical staff state that increased natural light has a positive effect on working life. Similarly, CABE (2004) reveals that an improved physical environment has a positive effect on nurses' work performance and job retention. Additionally, healthcare personnel working in radiation oncology departments with thick concrete walls for protection against radiation and largely windowless spaces generally feel themselves to be working "in the middle of darkness" (Edvardsson et al., 2006). They can interiorize that as a strong indication of less social value within the organization (Edvardsson et al., 2006). Hence, natural light within that darkness has a refreshing effect on the mind and provides a feeling of comfort and energy for staff (Edvardsson et al., 2006).

Most of the patients are afraid of the dark, especially those who need to be treated in inpatient services (Eceoğlu, 2010). Such problems arise mainly in the evening hours, when hopes are lost and anxiety increases (Eceoğlu, 2010). Therefore, light and the shade of artificial lighting should be designed carefully and selected at appropriate values to work within the particular space (Eceoğlu, 2010). Patients can be affected by artificial lighting systems adversely (Eceoğlu, 2010). For instance, while yellow and red lights are stimuli, blue light has a relaxing effect (Eceoğlu, 2010). Moreover, the glow and fluctuations of artificial lights within short periods of time affect the nervous system of the patient, trigger headaches, and cause perception errors (Poulton, 1972).

2.3.2. Access to Views

Research into aesthetic and emotional responses to outdoor visual environments reveals that people have a strong tendency to prefer natural scenes to urban features without natural elements (Altman & Wohlwill, 1976; Ulrich, 1981; Lawson, 2010). A study conducted by Mroczek et al. (2005) found that patients who spend time in windowless rooms experience sleep disturbances, delusions, and hallucination problems more than patients staying in rooms with translucent windows. Therefore, it can be concluded that even a translucent window can form a vital link to the outside world for patients to maintain a feeling of normality (Mroczek et al., 2005).

In another study conducted by Ulrich (1984), surgical patients who saw trees from their windows had shorter hospital stays in the post-operative period, received less negative evaluations from nurses, took fewer moderate and strong doses of analgesics, and experienced fewer surgical complications compared to the patient group who saw wall-views from their rooms (Ulrich, 1984). In this context, it should be considered that the hospital window design and the view from the window can affect the emotional state of patients with limited access to outdoor environments and with little opportunity for activity while they are in the hospital, and can reduce stress and accelerate healing (Ulrich, 1984; Verdeber & Reuman, 1987; Williams, 1988; Ulrich,

Figure 2.12. Massachusetts General Hospital, USA (Source: Google Images)

1992; Biley, 1993; Horsburgh, 1995; Devlin, 2003; Leather, Beale, Santos, Watts & Lee, 2003; Edvardsson et al., 2006; Lawson, 2010). Ulrich (1981) suggests that vegetation and especially water views tend to hold attention and interest more powerfully than urban views. Altman and Wohlwill (1983) also emphasize that most natural views generate positive feelings, decrease fear, hold interest, and may diminish stressful thoughts. Lawson and Phiri (2003) further claim that the ability to see the daily patterns of life, such as watching mail carriers, school buses, or people rushing home for dinner, has a positive effect on patients and their ability to communicate with others.

As mentioned in the previous subsection, being in an oncology-related environment generates strong metaphors of fear, pain, and death for cancer patients (Edvardsson et al., 2006). However, a chance to look out of a window at natural scenery would be an opportunity to connect to the outside world, in which cancer is less of a focus (Edvardsson et al., 2006). Additionally, it has a powerful and positive sub-meaning regarding escape from the darkness of the disease (Edvardsson et al., 2006).

Window design and access to a view is a desirable feature not only for patients but also for medical staff (Lawson & Phiri, 2003). A nurse from the focus group of Lawson and Phiri's (2003) study stated, "You know that if you sit in front of a view for a long time watching the clouds you forget what you've been worrying about and you think of other things, and you know that that's doing you good". Moreover, working in oncological departments generally has negative psychological effects on staff due to the existential meaning of cancer (Edvardsson et al., 2006). Therefore, seeing natural elements such as birds or clouds moving outside the window can give staff a moment of comfort and refreshment (Edvardsson et al., 2006).

2.3.3. Privacy and Company

Today's standard of healthcare requires more private and family-friendly spaces with ensured security (Wignall, 2007). Patients are highly vulnerable in terms of privacy, since they try to maintain their daily habits as much as possible during the hospitalization period (Lawson & Phiri, 2003). That is even more pronounced in patients confined to bed or with limited response capability (Aripin, 2007). On the other hand, relations with fellow patients could allay social isolation and contribute to a comforting atmosphere (Edvardsson et al., 2005; Høybye, 2013).

Patients generally spend their time in their rooms at the hospital, receiving intravenous treatments of chemotherapy or other drugs (Edvardsson et al., 2005; Høybye, 2013). Those inpatient care services could be designed as single-bedded, double-bedded, or multi-bedded. Although public and private spaces are not clearly separated within a healthcare building, the patient's bedroom is where negotiations on personal space are continuous (Høybye, 2013). Studies show that single-bedded rooms are more preferable than double- or multi-bedded rooms (Ulrich et al., 2008; Andritsch et al., 2013). For instance, the study conducted by Press Ganey was based on the satisfaction data of 2,122,439 patients who received inpatient care during 2003 in 1,462 healthcare facilities (Andritsch et al., 2013). According to that study, increased privacy satisfaction is obvious in single-bedded rooms across all major categories and types of medical units and different groups of age and gender (Andritsch et al., 2013).

Figure 2.13. Merrifield Center, USA (Source: Google Images)

Single-bedded rooms are in demand due to the possible noise problems and commotion caused by a fellow patient, and due to the awareness of the possible negative effects of another patient's suffering (Høybye, 2013).

However, multi-bedded patient rooms have the potential for social recognition and the filling of abundant idle time (Høybye, 2013). Patients and relatives may come into contact with others and form intimate bonds through the sharing of knowledge and similar experiences (Edvardsson et al., 2005). One female patient from the study of Edvardsson et al. (2005:349) who shared a room with three other women made the following observation:

> Being here you meet a lot of other people in similar circumstances, and that takes your mind off things. (…) just imagine if I was in this room all alone, then I could spend the whole day lying here feeling sorry for myself.

The key design goal in this regard is to create healthcare spaces with flexible possibilities for inhabitants to be alone or with others, which means to enable them to control their privacy level (Lawson, 2010; Høybye, 2013). Accordingly, a combination of single- and multi-bedded rooms may endorse a balance between patients seeking privacy and enjoying company (Edvardsson et al., 2005; Høybye, 2013). Moreover, the addition of comfortable chairs and sofas to single-bedded rooms can promote interactions among staff, relatives, and patients from other rooms, thus supporting the maintenance of social relations in the healthcare environment (Edvardsson et al., 2005). Although some patients are more sensitive about their privacy, the experience of hospital life is not constant. Rather, it fluctuates over time (Spichiger, 2009).

Waiting areas are also important healthcare facility spaces in terms of privacy. Although waiting areas are generally designed to provide seating for as many people as possible, privacy within those spaces is highly necessary and desired (Edvardsson et al., 2006; Lawson, 2010). A balance between being involved and finding privacy should be maintained within the environment (Edvardsson et al., 2006). In this regard, a waiting area having various groups of places to sit provides the freedom to choose to be involved with fellow patients or to be alone with oneself or other family members, away from the pain and suffering of others (Edvardsson et al., 2006).

Privacy and personal space issues are also essential for hospital staff (Douglas & Douglas, 2005; Edvardsson et al., 2005; Wignall, 2007). Working and resting rooms should be provided for all of the personnel in quiet areas away from patient-care zones (Wignall, 2007). Douglas and Douglas (2005) also note the importance of a sense of independence for all types of hospital users, including the staff.

2.3.4. Sense of Control

In the literature, the relationship between satisfaction and a sense of personal control over the physical environment is underlined (Lee & Brand, 2005; Cole, Robinson, Brown & O'Shea, 2008; Hauge, Thomsen & Berker, 2010; Trill, 2012). According to Høybye (2013), becoming a patient means loss of control for every individual at different levels, sustained by the environment in ways such as compulsory hospital clothing, bed linens, phlebotomization (the taking of blood), or limited personal space. It seems that control over basic day-to-day actions such as opening a window, switching lights on and off, adjusting the air conditioning, or making a cup of tea enhances the patient's comfort and reduces anxiety and stress (Andritsch et al., 2013; Douglas & Douglas, 2005; Lawson, 2010; Yundt, 2009). Moreover, providing patients and visitors with both enough space to wander around and access to external areas is especially valued for promoting a sense of normality (Douglas & Douglas, 2005).

Giving patients the opportunity of bringing some personal items such as photos of their family, house, or garden and drawings or poems, and providing appropriate space for them within their immediate surroundings, also has a strong positive effect (Høybye, 2013). Such personal items help to reconcile the standardized and cold environment of the hospital with a sense of homeliness and control for the patient (Høybye, 2013).

2.3.5. Interior Design, Art and Music

The physical environments of healthcare buildings can deliver various messages. It has been demonstrated that guests in a waiting area of a hospital decorated with scenic pictures, plants, and comfortable seats evaluate the medical practice to be of higher quality than those who wait in a similar lounge area without decorations (Ingham & Spencer, 1997; Edvardsson et al., 2006; Lawson, 2010). Additionally, environments that are carelessly arranged and inadequately decorated can give a negative message of value and suggest a lack of caring to the space's occupants (Edvardsson et al., 2006).

The design of interior and transitional spaces in healthcare facilities should be planned to meet the needs of staff, patients, and relatives (Douglas & Douglas, 2005). Poor indoor designs in health settings in terms of color and decoration have been associated with adverse health effects such as increased anxiety, the need for analgesic drugs, insomnia, and higher delirium rates (Baldwin, 1985; Douglas & Douglas, 2005). Moreover, it has been shown in studies that natural and home-like physical environments can alleviate psychological stress and have a positive effect on patients' healing and well-being (Alvermann, 1979; Martin, Hunt & Conrad, 1990; Ulrich, 1991; Nesmith, 1995; Leather et al., 2003; Edvardsson et al., 2005; Edvardsson et al., 2006; Lawson, 2010). The presence of medical equipment is associated with unpleasant feelings and patients prefer daily objects that help them to locate themselves in that environment (Radley & Taylor, 2003; Edvardsson et al., 2005). Thus, even though the presence of medical necessities such as white uniforms and blood pressure gauges has been seen as a requirement to provide safety and care, familiar objects are appreciated in acute care settings (Edvardsson et al., 2005).

Objects in the environment that attract attention and initiate thinking can facilitate shifting the focus from one's self towards the environment for shorter or longer periods of time (Edvardsson et al., 2006; Lawson, 2010). While such objects mean a break from a challenging working environment for staff, for patients they imply

Figure 2.14. Children’s Hospital of Philadelphia, USA (Source: Google Images)

getting away from the universe of disease and encountering an association with the outside world (Edvardsson et al., 2006). These observations reinforce Ulrich’s (1992) findings that “positive distractions” help patients to feel a sense of comfort and diminish worrisome thoughts.

Lawson and Phiri (2003) state that hospital users demand diversity in lighting, color, and materials. In particular, materials that trigger interactive tactile sensations are desirable (Lawson and Phiri, 2003). However, it is necessary to make sure that the textural surfaces of the walls, flooring, and other fittings are not too rough or too bright (Eceoğlu, 2010). Rough surfaces may cause dizziness due to optical illusions, and very bright and smooth surfaces may cause nausea (Eceoğlu, 2010). Textures can be used correctly if they adapt to the environment. Therefore, different kinds of textures used for stairs, door surfaces, flooring, lighting fixtures, and other construction elements should be in harmony with each other (Eceoğlu, 2010).

Colors emphasize specific moods and behavioral responses to health and disease (Andritsch et al., 2013). All colors affect the organs and metabolism physiologically with their associated qualities (Table 2.4.). For instance, while blue indicates coolness, red suggests warmth, excitement, passion, and aggression (Andritsch et al., 2013). For this reason, choosing colors in hospitals is an important issue (Eceoğlu, 2010). The duration of hospitalization should be taken into consideration when making the selection (Eceoğlu, 2010). According to study results, patients who stayed in the hospital for a short time preferred short-wavelength colors such as red and yellow, while long-term hospital patients preferred colder colors such as blue and green (Eceoğlu, 2010). Moreover, using light and matte colors instead of strong or bright colors on the walls helps reduce the clinical and “cold” feelings that patients have about their rooms (Lawson & Phiri, 2003; Timmermann et al., 2013). Therefore, the

Table 2.4. *Colors and their psychological effects (Johnson, 2005; Eceoğlu, 2010)*

Color	**Psychological effects**
Black	Color of power and authority. Absorbs light and dims a space, usually making the space less desirable to occupy.
White	Reflects light and makes a space brighter and, usually, more pleasurable to be in.
Red	Emotionally most intense color. Tends to cause a faster heartbeat and breathing. If it is used too much, it causes irritability and aggression.
Blue	Opposite of red, it causes the body to produce relaxing chemicals. However, unnecessary and unlimited use may cause melancholia.
Green	Most popular color in decorating because it is the most calming and refreshing and can even improve eye health.
Yellow	Although a cheerful color, it is common for it to make people lose their temper. It tends to increase metabolism.
Orange	Stimulating color. It is more convenient to use in areas that need to draw attention. Excessive use will cause distress and discomfort.
Purple	Purple connotes luxury, wealth, and sophistication. It has a calming and soothing effect. However, because it is rare in nature, purple can appear artificial.
Brown	Brown is the color of nature. It symbolizes strength and genuineness. If not used in combination with other colors, it causes tiredness.

combination of colors selected in terms of medical practice within the space can be used to create healing surfaces in healthcare buildings (Andritsch et al., 2013).

The music and art present in treatment areas have a positive effect on physiological and psychological changes in clinical outcomes, such as reducing the consumption of medication, shortening the length of stay in the hospital, improving the job satisfaction, encouraging better doctor-patient relationships, and promoting empathy towards gender and cultural diversity (Ulrich 1992, Staricoff, Duncan & Wright, 2001; Leather et al., 2003; Staricoff, 2004). Treatment of mental illnesses with music has been a subject for thousands of years, described in many history books (Eceoğlu, 2010). In ancient civilizations such as Rome, China, and Egypt, music was used to cure various diseases (Eceoğlu, 2010). Today, classical music is applied as a treatment in many European countries and especially in the USA, and it shows successful results (Eceoğlu, 2010).

Staricoff et al. (2001) used visual art and live or recorded music during chemotherapy treatments that caused high anxiety and stress, and they state that this practice was effective in reducing both anxiety and depression and that it acted strongly to prevent side effects of treatment. Similarly, another study conducted by Staricoff and Loppert (2003) measured psychosocial indicators of patients regarding art interventions and found that anxiety and depression were respectively 20% and 34% lower in the experimental group exposed to art. According to various studies, the benefits of art include enhanced care experiences, reduced vandalism and aggression, feelings of greater dignity among patients, promotion of a sense of identity, and enhancement in staff morale and motivation (Daykin, Byrne, Soteriou & O'Connor, 2008).

On the other hand, a study conducted by Ulrich (1991) concluded that although there is a common belief that all kinds of paintings function as positive distractions for patients, abstract pictures and prints had negative effects on hospital patients. This study shows that while nature images have a positive effect on patients, images that are unclear or abstract result in complaints to hospital staff, aggressiveness in patients, and even some physical attacks such as tearing the wall paintings (Ulrich, 1991). During the fifteen-year study of Ulrich (1991), seven paintings and prints were physically assaulted and five of them were attacked more than once. Those attacked artworks all had similar qualities such as vague content, abstract elements, and chaotic, complex schemes of contrasting colors (Ulrich, 1991).

According to these reported studies, it can be concluded that the appropriate physical environment for hospital design provides better physical, mental, and psychological health outcomes for patients, staff, and visitors (Horsburgh, 1995; Jones, 2002; Lawson, 2002). While the perfect care surroundings for oncology cannot be universally defined, the subjective needs of patients and their families can be estimated by observing them (Andritsch et al., 2013). The healing process is enhanced by a gentle, unobstructed, and calming environment, with all of the vitality that comes from living colors, forms, and artistic designs (Andritsch et al., 2013).

2.3.6. Landscape Design

Researchers working in the discipline of landscape design and architecture emphasize that people are very sensitive to the environmental information they receive (Douglas & Douglas, 2005). Therefore, the landscape design of healthcare facilities needs to be carefully considered in terms of the users' views of nature and access to the natural environment (Douglas & Douglas, 2005; Aripin, 2006).

The benefits of integration with nature have been a subject of study for thousands of years (Francis & Hester, 1990; Lawson, 2010; Anthopoulus & Georgi, 2011). Healthcare buildings that incorporate gardens into their designs provide areas for physical therapy, individual or group counseling, exercise, sitting, walking, listening, and observation (Marcus & Barnes, 1995; Grassi et al., 2005). In general, the landscape design of a healthcare facility aims to achieve some common goals for its users: to alleviate physical symptoms and distract patients; to increase comfort and the ability to cope with current living conditions; and to make patients feel better in general and in a mental sense (Hartig, Mang & Evans, 1991; Ulrich & Parsons, 1992;

Marcus & Barnes, 1995; Rodiek, 2002; Söderback, Söderström & Schalander, 2004; Cama, 2009).

According to the studies of Ulrich (1999), a sense of control reduces stress, increases the ability to cope with stress, and improves overall well-being. In this regard, landscape design may allow patients to determine what to do. For example, a patient may prefer a sunny or a shadowed area to sit or walk in. Similarly, a patient may want to look at the others around her, or she may prefer to read a book in an isolated environment. Moreover, gardens can enhance the feeling of control by providing a sensation of temporary escape (Ulrich, 1999). A temporary escape means that a person's mind can move away from the present with a certain level of privacy (Ulrich, 1999). Thus, a well-designed garden could affect health outcomes by providing options for personal preferences (Marcus & Barnes, 1995; Ulrich, 1999).

Figure 2.15. New Parkland Hospital, USA (Source: Google Images)

Landscape design also aims to increase social and emotional support, which has positive effects on decreasing stress and minimizing harmful effects on health (Grassi et al., 2005). Ulrich's research (1999) shows that there is a positive relationship between a person's health status and number of social connections. When a person in the hospital actively participates in a group activity, he may forget his troubles for a short time, escaping from stress and loneliness. Moreover, a person in a group activity is well-behaved, exhibits a more promising attitude, and has a sense of belonging (Spiegel et al., 1989; Ulrich, 1999; Grassi et al., 2005).

Additionally, the landscape design of a healthcare building can encourage exercise by motivating patients to move outside, which is already an active movement in itself (Ulrich, 1991). Gardens can also encourage additional exercise by providing gardening opportunities or walking tours that allow for movement (Ulrich, 1991). Exposure to natural landscapes and greenery as a positive distraction further helps to reduce stress hormones and blood pressure (Ulrich, 1991; Marcus & Barnes, 1995; Edvardsson et al., 2005; Daykin et al., 2008; Andritsch et al., 2013). In a hospital environment, positive distractions can take the form of music, artwork, animals, water sounds and images, or sound and images of natural elements. While others may stimulate only one or two senses, natural elements appeal to all sensory organs (Marcus & Barnes, 1995; Ulrich, 1991).

In efforts to provide suitable amenities to patients, it is usually overlooked that the facility is also a working environment (Chand, 2002). However, the need to give "breakout" spaces for focused and exhausted staff is evident. Courtyards and landscape areas should be included in the early briefs of the design process as therapeutic areas for both formal and casual interactions among patients, families, staff, and visitors (Chand, 2002). Eceoğlu (2010) states that hospitals should have green areas at least equal to the footprint of the building itself in order to provide a better presentation from the perceptual point of view and to meet the needs properly.

Figure 2.16. Fiona Stanley Hospital, Australia (Source: Google Images)

2.3.7. Social Amenities

Healthcare facilities as public areas need to provide supportive, flexible, and social spaces for all (Douglas & Douglas, 2005). It has been shown that, for patients, relatives, and staff alike, taking part in interesting activities or conversations can lead to experiences whereby people can escape their own situations and divert their minds for a while, adding meaning to the day and a desire for tomorrow (Edvardsson et al., 2005). This is similar to what Ulrich calls “positive distractions,” with which patients can feel comfortable in an environment that enables individuals to pursue their personal interests and hobbies, thereby supporting a feeling of control (Edvardsson et al., 2005). In that regard, the possibility of maintaining and creating social relations is essential (Edvardsson et al., 2005). In a healthcare facility, maintaining social relations represents a person’s ability to stay in touch with family, friends, and other visitors (Edvardsson et al., 2005), whereas creating social relations means making contact with others and being able to talk to somebody, as well as to build personal ties through sharing time and experiences (Edvardsson et al., 2005).

In recent years, the role of family members has changed from being concerned bystanders to being members of the healthcare team (Andritsch et al., 2013). Family members are now participating in the healing process completely. Studies indicate that the participation of the family in the care of patient improves and speeds recovery (Andritsch et al., 2013; Epstein-Lubow et al., 2014; Miller et al., 2016). Moreover, the presence of family members in a patient’s space was found to decrease patient falls, reduce patient anxiety, enhance intimacy and confidentiality, improve patient and family contact, and promote patient satisfaction (Cardon, 2009; Wolff & Roter, 2011; Andritsch et al., 2013).

The structure of patients’ rooms is beginning to reflect this shift in the role of the family (Herman-Miller Healthcare, 2010). Nowadays, hospitals not only provide one or more family members with a comfortable room to stay in, but also lockable storage and an area for doing paperwork or computer work (Herman-Miller Healthcare, 2010).

As discussed earlier, the key design goal here is to create healthcare spaces with flexible possibilities for patients to be alone or with others, which means to empower them to control their own privacy levels (Lawson, 2010; Høybye, 2013). However, in terms of relatives, it is important to provide appropriate space with tables and comfortable chairs to spend time with the patients and meet, sit, and talk with others (Ulrich, 1992; McAllister & Silverman, 1999; Edvardsson et al., 2006). Those spaces should be designed to create a familiar environment where people are able to read newspapers and watch television, maybe with offerings of light snacks or coffee (Edvardsson et al., 2005).

In summary, it is important for patients and their families to feel normal in healthcare settings and to perform daily activities such as eating, drinking, and communicating with others in a social environment (Douglas & Douglas, 2005; Schreuder et al., 2015). From that point of view, it is necessary to plan facilities that offer social and

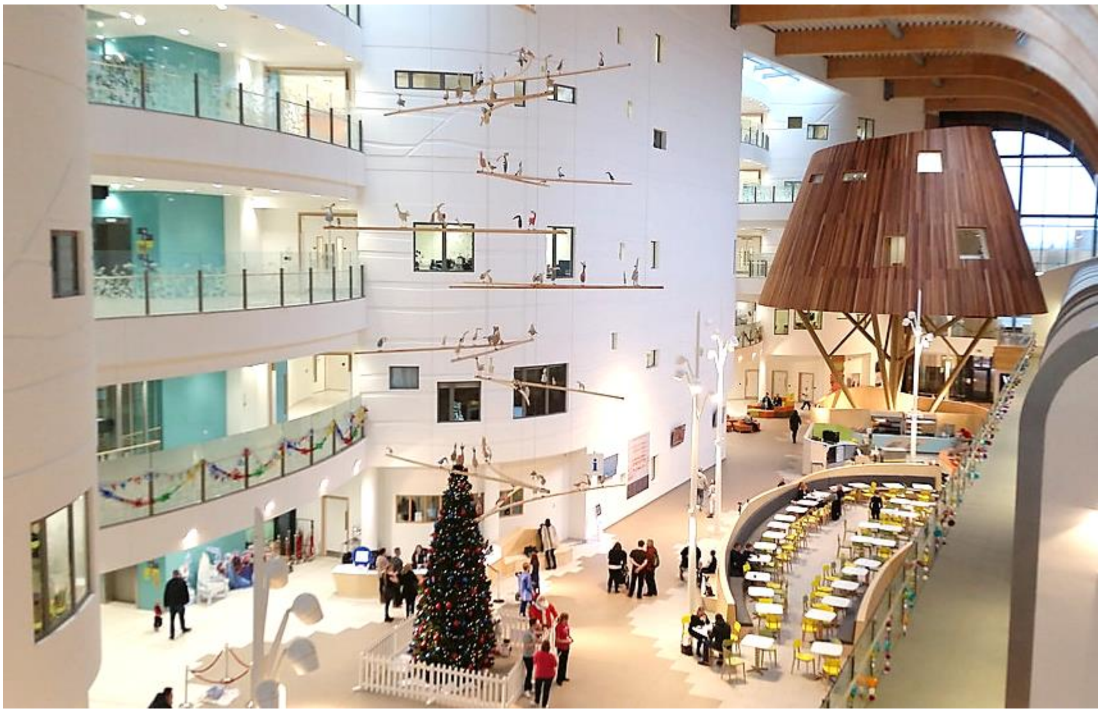


Figure 2.17. Alder Hey Hospital, United Kingdom (Source: Google Images)

personal services such as shops, entertainment and recreation areas, indoor and outdoor children's playgrounds, accommodations for visitors, and a hairdresser for short recovery periods and a healthy working environment (Douglas & Douglas, 2005; Wignall, 2007; Schreuder et al., 2015). Some oncology wards are designed to support social associations, while others are intended to promote silence and reflection (Andritsch et al., 2013). A legitimately planned healing environment should create an integrative and harmonious equilibrium between those two extremes for patients and relatives throughout their long journey of caring (Andritsch et al., 2013).

2.3.8. Accessibility and Way-Finding

It is very important for patients to know where they are while they are in the hospital. People move according to their own mental maps, and confusing spaces prevent them from using or creating those maps and increase their stress levels (Lawson, 2010). In the study of Douglas and Douglas (2005), most patients were reported to experience

Figure 2.18. Queensland Children's Hospital, Australia (Source: Google Images)

confusion and difficulty in their hospital experiences. This finding supports the studies of Schreuder et al. (2015), Lam (1977), Gordon (1989), Kaplan and Kaplan (1989), Douglas and Douglas (2004), Wignall (2007), and Lawson (2010) on the biological needs of individuals regarding orientation, visual perception, and definition of a region. Lawson (2010) states that healthcare facilities should be designed with legibility, where there is a certain hierarchy of space, public and private places are clearly distinguished, entrances and exits are obvious, and different parts of the building have different qualities. Furthermore, Aripin (2006) emphasizes that long circulations throughout hospitals should be avoided in order to ensure the effective work of the medical staff.

2.3.9. Universal Design

The design of hospital settings is an area in which patients' needs and preferences play an important role in the quality of healthcare (Lawson, 2010). Therefore, healthcare designers should consider the fact that patients, relatives, and staff could have very different characteristics in terms of age, gender, height, weight, mobility level, perception level, and cultural background, and they should be respectful and aware of these preferences, needs, and individual values (Ullán, Belver, Serrano, Delgado & Badia, 2012).

On this issue, the studies of Devlin and Arneill (2003) and Dijkstra, Pieterse, and Pruyn (2006) addressed the preferences and needs of adult patients with different characteristics, while those addressing the diverse needs of children include the works of Boswell, Finlay, Jones, and Hill (2000); Eisen, Ulrich, Shepley, Varni, and Sherman (2008); and Rollins (2009).

However, there is limited research on the preferences and needs of adolescent patients (Jedeloo, van Staa, Latour & van Exel, 2010). For example, Coad and Coad (2008) found in their studies of adolescent and childhood color and thematic preferences that adolescents preferred colors associated with children's designs but were disturbed by childhood symbols such as toy bears or balloons.

Figure 2.19. Acıbadem Altunizade Hastanesi, İstanbul (Source: Google Images)

2.3.10. Entrance and Waiting Room Design

The entrance areas of healthcare facilities are the cores of the buildings (Eceoğlu, 2010). Their importance is due to the need for providing a good relationship with the environment, meeting the diverse needs of occupants, and supporting patients psychologically and physiologically (Eceoğlu, 2010). After all, while the time that patients spend talking about their conditions with doctors is limited, they spend considerable time outside of the main diagnostic or treatment spaces, such as in waiting rooms (Hesse, Beckjord, Rutten, Fagerlin & Cameron, 2015).

For cancer patients, as mentioned before, being in an oncology-related space implies being constrained into an area of disease and death, rife with symbolism of fear and pain (Edvardsson et al., 2006). Moreover, although chemotherapy units are closer to the entrances and thus easier to find, radiotherapy sessions generally require walking through long corridors and down stairs to units in the basement of the building, which may hold powerfully negative meaning for patients, representing a mental and physical downfall (Edvardsson et al., 2006). Furthermore, in that walk to the unit, patients often feel insecure and concerned about whether they are in the right place at the right time (Edvardsson et al., 2006). Therefore, finding an individual behind a reception desk and being met, seen, and informed would be welcoming and would promote positive messages about involvement and safety (Edvardsson et al., 2006). For staff, meanwhile, a reception desk at which patients can ask their questions and be informed properly helps to maintain privacy for treatment applications due to fewer interruptions by other patients asking for directions or entering the occupied therapy space unnecessarily (Edvardsson et al., 2006).

Despite the need of being met, seen, and informed, privacy is also highly necessary and desired for patients and their relatives (Edvardsson et al., 2006; Lawson, 2010). In this regard, a waiting environment with various groups of places to sit provides the freedom to choose to be involved with fellow patients or to be alone with oneself and/or family members, removed from the pain and suffering of other patients (Edvardsson et al., 2006).

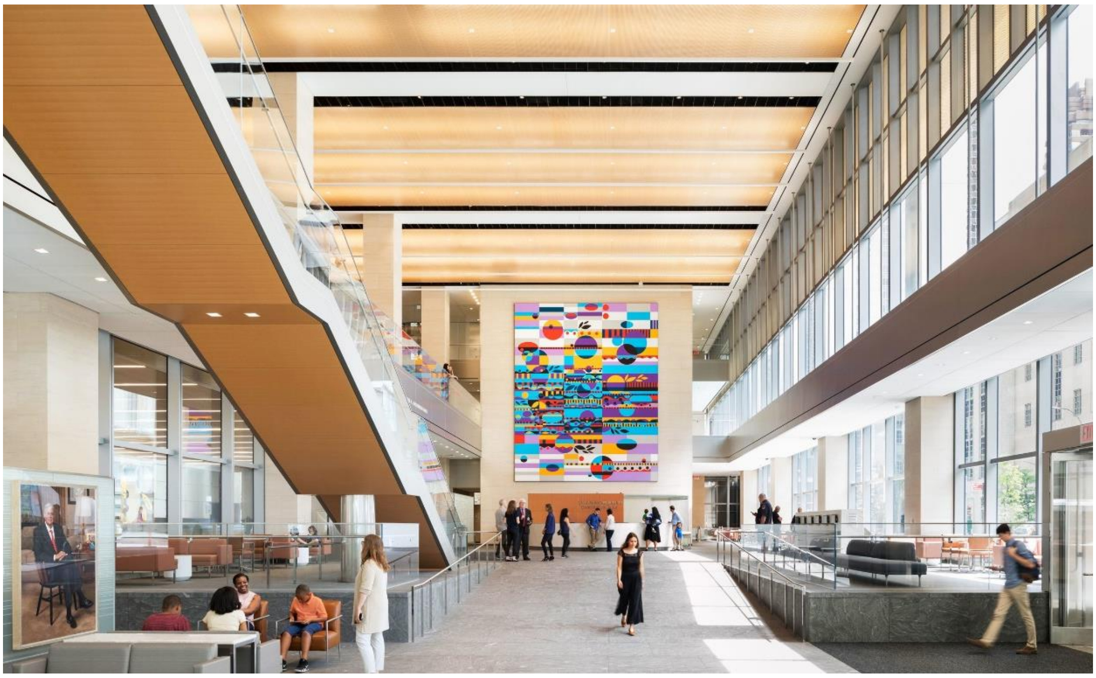


Figure 2.20. New York Presbyterian Hospital, USA (Source: Google Images)

Jencks (1995) states that healthcare buildings are generally not patient-friendly, with overhead and sometimes neon lighting, viewless interior spaces, and poor seating arrangements, which all lead to severe mental and physical stress. She further notes the following (Jencks, 1995:21):

> Waiting time could be used positively. Sitting in a pleasant, but by no means expensive room, with thoughtful lighting, a view out to trees, birds and sky, and chairs and sofas arranged in various groupings could be an opportunity for patients to relax and talk, away from home cares. An old-fashioned ladies' room – *not* a partitioned toilet in a row – with its own hand basin and a proper door in a door frame – supplies privacy for crying, water for washing the face, and a mirror for getting ready to deal with the world outside again. There could be a tea and coffee machine for while you're waiting, and a small cancer library, for those who want to learn more about their disease. More ambitiously there could be a TV with a small library of cancer-informing tapes and, to cheer you up, a video laughter library, as well as backup and other leaflets, for those who want to learn more about their disease.

The inferences related to this subject matter from the study of Eceoğlu (2010) can be listed as follows:

- Continuity should be provided between the entrance space and the landscape arrangement of the buildings. At the entrances, a spacious effect should be provided for the user with the connection between the interior and exterior. The slope of any ramp should be designed up to five percent considering stretcher/wheelchair users and elderly people. The connection of the hospital entrance spaces with the external environment should be provided with large windows that maximize natural light within the space.
- In entrances, security desks should be established and patients should be directed to reception sections. In addition, directional plates or similar visual aids should be employed to support orientation. An office should be designed

at the back of the registration desk for financial work and for people who want to speak with any authorized person privately.

- Important design considerations include easy access to the registration desk in the entrance section; positioning of signposts at a comfortable eye-level height; location of service/patient elevators, stairs, and restrooms at visible points; and appropriate spans between these items to allow for comfortable movement.
- Green and brown tones should be used in entrance spaces to prevent tension or accelerated pulse rates. In order to draw attention, however, vivid, prominent colors may be used on guidance and information boards, for other navigation equipment, and for emergency signs and equipment.
- Seating elements should be designed comfortably in the waiting area. The interpersonal distance should be well adjusted and transition areas should be comfortable. The waiting area should be established according to the hospital's capacity; the entrance section must be capable of accommodating one-fifth of the hospital's capacity.
- The connection point of the diagnosis and treatment units with the entrance space should be easily accessible and understandable. In these sections, patients or other users should be able to find the unit that they need to reach without asking.
- Elevation differences should not be used, considering the comfort of patients and other users.
- Patients and other users should be able to access and use a cafeteria. The cafeteria should ideally be connected to the entrance via a corridor.

CHAPTER 3

MATERIAL AND METHOD

3.1. Material

In this study, to evaluate the architectural design of cancer treatment services, the standards or guidelines of five countries are used, which are Australia, Canada, the United Kingdom, the United States, and Turkey (Figure 3.1.). The criteria for the selection of the legislation of these countries, excluding Turkey, are as follows.

In the literature, data related to the number of cancer treatment applications are not available. However, the countries selected here rank near the top in their shares of population with cancer worldwide (Institute for Health Metrics and Evaluation, 2017) (Figure 3.2.). This may be interpreted as intensive treatment applications for cancer in these countries.

In addition, to determine the leading countries in healthcare architecture, the last three years' results for the AIA / AAH Healthcare Design Awards and the European Healthcare Design Awards, which are major competitions in hospital architecture at the global level, have been analyzed. It was observed that Australia, Canada, the United Kingdom and the United States are the leading countries in these competitions, selected in the light of functional, aesthetic, civic, urban, social, and sustainability concerns (Tables 3.1. and 3.2.).

As stated in the literature survey in Section 2.2., cancer treatment services are mainly applied in:

- chemotherapy departments,
- radiation oncology departments,
- inpatient care services, and
- surgical services.

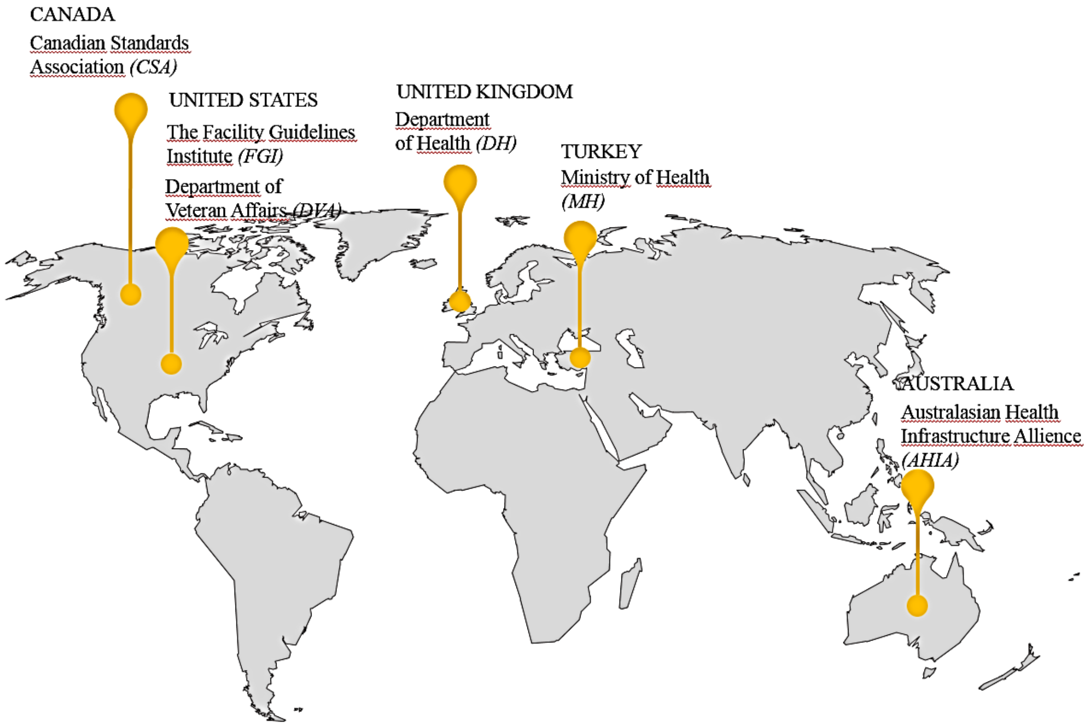


Figure 3.1. Countries and legislations used in the study

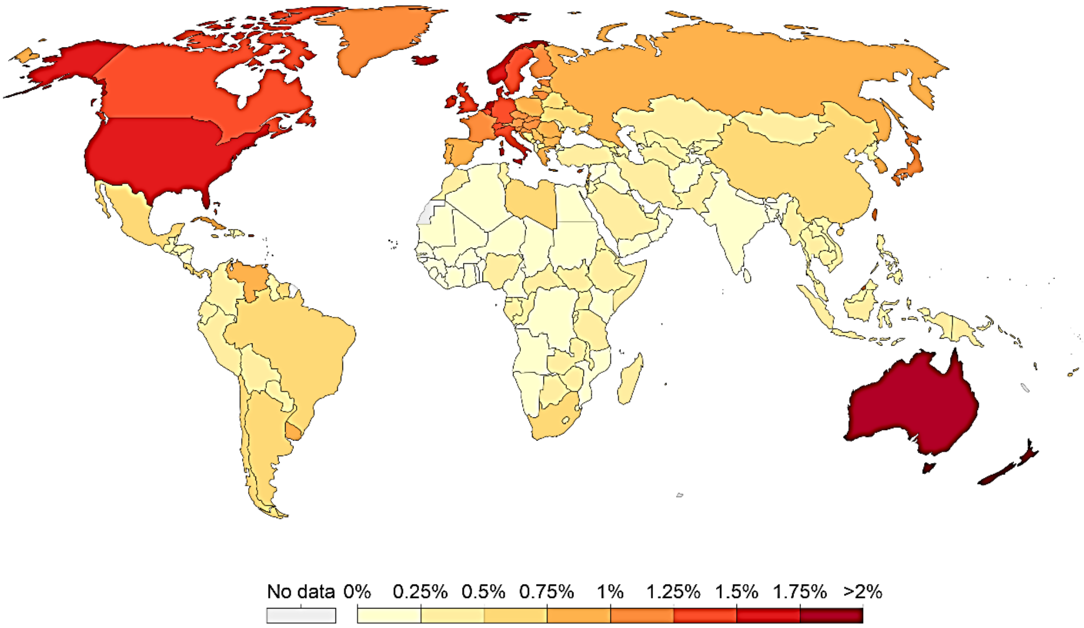


Figure 3.2. Percentage of population with cancer, 2016 (Institute for Health Metrics and Evaluation, 2017)

Table 3.1. *AIA/AAH Healthcare Design Awards winners, 2016-2018 (AIA, 2018)*

	Project	**Country**	**Year**
1	Story County Medical Center Outpatient Unit Expansion, INVISION Architecture	United States	2018
2	Maggie’s Centre Barts, Steven Holl Architects and JM Architects	United Kingdom	2018
3	Lucile Packard Children's Hospital Stanford, Perkins+Will and HGA Architects and Planners	United States	2018
4	Memorial Sloan Kettering Monmouth, Perkins+Will	United States	2018
5	Cedars Sinai Advanced Health Sciences Pavilion, HOK	United States	2018
6	Cedars-Sinai, Playa Vista Physician Office & Urgent Care, ZGF Architects LLP	United States	2018
7	Eastside Health Clinic, Ankrom Moisan Architects	United States	2018
8	Harvey Pediatric Clinic, Marlon Blackwell Architects	United States	2017
9	Neighborcare Health, Meridian Center for Health, NBBJ	United States	2017
10	Mercy Virtual Care Center, Forum Studio	United States	2017
11	UC San Diego Jacobs Medical Center, CannonDesign	United States	2017
12	Advocate Lutheran General Hospital Cardiac Catheterization Suite, Philips Design and Anderson Mikos Architects	United States	2017
13	Bayshore Dental, Johnsen Schmaling Architects	United States	2017
14	Ambulatory Surgical Facility, Kliment Halsband Architects	Uganda	2017
15	Kaiser Permanente, Kraemer Radiation Oncology Center, Yazdani Studio of Cannon Design	United States	2016
16	Planned Parenthood Queens: Diane L. Max Health Center, Stepehn Yablon Architecture	United States	2016
17	Memorial Sloan Kettering Regional Ambulatory Cancer Center, EwingCole	United States	2016
18	The Christ Hospital Joint and Spine Center, Skidmore, Owings & Merrill LLP	United States	2016
19	The University of Arizona Cancer Center (UACC) at Dignity Health St. Joseph’s Hospital and Medical Center, ZGF Architects LLP	United States	2016
20	University Medical Center New Orleans, NBBJ/Blitch Knevel	United States	2016
21	Seattle Children's Hospital, South Clinic, ZGF Architects LLP	United States	2016

Table 3.2. *European Healthcare Design Awards winners, 2016-2018 (European Healthcare Design, 2018)*

	Project	**Country**	**Year**
1	Joseph and Rosalie Segal Family Health Centre, Parkin Architects	Canada	2018
2	Omagh Hospital and Primary Care Complex, Todd Architects	United Kingdom	2018
3	University of Iowa Stead Family Children’s Hospital, CBRE | Heery	United States	2018
4	Kachumbala Health Centre 3, Maternity Unit, HKS Architects	Uganda	2018
5	St Andrew’s Hospital, Eastern Clinical Development, Wiltshire + Swain Architects	Australia	2018
6	Waterfall House, Birmingham Children’s Hospital, BDP	United Kingdom	2018
7	Brunel Building, Southmead Hospital, BDP	United Kingdom	2017
8	Brigham and Women’s Hospital Building for Transformative Medicine, NBBJ	United States	2017
9	Markham Stouffville Hospital Redevelopment, B+H Architects in association with Perkins+Will Architects	Canada	2017
10	Stamford Health, New Hospital, EYP Health	United States	2017
11	Eastwood Health & Care Centre, Hoskins Architects	United Kingdom	2017
12	New Cancer Centre at Guy’s Hospital, Rogers Stirk Harbour + Partners and Stantec Architecture	United Kingdom	2017
13	Biripi Clinic, Purfleet, Kaunitz Yeung Architecture	Australia	2017
14	The Bright Alliance Prince of Wales Hospital, HDR	Australia	2017
15	Alder Hey Children’s Hospital, BDP	United Kingdom	2016
16	Akershus University Hospital, C.F. Møller Architects	Norway	2016
17	Ng Teng Fong General Hospital and Jurong Community Hospital, CPG Consultants in collaboration with HOK and Studio 505	Singapore	2016
18	New QEII Hospital, Penoyre & Prasad	United Kingdom	2016
19	Banbridge Health and Care Centre, Avanti Architects with Kennedy FitzGerald Architects	United Kingdom	2016
20	Jim Pattison Outpatient Care and Surgery Centre, Kasian Architecture, Interior Design and Planning	Canada	2016
21	Mother-Child and Surgical Centre, SZX Kaiser-Franz-Josef-Hospital, Nickl & Partner Architekten AG	Australia	2016

However, although surgery is used in the curative treatment of many cancer patients; surgical oncology is usually performed in standard operating rooms (DH, 2013a). Additionally, surgical services do not require specialization in terms of cancer patients, since almost all patients are brought to these units in an unconscious state. For those reasons, surgical services are not included in this study, which is also beneficial for keeping the scope of the study within feasible limits.

Therefore, the related legislation of the selected countries are listed in Table 3.3. regarding:

- chemotherapy departments,
- radiation oncology departments, and
- inpatient care services.

In addition to the aforementioned legislations, the results of the studies mentioned in the literature survey in Section 2.3. have been utilized to include considerations of the healing environment concept within the scope of the study. The selected studies are listed in Table 3.4. Those studies are chosen from the related sections in the literature survey chapter considering their comprehensiveness and result-oriented approaches. Otherwise, including all of the studies would have caused unnecessary replication of information. The findings of the selected studies are listed in Table 3.5., which are accepted as truth and used as inputs for this study. In addition to those documents, statistical data on the number of practicing doctors, nurses and midwifes are used to consider the manpower of Turkey, as demonstrated in Figures 3.3. and 3.4.

3.2. Method

Within the scope of the thesis, first, the current legislation in Turkey and the standards of the other selected countries have been examined and analyzed for the planning of cancer treatment services, particularly in terms of the following:

Table 3.3. *The list of legislation used in the study*

	Country	Institution	Title	Year
1	Australia	Australasian Health Infrastructure Alliance [AHIA]	Australasian Health Facility Guidelines Part B - Health Facility Briefing and Planning 0360 – Intensive Care - General	2016
			Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0600 – Radiation Oncology Unit	2016
			Australasian HFG Standard Components - Bed Room/Outboard Ensuite	2017
			Australasian HFG Standard Components - Clean Utility/ Medication Room	2017
			Australasian HFG Standard Components - Consult Room	2017
			Australasian HFG Standard Components - CT Scanning	2017
			Australasian HFG Standard Components - Procedure Room	2017
			Australasian HFG Standard Components - Treatment Bay – Chemotherapy	2017
			Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0340 – Inpatient Accommodation Unit	2018
			Australasian HFG Standard Components - 1 Bed Room - Inboard Ensuite, Type 1	2018
			Australasian HFG Standard Components - 2 Bed Room - Inboard Ensuite, Type 1	2018
			Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0360 – Intensive Care Unit	2019
			Australasian HFG Standard Components - Patient Bay – Acute Treatment	2019

(continued)

Country	Institution	Title	Year	Country
			Australasian HFG Standard Components - Patient Bay – Intensive Care	2019
			Australasian HFG Standard Components - 1 Bed Room – Intensive Care	2019
2	Canada	Canadian Standards Association [CSA]	Canadian healthcare facilities	2016
3	United Kingdom	Department of Health [DH]	Health Building Note 02-01 Cancer Treatment Facilities	2013
			Health Building Note 04-01 Adult Inpatient Facilities	2013
			Health Building Note 04-02 Critical Care Units	2013
4	United States	The Facility Guidelines Institute [FGI]	Guidelines for design and construction of hospital and outpatient facilities	2014
5	United States	Department of Veterans Affairs [DVA]	Radiation Therapy Service Design Guide	2008
			Ambulatory Care Design Guide	2009
			Medical/Surgical Inpatient Units & Intensive Care Nursing Units	2011
			Chapter 277: Radiation Therapy Service	2016
6	Turkey	Ministry of Health [MH]	“Türkiye Sağlık Yapıları Asgari Tasarım Standartları 2010 Yılı Kılavuzu”	2010
			“Yataklı Sağlık Tesislerinde Yoğun Bakım Hizmetlerinin Uygulama Usul ve Esasları Hakkında Tebliğ”	2011
			“Mevcut ve Yeni Yapılacak Sağlık Tesislerinde Uyulması Gereken Asgari Teknik Standartlar Genelgesi”	2012

Table 3.4. *The list of sources used in the study*

	Source	Title
1	Altman & Wohlwill, 1983	Behavior and the Natural Environment
2	Andritsch et al., 2013	The ethics of space, design and color in an oncology ward
3	Aripin, 2006	Healing architecture: a study on the physical aspects of healing environment in hospital design
4	CABE, 2004	The role of hospital design in the recruitment retention and performance of NHS nurses in England
5	Chand, 2002	Architecture and hospital
6	Daykin et al., 2008	The impact of art, design and environment in mental healthcare: a systematic review of the literature
7	Douglas & Douglas, 2005	Patient-centered improvements in health-care built environments: perspectives and design indicators
8	Eceoğlu, 2010	"Değişen Kullanım İhtiyaçları Karşısında Hastane Yapılarında Giriş Mekanlarının Şekillenmesi"
9	Edvardsson et al., 2005	Sensing an atmosphere of ease: A tentative theory of supportive care settings
10	Edvardsson et al., 2006	Caring or uncaring – meanings of being in an oncology environment
11	Grassi et al., 2005	Psychiatric concomitants of cancer, screening procedures, and training of health care professionals in oncology: the paradigms of psycho-oncology in the psychiatry field
12	Høybye, 2013	Healing environments in cancer treatment and care. Relations of space and practice in hematological cancer treatment
13	Jencks, 1995	A view from the front line
14	Lawson, 2010	Healing architecture
15	Lawson & Phiri, 2003	The architectural healthcare environment and its effect on patient health outcomes
16	Marcus & Barnes, 1995	Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Considerations
17	Mroczek et al., 2005	Hospital design and staff perceptions: An exploratory analysis
18	Staricoff et al., 2001	A study of the effects of the visual and performing arts in healthcare
19	Ulrich, 1981	Natural versus urban scenes: Some psycho-physiological effects
20	Ulrich, 1984	View through a window may influence recovery from surgery
21	Ulrich, 1991	Effects of Interior Design on Wellness: Theory and Recent Scientific Research
22	Ulrich, 1999	Effects of Gardens on Health Outcomes
23	Ullán et al., 2012	Perspectives of youths and adults improve the care of hospitalized adolescents in Spain
24	Wignall, 2007	Future hospital design embraces patients, families and staff

Table 3.5. *Findings from the studies*

Source	Findings
Natural light & lighting design	
CABE, 2004	• Access to natural light is one of the critical factors affecting the healing of patients. • An improved physical environment had a positive effect on nurses' work performance and job retention.
Mroczek et al., 2005	• Increased natural light had a positive effect on working life.
Edvardsson et al., 2006	• Existence of natural light would be an opportunity to encourage positive thinking and shift the focus away from cancer for patients, while having positive value in escaping the metaphor of darkness in a symbolic way. • Natural light within the darkness of radiation oncology departments, which have thick concrete walls for protection against radiation, has a refreshing effect for the mind and provides a feeling of ease and energy for staff.
Eceoğlu, 2010	• Light and shade of artificial lighting should be well-designed and selected appropriately in terms of color according to the space and work within the space.
Access to view	
Ulrich, 1981	• Vegetation and especially water views tend to sustain attention and interest more powerfully than urban views.
Altman & Wohlwill, 1983	• Most of the natural views generated positive feelings and lower fear, held interest, and may diminish stressful thoughts.
Ulrich, 1984	• Hospital window design and the view from the window can affect the emotional state of patients with limited access to outside environments; and can reduce stress and accelerate healing.
Lawson & Phiri, 2003	• Access to view is a desirable feature for medical staff.
Mroczek et al., 2005	• Even a translucent window can form a vital link to the outside world for patients to resume normality.
Edvardsson et al., 2006	• A chance to glance out of an opening overlooking natural scenery would be an opportunity for cancer patients to connect with the outside World, in which cancer is less of a focus. • Seeing natural elements such as birds or clouds moving outside the window gave the staff a moment of being and feeling of ease and refreshment.

Source	Findings *(continued)*
Privacy & company	
Lawson & Phiri, 2003	• Patients are highly vulnerable in terms of privacy, since they try to maintain their daily habits in hospital condition as much as possible during the hospitalization period. This is even more pronounced in patients confined to bed or with limited response capability.
Edvardsson et al., 2005	• Engaging in interesting activities or conversations could evoke experiences of escaping from one's situation and deflecting one's mind for a while, which gives meaning to the day and hope for the future for patients and relatives. • Addition of comfortable chairs and sofas to single-bed rooms can promote interactions between staff, relatives, and patients from other rooms, thus supporting social relations in the environment. • Although waiting areas are generally designed to provide seating for as many people as possible, privacy within those spaces is highly necessary and desired.
Wignall, 2007	• Working and resting rooms should be provided for all of the personnel in quiet areas away from patient care zones.
Andritsch et al., 2013	• Single-bed rooms are more preferable than double or multi-bed rooms.
Høybye, 2013	• Multi-bed patient rooms have a potential for social recognition and the filling of abundant idle time. • Creating healthcare spaces with flexible possibilities for inhabitants to be alone or with others enables them to control their privacy levels. • Combinations of single- and multi-bed rooms may provide a balance between patients seeking privacy and enjoying company.
Sense of control	
Douglas & Douglas, 2005	• Control over basic day-to-day actions such as opening a window, switching lights on and off, adjusting the air conditioning or making a cup of tea enhances the patient's comfort and reduces anxiety and stress. • Providing patients and visitors enough space to wander around and access external areas is especially valued due to promoting a sense of normality.
Høybye, 2013	• Personal items helps to reconcile the generic and phlegmatic environment of the hospital with a sense of homeliness and control for the patient.

Source	Findings *(continued)*
Interior design, art & music	
Ulrich, 1991	• Although there is a belief that all kinds of paintings are positive distractions for patients, abstract pictures and prints had negative effects on hospital patients. • While nature images have a positive effect on patients, images that are unclear or uncertain result in complaints to hospital staff, aggressiveness in patients and even some physical attacks such as tearing the wall paintings.
Staricoff et al., 2001	• Visual art and live or recorded music during chemotherapy is effective in reducing both anxiety and depression and acted strongly to prevent side effects of treatment.
Lawson and Phiri, 2003	• Hospital users demand diversity in lighting, color, and materials. Materials that trigger tactile sensations and with which users can interact are especially desirable. • Using light and matt colors instead of strong or bright colors on the walls helps reduce the clinical and 'cold' feeling in patients' rooms.
Douglas & Douglas, 2005	• Poor indoor designs in health settings in terms of color and decoration in health settings have been associated with adverse health effects such as increased anxiety, the need for analgesic drugs, insomnia and higher delirium rates.
Edvardsson, et al., 2005	• Natural and home-like physical environments can alleviate psychological stress and have a positive effect on patients' healing and well-being. • While the presence of medical items is associated with unwelcome feelings, patients prefer daily objects, which help them locate themselves in that environment.
Edvardsson et al., 2006	• Environments that are carelessly arranged and inadequately decorated can give a message of lower value and the absence of caring to the occupants. • While decorative items and daily objects mean a break from a challenging working environment for staff, they imply getting away from the universe of disease and encountering associations with the outside world for patients.
Daykin et al., 2008	• The benefits of art include enhanced care experiences, reduced vandalism and aggression, feelings of greater dignity of patients, promotion of a sense of identity, and enhancement in staff morale and motivation.

Source	Findings *(continued)*
Eceoğlu, 2010	• It is necessary to make sure that the textural surfaces of the walls, flooring and other fittings are not too rough or too bright. Rough surfaces may cause dizziness due to optical illusions, and very bright and smooth surfaces may cause nausea. • Patients who stayed in the hospital for a short time preferred short-wavelength colors such as red and yellow, and long-term hospital patients preferred colder colors such as blue and green.
Landscape design	
Ulrich, 1991	• Landscape design of a healthcare building can encourage exercise by motivating patients to move outside, which is already an active movement in itself. • Exposure to natural landscapes and greenery as a positive distraction helps to reduce stress hormones and blood pressure.
Marcus & Barnes, 1995	• Healthcare buildings that incorporate gardens into their designs provide areas for physical therapy, individual or group counseling, exercise, sitting, walking, listening, and observation.
Ulrich, 1999	• A sense of control reduces stress, increases the ability to cope with stress, and improves overall well-being. Gardens can enhance the feeling of control by providing a temporary sensation of escape. • A well-designed garden could affect health outcomes by providing options for personal preferences. • There is a positive relationship between a person's health status and the number of social connections.
Chand, 2002	• Courtyards and landscape areas should be included in the early briefs of the design process as therapeutic areas for both formal and casual interactions among patients, families, staff, and visitors.
Grassi et al., 2005	• Landscape design also aims to increase social and emotional support, which has positive effects on decreasing stress and minimizing harmful effects on health.
Eceoğlu, 2010	• Hospitals should have green areas at least equal to the footprint of the building itself in order to provide a better presentation from the perceptual point of view, and to meet the needs properly.
Social amenities	
Douglas & Douglas, 2005	• Healthcare facilities as public areas need to provide supportive, flexible, and social spaces for all.

Source	Findings *(continued)*
Edvardsson et al., 2005	• Engaging in interesting activities or conversations could evoke experiences of escaping from one's situation and deflecting one's mind for a while, which give meaning to the day and hope for the future for patients and relatives. • Spaces provided for social interaction should be designed to create a familiar environment where people are able to read newspapers and watch television, maybe with cake or coffee offerings.
Andritsch et al., 2013	• In recent years, the role of family members has changed from being concerned bystanders to being members of the health care team. The participation of the family in the care of the patient improves and speeds recovery.
Accessibility & way-finding	
Aripin, 2006	• Long circulations in the hospital should be avoided in order to ensure effective work of medical staff.
Lawson, 2010	• People move according to their own mental maps. Confusing spaces prevent them from using or creating those maps and increase stress levels. • Healthcare facilities should be designed with legibility where there is a certain hierarchy of space, public and private places are clearly distinguished, entrances and exits are obvious, and different parts of the building have different qualities.
Universal design	
Ullán et al., 2012	• Healthcare designers should consider the fact that patients, relatives, and staff could have very different characteristics in terms of age, gender, height, weight, mobility level, perception level, and cultural background, and should be respectful and aware of their preferences, needs, and individual values.
Entrance & waiting room design	
Jencks, 1995	• Sitting in a pleasant area, with thoughtful lighting, a view of greenery and sky, and chairs and sofas arranged in various groupings, could be an opportunity for patients to relax and talk, away from home cares. • Old-fashioned restrooms – *not* partitioned toilets in a row – with their own hand basins and proper doors in doorframes will supply privacy. • There could be a tea and coffee machine for patients who are waiting, and a small cancer library for those who want to learn more about their disease. There could be a TV with a small library of informative videos about cancer.

Source	Findings *(continued)*
Edvardsson et al., 2006	• Finding an individual behind a reception desk to be met, seen and informed would be welcoming, and would promote positive messages about involvement and safety. • A reception desk, at which patients could ask their questions and be informed properly, helps to maintain privacy for treatment application due to fewer interruptions by other patients asking the way or entering the occupied therapy space. • Despite the need of being expected, being seen and being invited, privacy is highly necessary and desired for patients and relatives. In this regard, a waiting environment with various groups of places to sit provides freedom to choose to be involved with fellow patients or to be alone with oneself or other family members.
Eceoğlu, 2010	• Continuity should be provided between the entrance space and the landscape arrangement of the buildings. • The slope of any ramp should be designed at up to five percent considering stretcher / wheelchair users and elderly people. Elevation differences should not be used considering the patients' and other users' comfort. • Directional plates or similar visual aids should be provided to support orientation. • An office should be designed at the back of the registration desk for financial work and for people who wants to speak with any authorized personnel privately. • Easy access to the registration desk in the entrance section; positioning of the signposts at a comfortable height for eye level; location of service/patient elevators, stairs and restrooms at a visible point; and an appropriate clear span between those items for comfortable movement are important design considerations. • A waiting area should be established according to the hospital's capacity. The entrance section must be capable of accommodating one-fifth of the hospital's capacity. • The connection point of the diagnosis and treatment units with the entrance space should be easily accessible and understandable. • Patients and other users should use a cafeteria. It should be preferred to connect the cafeteria to the entrance with the help of a corridor.

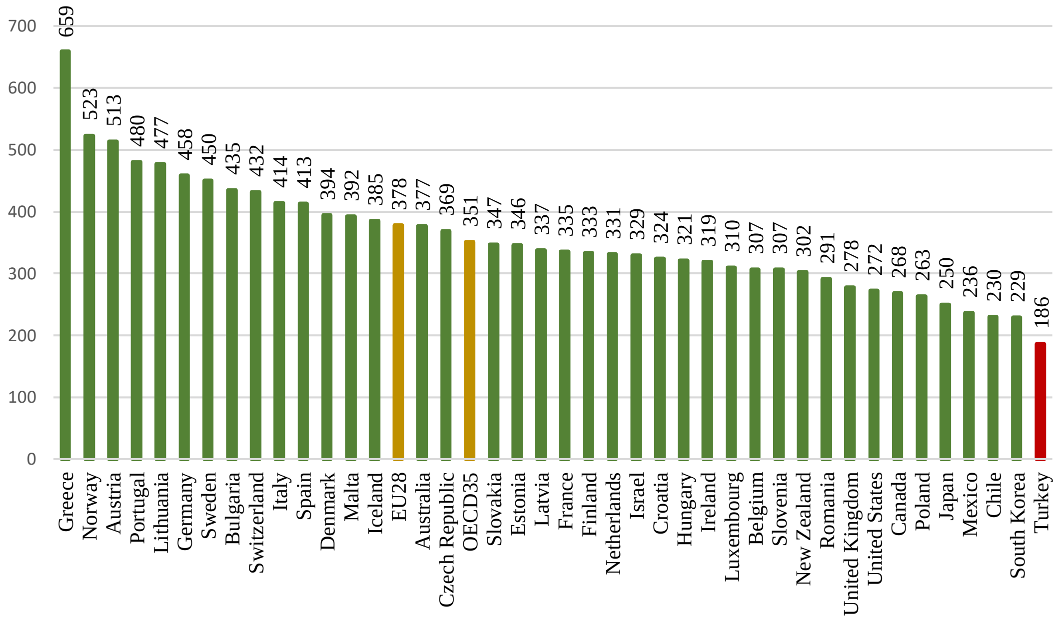


Figure 3.3. Number of practicing doctors per 100.000 population, 2016-2017
(Source: EUROSTAT Database)

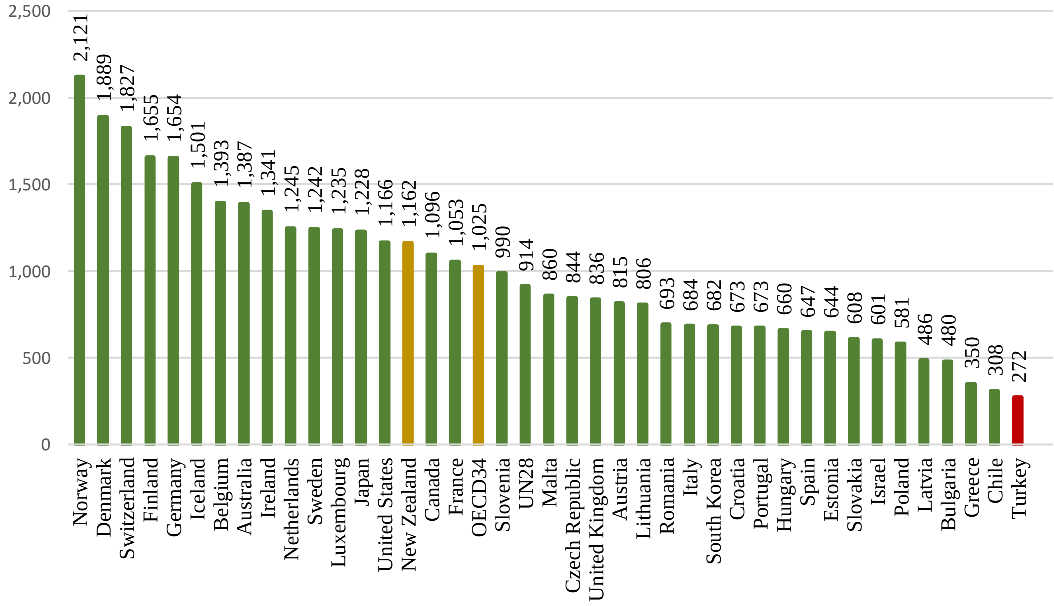


Figure 3.4. Number of practicing nurses and midwives per 100.000 population, 2016-2017
(Source: EUROSTAT Database)

- chemotherapy department,
- radiation oncology department, and
- inpatient care services.

The analysis of the selected countries' standards has been conducted by utilizing the relevant information on the subject in the order given in Table 3.3. Therefore, the sequence is as follows:

1. Australasian Health Infrastructure Alliance [AHIA], Australia;
2. Canadian Standards Association [CSA], Canada;
3. Department of Health [DH], United Kingdom;
4. The Facility Guidelines Institute [FGI], United States;
5. Department of Veterans Affairs [DVA], United States; and
6. Ministry of Health [MH], Turkey.

If information on a certain subject matter is absent within a selected standard, the text of the thesis proceeds to the next standard without notification. Examination and analysis of these regulations for cancer treatment services according to the following categories:

- general settlement principles,
- internal function relations,
- clinical areas,
- clinical support areas,
- staff support areas, and
- patient and public areas,

At the end of each category, the similarities and differences between the legislations are specified and discussed. All of this material is given at Appendices A, B, and C for the chemotherapy department, radiation oncology department, and inpatient care services, respectively.

Afterwards, a new series of analysis criteria is constituted regarding themes for the healing environment concept within the studies given in the literature review, which are as follows:

- natural light and lighting design,
- access to view,
- privacy and company,
- sense of control,
- interior design, art and music,
- landscape design,
- social amenities
- accessibility and wayfinding,
- universal design, and
- entrance and waiting room design,

and the above-mentioned examination categories of the selected standards. These criteria have been formulated to include all of the themes studied, discussed, and examined within the previously specified conceptual framework, comprising the following:

- general settlement principles,
- internal function relations,
- medical necessities,
- patient and family/visitor experience,
- healthy working environments,
- interior design,
- social interaction and privacy,
- safety, and
- landscape design and outdoor relations.

The relations of these analysis criteria with the topics of the healing environment concept and the examined standards are shown in Figure 3.5. Each criterion is discussed and evaluated in terms of the conducted studies on the healing environment concept and the examined standards by considering the medical practices, health manpower and cultural characteristics of Turkey, and results and suggestions are presented within each section with the help of plans, diagrams, and schematic drawings.

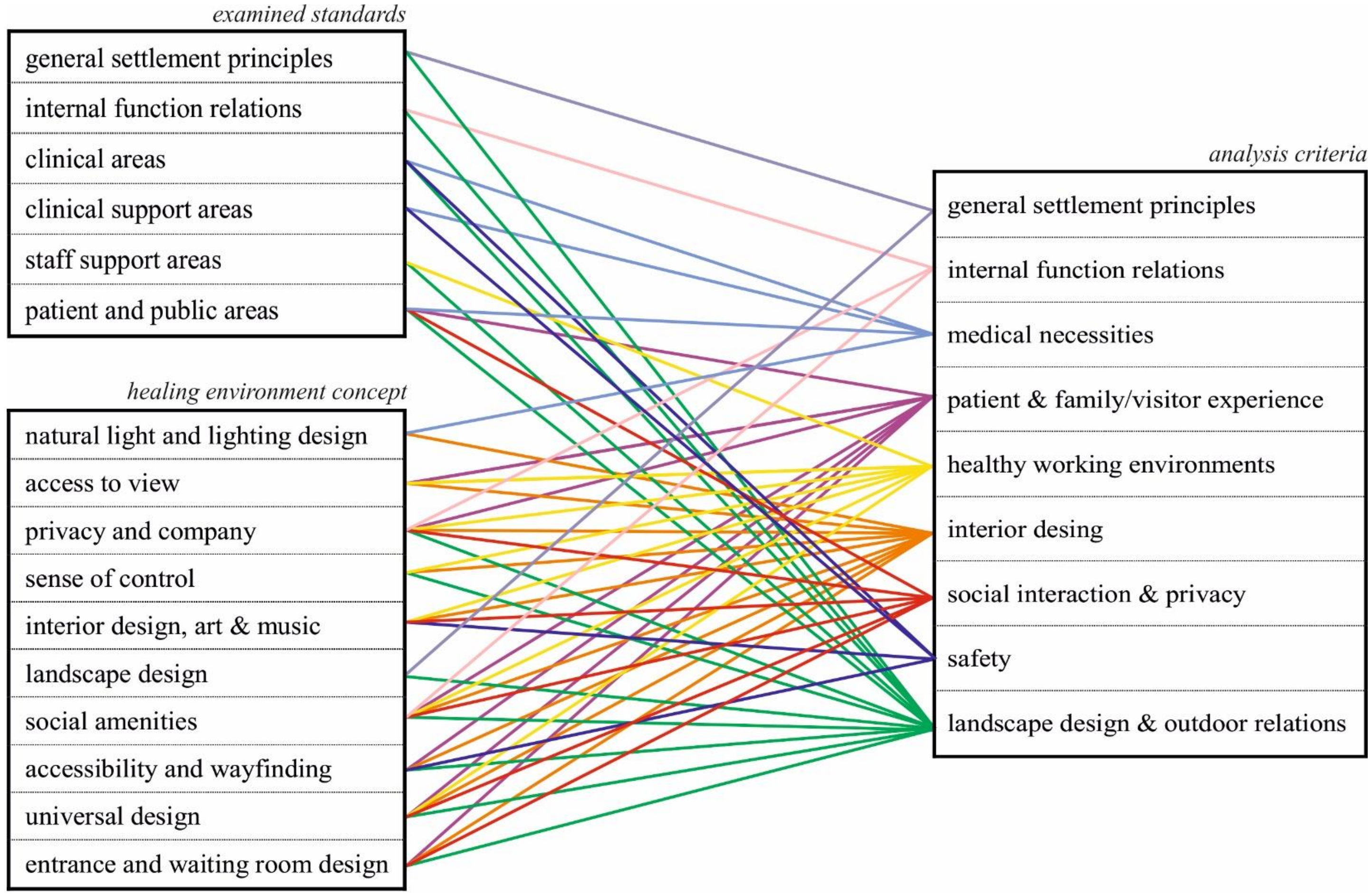


Figure 3.5. Relations of literature and appendices themes with analysis criteria

CHAPTER 4

ANALYSIS AND THE DESIGN GUIDELINE PROPOSAL

4.1. General Settlement Principles

General settlement principles are of great importance in terms of achieving a correct distribution of sources and effective flow plan within a healthcare facility. In this context, when presenting the design principles of the cancer treatment services, first the frame of where and with which connections the department will be placed within the facility should be determined. In this way, the first step of an efficient and sustainable health environment is taken by minimizing the circulation distances for the employees and all other users within the hospital. An improperly located department, however efficient it may be in terms of internal function relations, will not function properly within the hospital's organic flow.

4.1.1. Chemotherapy Department

The information obtained from the selected standards, which is presented in Appendix A.1., is generally parallel with the operation of hospitals in Turkey. Although not mentioned in any Turkish legislation, in architectural design, it is preferable to have a separate entrance and car park area for chemotherapy departments due to the weakened physical and psychological conditions of cancer patients and their extended treatment periods over multiple visits. While this preference has a different root cause in the case of the CSA (2016) standard of Canada, which recommends a relation between the chemotherapy department and exterior garden/therapy area for leisure and mobilization activities, the landscape areas to be designed in the entrance areas may meet both accessibility and therapy goals.

Chemotherapy departments should incorporate landscape areas at least equal to the footprint of the department to provide areas for physical therapy, individual or group counseling, exercise, sitting, walking, listening and observation, which are used as therapeutic areas for both formal and casual interaction among patients, families, staff and visitors. Those landscape areas could be formed either around the entrance or as inner courtyards.

Although patient privacy and dignity issues let chemotherapy departments formed as stand-alone units, close proximity of the chemotherapy department to the pharmacy is essential to deliver chemotherapeutic drugs to the department. If this condition cannot be provided, a satellite pharmacy, which only serves the department, could be an alternative solution. In addition, the scenario of a patient reaching emergency services in the event of an emergency is also one of the issues to be considered. This could be either through the hospital or by ambulance to the emergency service, depending on timing, the scale of the hospital, and characteristics of interior routes such as public or restricted corridors through which the patient would be carried.

Although the CSA standard (2016) states that the chemotherapy department should be associated with ambulatory care services, in the scope of chemotherapy delivery services in Turkey, examination rooms are provided within chemotherapy departments, and clinical services for the treatment process are received in those areas. This approach is considered more appropriate regarding wellness and satisfaction of the staff, patients and families.

In addition, although the DH standard (2013a) states that the chemotherapy unit should be located close to the imaging service, it is considered that 'imaging service' refers to the nuclear medicine unit within the scope of cancer care. Nuclear medicine is a specialized area of imaging that uses very small amounts of radioactive materials to examine organ function and structure, and to help diagnose cancer in its earliest stages or show whether a patient is responding to treatment or not. In this context, the chemotherapy department should be located in close relationship with the nuclear medicine unit in terms of reducing the circulation of patients and relatives, and ensuring the correct operation of medical processes.

4.1.2. Radiation Oncology Department

Although there is no explanation about the settlement principles of radiation oncology departments in the Turkish regulations, in practice, it is known that these departments are generally located on basement floors. This is usually for physical reasons. Since the radiation-shielding specifications of radiotherapy bunkers and the specialized heavyweight equipment used within these rooms create an imbalance in the weight distribution of the building, the department is positioned on top of the soil to compensate that weight.

At the same time, the location of the radiation oncology department should enable direct access from parking areas and public transportation as much as possible to minimize the stress of physically and psychologically weakened cancer patients attending the department generally on a daily basis. Therefore, although physical reasons lead the department to be located underground, it is essential to plan the department with a separate entrance and a car park area that is also close to public transportation for easy access. Therefore:

- if there are elevation differences in the field, they should be utilized to provide separate access;
- if separate access cannot be provided, the department should be positioned very close to the main entrance to ensure that patients reach the unit at the closest distance;
- if none of this can be realized, the department should be designed as an independent unit by providing infrastructure connections with the main hospital.

Moreover, if the department has its own entrance and connection with the external area, that would also facilitate the connection of the department with the landscape areas and would provide patients, families and staff with opportunities for resting, physical therapy, observation, and socialization. Of course, such landscape areas can be provided by internal gardens and terraces, but creating suitable open areas for the units located on basement floors entails significant architectural planning decisions and challenges.

Since cancer treatment services requires an interdisciplinary approach to achieve comprehensive patient-centered and family-centered operations, enclosed links are needed between the department and the main hospital not only for inpatients but also for access to other related departments and the transfer of supplies and goods. In this respect, radiation oncology departments require good access to:

- inpatient care services,
- chemotherapy department,
- emergency services, and
- nuclear medicine units.

Although the majority of the examined standards state that radiation oncology departments should be associated with ambulatory care services, like in the case of chemotherapy departments, in the scope of healthcare delivery services in Turkey, examination rooms are provided within radiation oncology departments and clinical services for the treatment process are received in those areas. This approach is considered to be more appropriate in terms of staff, patient, and family well-being and satisfaction.

Additionally, in spite of the examined standards' defense of the necessity of close a relationship between radiation oncology departments and imaging services, within the context of cancer care, 'imaging services' applies to nuclear medicine units in terms of reducing the circulation of patients and relatives, and ensuring the correct operation of medical processes. Nuclear medicine units are used to examine organ function and structure, and to diagnose cancer in its earliest stages or show whether a patient is responding to treatment or not.

A strong connection between the radiation oncology department and emergency service is important and should be considered carefully for the transfer of patients requiring emergency interventions. This transfer could be either through the hospital or by ambulance to the emergency service, depending on timing, the scale of the hospital and characteristics of interior routes such as public or restricted corridor.

4.1.3. Inpatient Care Services

Inpatient care services are among the core functions of healthcare facilities and need to be supported by a wide range of both clinical and non-clinical services. The delivery of these services is enhanced by good functional relationships. Moreover, being a large component of healthcare facilities, the departmental relationships of inpatient care services depend on the distance from diagnostic and treatment units, and the location and quantity of access points. Therefore, inpatient care services are generally located above or adjacent to the diagnostic and treatment units of a healthcare facility.

Intensive care service are particularly prioritized to be closest to surgical services and emergency departments. The location of the service should ensure ready response to emergency calls with minimum travel time by medical emergency resuscitation staff. Moreover, the connection between the intensive care inpatient services and the surgical service is critical for patients who have to undergo emergency surgery and who will be transferred to the inpatient service after the operation. Therefore, providing dedicated elevators for emergency and surgical services for direct connections is highly recommended.

For both acute and intensive care, oncology inpatient services, as discrete and specialist wards, require direct access to chemotherapy and radiotherapy departments as treatment units, and to nuclear medicine and imaging departments as diagnostic units. Moreover, inpatient care services should have an easy connection with laboratory services for rapid transfer of specimens for processing. However, if this condition cannot be provided, an automated conveyance system (e.g., pneumatic tube), could be an alternative solution to transport specimens directly.

In addition, inpatient wards' locations need to ensure privacy, especially at night. Therefore, although a good relationship with the main entrance of the hospital is important especially for visitors, ground floor locations should only be considered when the surroundings are free of hospital traffic and publicly accessible areas. Furthermore, the services should be structured to be separate from the general usage areas of patients, visitors, and staff.

4.2. Internal Function Relations

After the correct placement of the unit within the hospital is established, the second step is to ensure the correct distribution of services and an effective flow plan within the department. Similar areas in the context of users and functions should be grouped and located in correct relationships with other groups. In this way, not only is the staff utilized in the most effective and efficient manner, but the satisfaction of all users is also ensured due to the minimization of circulation and functional conflicts. On the other hand, a unit that has not been properly organized will not function properly, a healthy working environment will not be established, and privacy and security issues will arise.

4.2.1. Chemotherapy Department

Although three of the selected standards do not give information on this issue, the explanations obtained from the other standards, as presented in Appendix A.2., correlate with each other regarding segregation of patient- and staff-related areas, and the location of treatment rooms between them, which is also parallel to the operation of hospitals in Turkey.

Chemotherapy is usually given at regular intervals called ‘chemotherapy cycles’, which includes treatment periods alternating with rest periods (CSA, 2016). A typical treatment regimen can last for up to six months while the patient returns at frequent intervals for treatment (DH, 2013a). Therefore, although patients have been examined and evaluated on a regular basis before the treatment in the examination module, the same flow is not implemented every time they come. Sometimes patients may enter the treatment rooms directly from the waiting area. In addition, in the DH (2013a) standard, there is a special treatment area called ‘quiet treatment’, which is a highly recommended space for chemotherapy departments in Turkey where patients requiring greater privacy could be treated in special single-seated rooms.

Therefore, when the abovementioned inferences and findings of the selected studies on the healing environment concept are filtered and combined with medical application and preferences in healthcare facilities of Turkey, it is concluded that a chemotherapy department should composed of four zones, which are:

1. public zone, including:
    - patient/visitor entrance,
    - reception and waiting area, and
    - patient and public support areas (rooms for education of patients during treatment, cafeteria, toilets, etc.);
2. patient care zone, including:
    - examination module (pre-treatment consultation rooms for chemotherapy patients, oral chemotherapy treatment areas, phlebotomy unit, etc.),
    - chemotherapy treatment arenas, and
    - private treatment rooms;
3. clinical support zone, including:
    - staff stations,
    - medication rooms,
    - supply, utility and storage rooms, and
    - pharmacy or satellite pharmacy;
4. staff zone, including:
    - offices,
    - meeting/education rooms,
    - staff lounges, changing room, and lockers, and
    - changing room, lockers, and toilets.

Areas in the public zone such as reception, waiting, patient education rooms, and toilets should be located alongside the patient/visitor entrance and away from the patient care zone. Moreover, there should be a cafeteria located around the entrance and waiting area for patients, families, staff, and visitors. It is preferred to connect the cafeteria to the entrance with the help of a corridor.

Patient care and clinical support zones should be in the middle part of the department where they are directly accessible from the waiting areas. Areas in staff zones such as offices and lounges, which are used only by staff, should be discrete from patient-related areas due to security, privacy, and confidentiality issues. Because of that, separation of patient and staff circulation is highly recommended. A sample diagram of a chemotherapy department is presented in Figure 4.1.

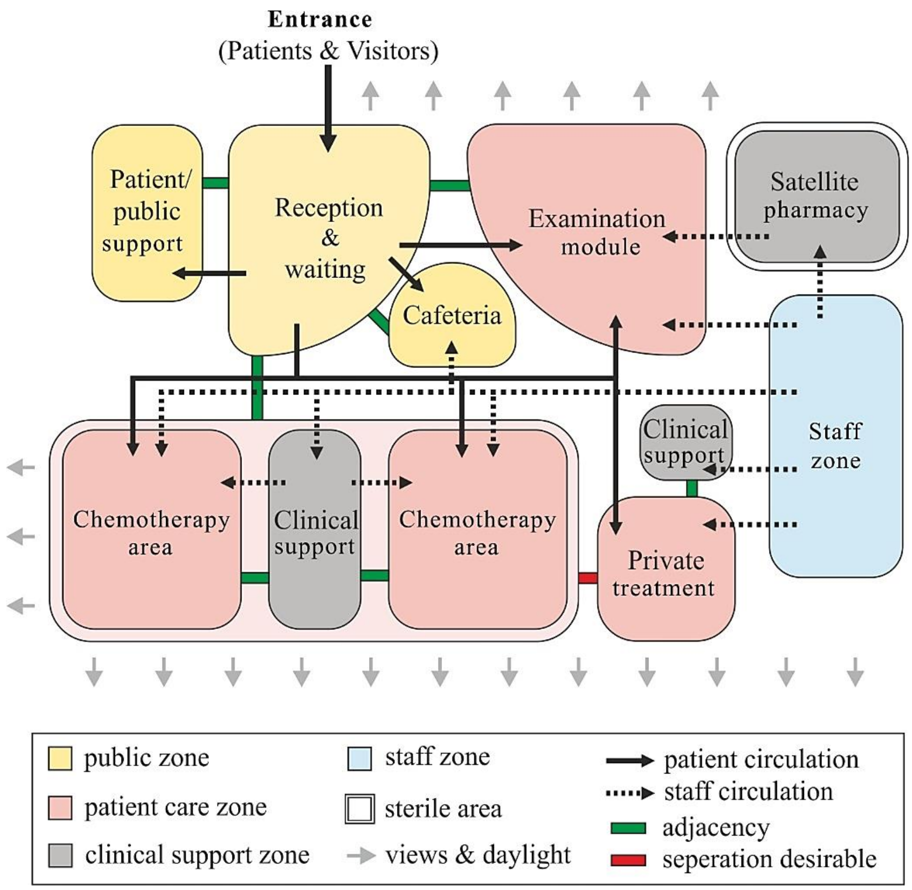


Figure 4.1. Proposal diagram for internal function relations of a chemotherapy department

4.2.2. Radiation Oncology Department

In radiation oncology departments, before a treatment plan is determined, the patient is first assessed for the suitability of treatment according to tests and CT simulation results (AHIA, 2016c). Patients then attend treatment either as day-case patients (outpatients) or as stay-in-hospital patients (inpatients) depending on the treatment type. However, radiotherapy is usually given as a series of sessions on an outpatient basis, in which the patient arrives at the hospital, receives the treatment, and leaves within the same day (DVA, 2008). A treatment period can be up to 40 sessions, usually lasting between 10 and 30 minutes, for 6 to 8 weeks to be applied once or twice a day (AHIA, 2016c). Periodic new screening can be done to determine the effectiveness of the current treatment (AHIA, 2016c).

Therefore, the internal function relations of the department should be determined according to those treatment processes and flows. In addition, an interdisciplinary care approach that includes all members of the care team (oncologists, nurses, radiation technology specialists, etc.) is emphasized as the basis of cancer care programs, and that perspective should be reflected in the whole design. Furthermore, to keep pace with evolutions in technology, flexibility and adaptability should be prominent in the design strategies. Like the chemotherapy department, a radiation oncology department is composed of four zones:

1. public zone, including:
    - patient/visitor entrance,
    - reception and waiting area, and
    - patient and public support areas (rooms for education of patients during treatment, cafeteria, toilets, etc.);
2. patient care zone, including:
    - examination module (pre-treatment consultation rooms for radiotherapy patients, phlebotomy unit, etc.),
    - radiotherapy treatment room (bunkers),

- imaging module, and
- mold module;

3. clinical support zone, including:
    - treatment planning rooms,
    - staff stations
    - medication rooms, and
    - supply, utility and storage rooms;
4. staff zone, including:
    - offices,
    - meeting/education rooms,
    - staff lounges, changing room, and lockers, and
    - changing room, lockers, and toilets.

The public entrance of the radiation oncology department should be adjacent to the waiting area but outside the patient care zone. The waiting area should be separated into inpatient and outpatient waiting, where a reception desk controls the access to the patient areas from both waiting rooms and channels visitors to the relevant rooms. In addition, the entrance and waiting areas should be situated around a cafeteria for patients, families, visitors, and staff. The cafeteria should be linked by means of a corridor to the entrance.

The examination module consists of multi-purpose clinical rooms where patients undergoing radiotherapy are seen for examinations and consultations. That area can also be used for the evaluation of emergency patients. In addition, if pediatric patients are being treated in the department, an anesthesia room should be planned. Moreover, a phlebotomy unit for medical tests, and interview/counseling rooms for information exchange between medical staff and patients/families are needed within the module. A clear transition from the waiting area to the examination, imaging and mold modules is an important aspect in terms of patient flow.

In addition, the treatment bunkers should be located between the patient- and staff-related spaces. The treatment planning rooms should be directly accessible from the staff areas, and located close to the imaging module for the correct functioning of workflows. Clinical support and clean supply rooms could be centralized based on functional program requirements, or decentralized by having direct access through an internal corridor for ready access from the patient care areas. The staff offices and clinical support rooms that are used only by staff, such as treatment planning rooms, should be located away from patient-related areas together with their circulation paths due to security, privacy, and confidentiality issues. The internal function relationships of radiation oncology departments are described by the sample scheme presented in Figure 4.2.

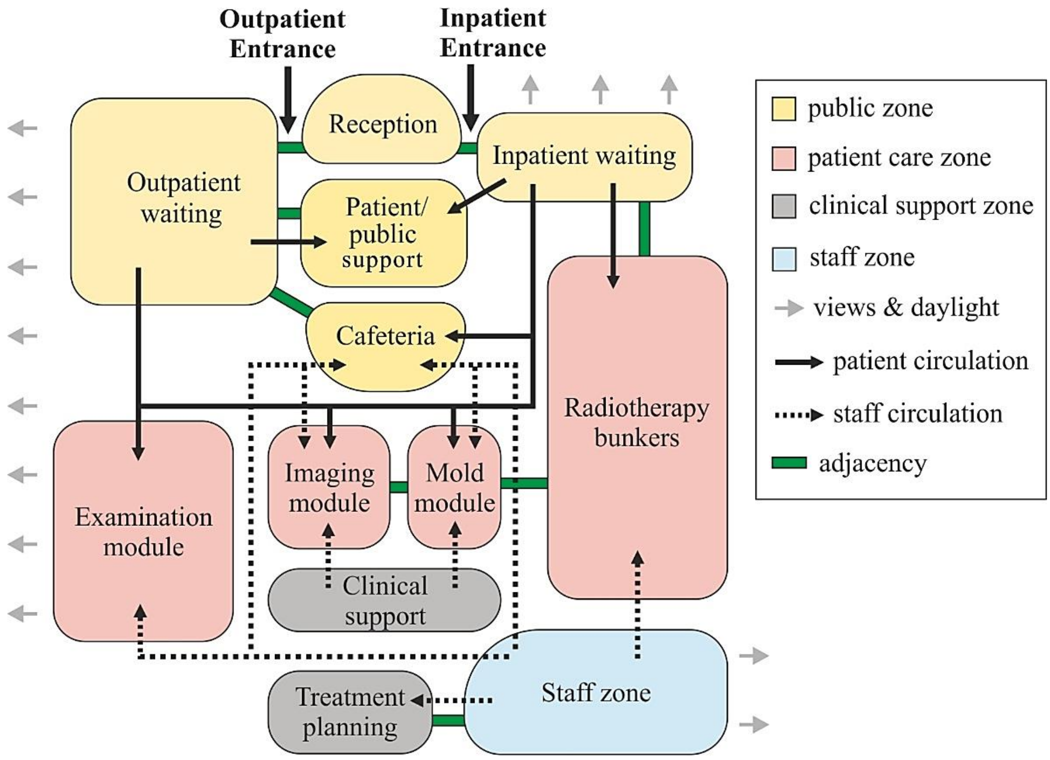


Figure 4.2. Proposal diagram for internal function relations of a radiation oncology department

4.2.3. Inpatient Care Services

Inpatient care services are provided for the observation of cancer patients for their overnight stays in terms of treatment-related symptoms and the progress of treatment. These services could be either at acute care or intensive care level according to the patient's condition. Moreover, some brachytherapy applications require a special type of inpatient care service, involving specialized shielded bedrooms. Inpatient care services consist of several functional zones:

1. public zone, including:
   - patient/visitor entrance,
   - reception and waiting area, and
   - patient and public support areas (family lounges, dayrooms, toilets, etc.);
2. patient care zone, including:
   - patient bedrooms, and
   - procedure rooms;
3. clinical support zone, including:
   - nurse stations,
   - medication rooms, and
   - supply, utility, and storage rooms;
4. staff zone, including:
   - offices,
   - meeting/education rooms,
   - staff lounges, changing room, and lockers, and
   - changing room, lockers and toilets.

Spaces in the public zone should be located adjacent to, but outside of the patient care zone, with one exception. Dayrooms where patients, families, and visitors spend time together should be located within the ward. The patient care zone forms the core of the service. Depending on the number of beds, inpatient care service wards can be arranged as a single service or grouped into clusters. According to the Turkish regulations (MH, 2011b), intensive care inpatient services with a bed number of ten or less can be arranged as a single service. However, services with more than ten beds should be divided into multiple units of up to six beds (MH, 2011b).

Patients admitted to inpatient care services are generally acutely ill and need to be observed. For that reason, nurse stations constitute the primary clinical support zone and should be designed to maintain direct observation from the station to patient rooms. Therefore, one of the primary design goals should be to reduce the distance between patient rooms and nurse stations. In this respect, decentralized nurse stations can increase patient observation while diminishing the travel distance of nurses. However, when statistics on the number of nurses per population in Turkey are considered (Figure 3.4.), sustainable use of the medical workforce is essential. Thus, although decentralized nurse stations have some medical advantages in terms of patient observation, centralized solutions are more appropriate for healthcare facilities in Turkey.

Within wards, appropriate and adequately sized clinical support areas should be provided for healthy functional relationships. Support functions should be decentralized to minimize staff circulation. Moreover, if the ward is arranged as clusters, each cluster should ideally have local access to supplies and disposal facilities. Utility and storage areas need to be readily accessible from both patient care and clinical support areas regarding ease of service. In addition, areas in the staff zone should be located in close proximity to the service but away from patient rooms to reduce noise in the ward and for staff respite. A sample diagram of an inpatient care service is presented in Figure 4.3.

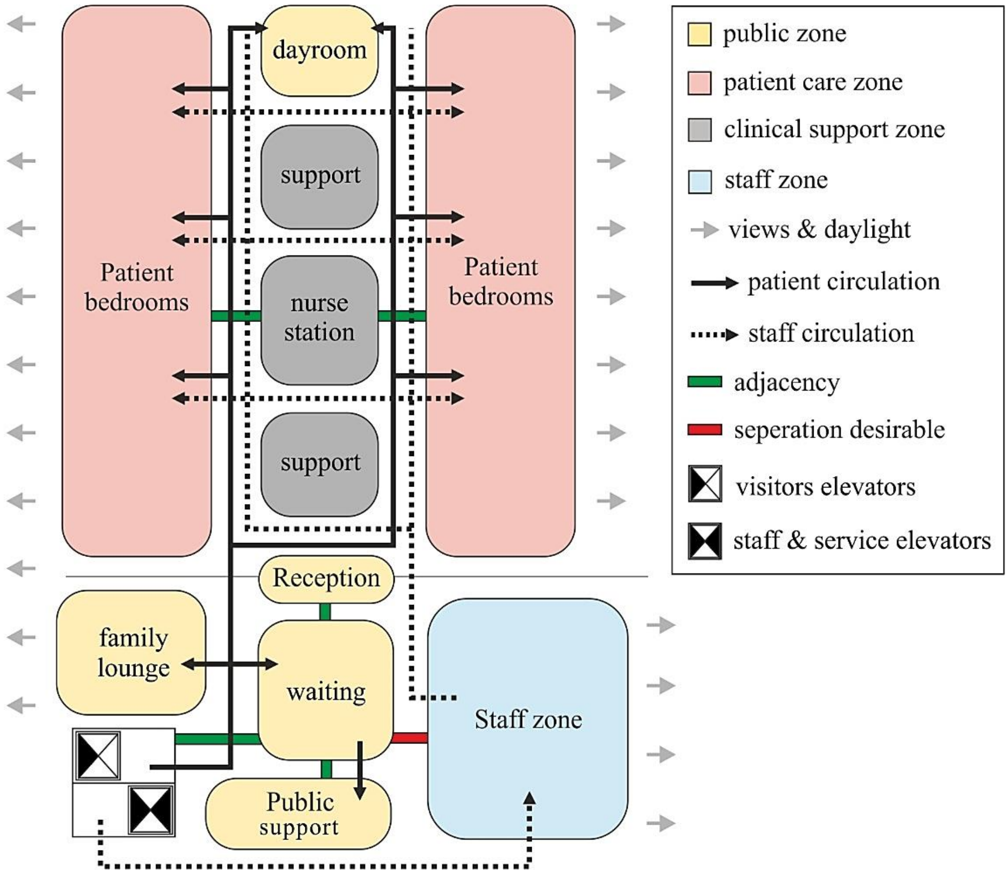


Figure 4.3. Proposal diagram for internal function relations of an inpatient care service

4.3. Medical Necessities

The primary purpose of hospitals is to provide medical service to people who need it. In this context, the next step for services that have been correctly positioned and for which internal relations have been properly arranged is to create sustainable and flexible medical areas that are in line with the latest technology.

4.3.1. Chemotherapy Department

The main treatment areas of chemotherapy departments are chemotherapy rooms. These rooms could be arranged in arena, cubicle, single private room, and airborne isolation room layout (Figure 4.4.). Arena-type chemotherapy spaces are composed of multiple patient-care areas, separated by movable dividers such as curtains

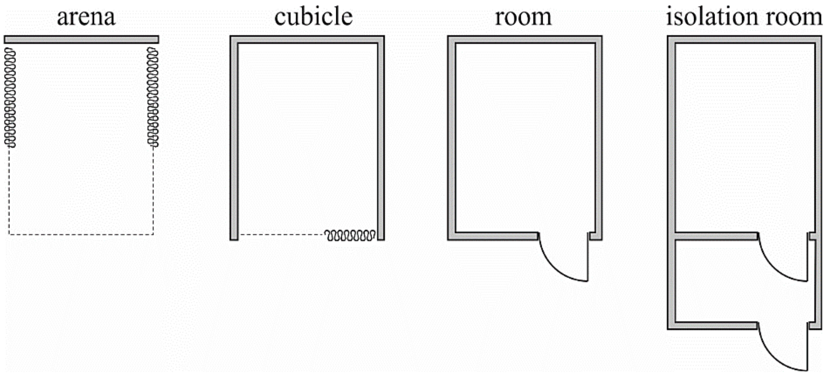


Figure 4.4. The schematic drawing of chemotherapy patient care area types

surrounding the areas. While the space and equipment requirements are similar to those of arenas, cubicle-type therapy rooms are arranged with fixed partitions (generally walls) on three sides and a movable partition (generally a curtain) on one side. Private chemotherapy rooms are for single patients separated from the other arena-type therapy areas and ideally have their own bathrooms. Airborne isolation rooms are similar to private rooms, but with an anteroom in the front.

Although there are mostly arena-type treatment spaces in the chemotherapy departments of healthcare facilities in Turkey, single private room and airborne isolation room layouts have become highly preferable in recent years due to privacy, confidentiality, and infection control issues. Therefore, in chemotherapy department design, both arena (or cubicle) and single private room types of treatment areas should be considered.

There is no regulation on the design of chemotherapy departments in Turkey. However, although hemodialysis is quite different from the medical procedures performed in chemotherapy departments, there are a number of design principles in the 2010 Ministry of Health Guidelines of Turkey for hemodialysis departments, which have similar spatial requirements. In the document, it is noted that:

- For each hemodialysis partition, at least 9 m^2 of floor area should be provided.

- A minimum of 120 cm of clearance shall be provided between the seat/bed/stretcher and the walls and in front of the station.
- The department should be designed to provide privacy for each patient.
- A place should be provided where patients can put their belongings and hang their clothing.
- The need for and number of airborne isolation rooms should be determined by the evaluation of the infection control committee. If necessary, airborne isolation rooms have to be planned; however, it is not mandatory to design toilets and bathrooms within them.

Additionally, for single private and airborne isolation treatment rooms to be planned in chemotherapy departments, the design codes given in the 2010 Ministry of Health Guidelines of Turkey in the section on inpatient treatment units can be taken as a reference. The document addresses the following issues:

- Single private rooms should have at least 15 m^2 of floor area with 110 cm of clearance around the patient's bed.
- Airborne isolation room should be at least 15 m^2.
- Each isolation room must have an entrance area of at least 4 m^2 for hand washing, dressing and clean/dirty material storage.
- For each of the isolation rooms, an area of at least 6 m^2 for toilet, shower, and hand washing section is required.

In spite of the similarities between these functions and spaces, the aforementioned statements in the Turkish legislation will be examined in terms of the explanations in the selected international standards, the practices in Turkey, and the healing environment concept as a part of this study. As stated in Table A.3. in Appendix A.3., the examined standards require an area of 6 to 10 m^2 for arena and cubicle types of chemotherapy areas and 9 to 12 m^2 for single rooms. In this context, the required floor areas of the arena/cubicle and single room types (9 and 15 m^2, respectively) in the

Turkish legislation are appropriate considering the required additional space for patients' relatives to stay next to the patient, personal belongings, and furniture.

In the Turkish legislation, while it is not obligatory to include a bathroom in the isolation rooms in dialysis units, it is obligatory for the isolation rooms within inpatient care services. The toilet needs of dialysis patients are negligible due to the special conditions related to their diseases. In this context, while the statement in the legislation makes sense for dialysis units, it is considered that a bathroom within isolation rooms is appropriate for chemotherapy departments.

The limitation of patient capacity is a critical input for arena or cubicle types of treatment areas. The number of patients a nurse could monitor at the same time should determine the limit. In practice, two nurses are charged with observation in each arena. Therefore, while proposing the design criteria of chemotherapy arenas (or the total number of cubicles), it is important to identify the maximum number of patients that can be observed by two nurses. Considering the statistics on the number of practicing doctors and nurses per population in Turkey (Figures 3.3 and 3.4), sustainable use of the medical workforce is extremely important.

In the legislation issued by the Ministry of Health (2011b) on the procedures and principles of the application of intensive care services in health care facilities, it is stated that:

- In first level intensive care services, there should be at least 1 nurse/medical assistant for each 5 patient beds.
- In second level intensive care services, there should be at least 1 nurse/medical assistant for each 3 patient beds.
- In third level intensive care services, there should be at least 1 nurse/medical assistant for each 2 patient beds.

Although intensive care services are different from chemotherapy procedures, in terms of nursing observation, that document (MH, 2011b) could be taken as a reference. According to the document (MH, 2011b), patients who may require invasive monitoring like chemotherapy patients, are hospitalized, in second-level intensive care services. Therefore, it can be concluded that two nurses can observe a maximum of 6 chemotherapy patients, which is also compatible with the examined international standards (Table A.3.).

All in all, when the above inferences and findings of the selected studies on the concept of the healing environment are filtered and combined with the medical applications and preferences in Turkish health-care facilities, the following conclusions may be drawn regarding chemotherapy areas:

- Arenas should consist of a maximum of 6 patient-care areas with a minimum of 9 m^2 of floor area each. A minimum of 120 cm of clearance shall be provided between the seat/bed/stretcher and the walls and in front of the station. Furthermore, the arenas (or cubicles) should be designed to provide privacy for each patient. Patients should be able to control the movement of curtains to determine the level of privacy according to their preference about social interaction or reclusion.

- Single private rooms should have at least 15 m^2 of floor area with 110 cm pf clearance around the patient's bed. The need for and number of airborne isolation rooms should be determined by the evaluation of the infection control committee. If necessary, airborne isolation rooms have to be planned with a bathroom. Those rooms should be located away from the main corridor and other patient cells, and closer to the department entrance to limit travel distance of patients with immunodeficiency or infectious diseases. Airborne isolation rooms should be at least 15 m^2. Each isolation room must have an entrance area of at least 4 m^2 for hand washing, dressing and clean/dirty material storage.

- Each patient care area should be equipped with:
  - treatment chair/bed,
  - treatment trolley,

- medical gas unit consisting of oxygen, vacuum and medical air,
    - examination lamp,
    - chair and stool (for family members and staff),
    - overbed table,
    - television,
    - nurse call and emergency system, and
    - storage for personal items.

- All treatment areas should receive direct natural light through appropriately designed windows so that patients, relatives, and staff can see the natural views outside. In that sense, landscape design in the front area of treatment spaces is highly recommended, consisting of mainly vegetation and water elements. The positioning and orientation of patient beds/chairs and staff stations should be determined to maximize the access to views. Moreover, audio system infrastructure should be established in all treatment areas for the use of music for therapy purposes. A sample schematic drawing is presented in Figure 4.5.

- Chemotherapy areas used by children and adolescents should be separated from the other treatment spaces. However, where there is some shared use of facilities, the patient pathways should be kept separate as much as possible. Chemotherapy areas of pediatric and adolescent patients should be designed and decorated in compliance with their needs and preferences.

Clinical support areas of a chemotherapy department should be directly accessible from clinical areas. The required clinical support areas consist of:

- nurse stations within chemotherapy areas,
- medication room,
- examination rooms,
- interview room,
- parking bay: trolley/bed,
- clean utility room,

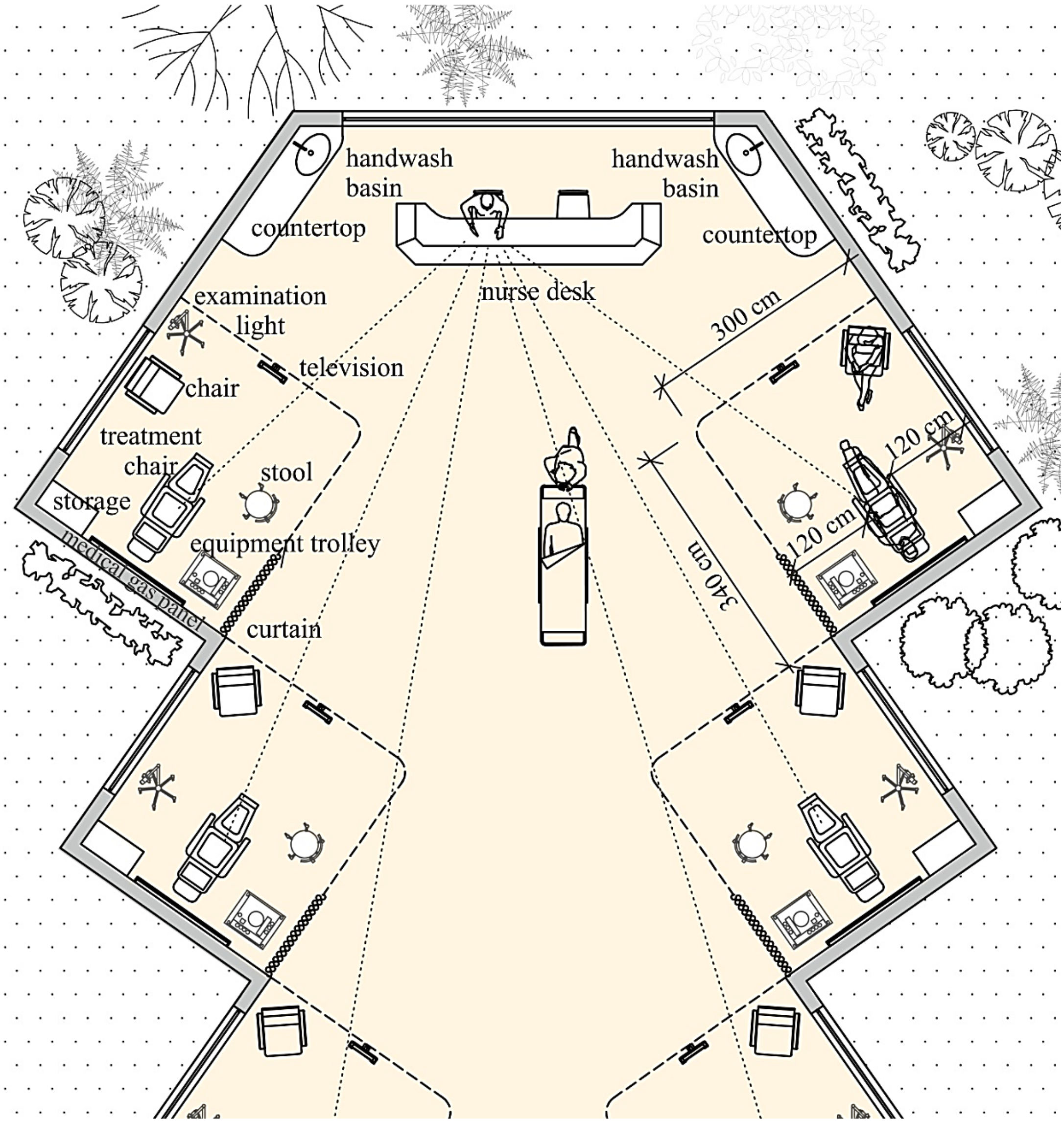


Figure 4.5. Proposed schematic drawing of a chemotherapy arena

- soiled holding room,
- clean and soiled workrooms, and
- storages for linen, equipment, and consumables.

A nurse station needs to be provided within each chemotherapy arena. Additionally, there should be centralized or split nurse stations for cubicle-type and room-type patient care areas. For the examination and consultation rooms to be planned within the department, the design codes given in the 2010 Ministry of Health Guidelines of Turkey in the section on polyclinics can be taken as a reference. The document (MH, 2010) includes the following recommendations:

- There should be at least 13 m^2 of empty floor area in the examination rooms; and at least 100 cm of clearance should be provided on the three sides of the patient's stretcher.
- Examination rooms should be at least 20 m^2 regarding the assumption that a doctor, a nurse or a medical secretary, a patient, and a patient's relative will be present within the room.
- There should be a system for reducing the light in the room to facilitate the use of the tools that the doctor will utilize during the examination.

Therefore, when the abovementioned inferences and findings of the selected studies and standards are assessed in terms of medical applications and preferences in Turkish health care services, it is concluded that examination rooms should be at least 20 m^2 regarding the assumption that a doctor, a nurse or a medical secretary, a patient, and a patient's relative will all be present within the room. At least 13 m^2 of empty floor area and 100 cm of clearance on the three sides of the patient's stretcher should be provided within the rooms. The necessary measures should be taken to ensure patient privacy in the rooms. Moreover, all examination rooms should receive direct natural light through appropriately designed windows so that users can see the natural views outside. There should also be a system for reducing the light in the room to facilitate the use of the tools that the doctor will utilize during the examinations.

Medication rooms should be positioned to be under the visual control of the nurses. Chemotherapy drugs can be prepared either in the central pharmacy unit of the healthcare facility or in medication rooms within the chemotherapy department. If chemotherapy drugs are prepared in medication rooms, the rooms should consist of an anteroom accessed from the department corridor, a clean hall working as an airlock accessed from the anteroom, a drug preparation room accessed from the clean hall, and a service room accessed from the clean hall. The drug preparation room is required to be maintained under sterile conditions. Therefore, a secondary wall system is strongly suggested for the clean hall and drug preparation room to maintain clean room conditions.

Clean supply and soiled holding rooms of the department could be brought together or decentralized according to the program necessities, and they should be readily accessible from the patient care areas they support. Storage spaces are essential to keep service corridors clear of trolleys, equipment and medical supplies. Storage areas could be designed as alcoves or rooms, centralized or decentralized, depending on the type, size, and amount of subject material (Figure 4.6.). However, all of the storage areas should be lockable and easily accessible by nursing and medical staff. Adequate numbers and sizes of clinical supports should be determined according to the number of staff and patients, and the footprint of the department.

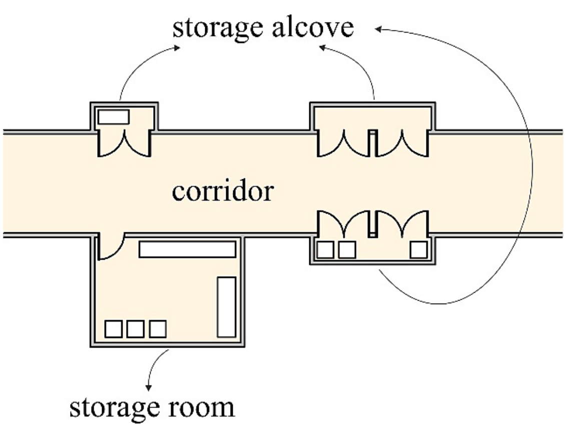


Figure 4.6. Schematic drawing of storage room and alcoves

4.3.2. Radiation Oncology Department

The main treatment areas of radiation oncology departments are radiotherapy rooms, also called as bunkers, which are specially designed rooms with a reinforced concrete, radiation-shielded vault and a maze-like entryway. The room is entered through a neutron-shielding door operated by an electro-pneumatic system. The entrance door and maze should be wide enough to allow easy access to the treatment machine, hospital bed, and service equipment. An entry maze is essential to prevent the escape of radioactive rays. Radiation protection requirements such as the thickness of the walls, floor, and ceiling and the design of the entry maze should be in accordance with the regulations of the TAEK.

Bunkers should be dimensioned considering the dimensions of the equipment, the patient's access to the equipment on a stretcher or in a wheelchair, the access of the medical staff to the equipment and the patient, and service access to the equipment. However, in order to implement the flexible design principle, these rooms should be designed to accommodate the equipment of all major suppliers for high-energy radiotherapy, and the infrastructure should facilitate installation of future technologies.

As described in Section 2.2.3., there are two types of radiotherapy: external and internal (or brachytherapy). Since the procedure and equipment used are different for two different types of radiotherapy, floor area requirements are differentiated between them. The Turkish regulations (MH, 2010) state that the minimum size for external radiotherapy bunkers should be 60 m^2, including the walls and entry maze. However, it is obvious that due to the excessive thickness of the walls, the area covered by the walls is approximately 50 m^2. This conflicting condition can be followed from the explanations of the selected standards given in Section B.3.1 and especially Table B.4., which shows a comparison of external radiotherapy treatment room size requirements in the different standards. Therefore, it is inferred that there is a mistake in the wording of the Turkish legislation, and the area mentioned is the net floor area excluding the walls. When the approximate wall area, 50 m^2, is added to the given value, the sum is 110 m^2, which is within the values given in the examined international standards and is considered to be reasonable. Thus, it is concluded that the size of an external radiotherapy bunker should be approximately 110 m^2, including the entry maze and radiation-shielding walls.

In the case of internal radiotherapy bunkers, the required area depends on the choice of catheter insertion concepts. When the catheter insertion application is done in the room, the brachytherapy bunkers are equipped as operating rooms and are sized accordingly. However, if that application is done in a separate room or an operating theater, the brachytherapy bunker could be planned to be smaller. Medical practices in Turkey generally follow like the second alternative, wherein insertion of the catheter takes place outside the bunker in a dedicated procedure room. Therefore, brachytherapy bunkers should be located in an area of approximately 65 m^2, including the entry maze and radiation-shielding walls.

For both external and internal radiotherapy bunkers, an automatic door with neutron-shielding capability should be controlled manually in the case of an emergency, and the swing of the door must not interfere with equipment or patient transfer space. A safety sign and warning lights at the entrance of the treatment room and within the room are essential. Moreover, the floor and ceiling structure should meet the minimum load requirements for equipment, patients, and staff. In order to facilitate bed transfer and provide access to the patient, there should be at least 120 cm of clearance on the other three sides of the treatment table. Furthermore, to gather all services between the control room and the radiotherapy device, a connection duct must be provided between the wall of the treatment room and the control area, and it should be designed so as not to compromise the radiation shield provided by the walls and floor.

Similar to the floor area specifications, external and internal radiotherapy bunkers also need some different internal arrangements due to the distinctive treatment technique and equipment used within the bunkers. The main accoutrements to be provided in external radiotherapy bunkers are:

- external radiotherapy treatment machine,
- last-man-out button located near entrance to maze,
- oxygen and suction on medical services panel,
- nurse call system including emergency call,
- alignment lasers firmly bolted to the structure,
- handwashing basin, shelf, and mirror,
- wall-mounted dispensers for paper towels, paper cups, soap, paper sheets, etc.,
- chair for patient,
- coat hooks,
- emergency stop switch,
- multiple CCTV cameras and audio equipment for patient contact during unaccompanied periods,
- an adequate number of storage areas for patient immobilization and positioning devices (vacuum pads, chest and lung panels, thermoplastic shells, etc.),
- a series of drawers for the storage of specialty products and equipment (breastplates, lung panels, electron applicators, lead end pieces, etc.), and
- ceiling art (fixed or projected) and music systems for patient distraction.

The following facilities should be provided in internal radiotherapy rooms:

- internal radiotherapy treatment machine,
- last-man-out button located near entrance to maze,
- CCTV cameras and audio equipment connecting to control room,
- dimmable lighting system,
- open stainless steel countertop area,
- a medical gas panel with oxygen and suction,

- nurse call system including emergency call,
- a stainless steel hand hygiene sink (with a towel and soap dispenser)
- a large sink for the cleaning of equipment (other than hand hygiene sink for staff), and
- an adequate number of storage spaces for X-ray applicators, accessories, and other equipment.

The optimum radiation oncology department configuration comprises paired bunkers, which assures that the facility can substantially continue operating in the case of a malfunction. Brachytherapy procedures can also be performed in external radiotherapy treatment rooms; however, this leads to difficulties in the maintenance and efficient use of linear accelerators (machines used in external radiotherapy bunkers). Bunkers should be placed to be easily accessible from treatment planning rooms and clinical support spaces and patient areas such as changing cubicles, sub-waiting areas, and toilets.

Clinical support areas should be planned in order to support the procedures carried out in the above-mentioned treatment areas and to perform other medical procedures related to treatment within the department. The clinical support areas of a radiation oncology department are bunker support areas, imaging module, examination module, mold module, and other common support areas.

Radiotherapy bunkers work as a whole with control rooms and some patient amenities such as waiting areas, changing cubicles and toilets (Figure 4.7.). Moreover, especially if children are being treated in the department, an anesthetic room of approximately 20 m^2 is required in close proximity to the bunkers. However, a play therapy room, as recommended in the DH standard (2013a), could replace the need for anesthesia, which is used to sooth pediatric patients through the use of toys and games in a calming environment. For brachytherapy applications, in addition to the mentioned spaces, a procedure room, a pre/post-procedure room, and a radioactive source room should be provided.

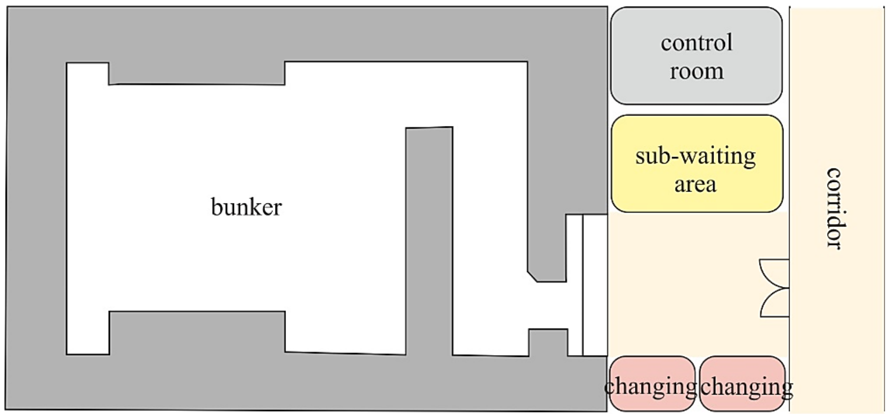


Figure 4.7. Schematic diagram of a bunker with its support areas

A control room is required for each bunker to direct the treatment machine, ensure the positions of patients with the help of cameras and lasers, control the state of the process, and communicate with patients during treatment if needed. Floor area of 20 m^2 and 15 m^2 should be provided for each external radiotherapy and brachytherapy bunker control rooms, respectively. In the room, an appropriate work environment is required considering the space needed for monitors, the machine control console and shelving units to suit the equipment. Waiting areas may be planned as sub-waiting areas associated with a single bunker or pair of bunkers or consolidated within a single area, depending on the size and layout of the department. Additionally, at least two patient changing rooms should be reserved for each bunker, which are lockable, and adjacent to the bunkers, with storage space for valuable items and clothes, and positioned so that individuals in the surrounding areas cannot see the patients when they are dressed or undressed. Patient toilets should be provided close to the treatment rooms and waiting areas considering the privacy of patients.

For brachytherapy bunkers, a procedure room of 24 m^2 should be planned, which is to be equipped with an anesthetic gas system. Additionally, a pre- and post-procedure patient care area must be provided, which is expected to be immediately accessible from procedure rooms and brachytherapy bunkers. The area is required to be planned for a minimum of two patients per bunker and could be arranged as cubicles or rooms according to the department's layout. The room needs to be planned considering patient privacy while also permitting visual observation by medical staff. Moreover, a radioactive source room of 12 m^2 should be designed to provide a suitable environment for the preparation, collection, storage, and transport of solid or sealed radioactive materials used in the brachytherapy process. A shielded workbench should be provided for the preparation and handling of radioactive materials that takes place within the room.

In the imaging module, a CT simulator room (a minimum of 40 m^2), a CT simulator control room (a minimum of 15 m^2), and some patient amenities such as waiting areas, changing cubicles, and toilets should be designed. CT simulator rooms should be sized considering the dimensions of the equipment, the patient's access to the equipment on the stretcher, the medical personnel's access to the equipment and the patient, and service access to the equipment. Orthogonal lasers are an indispensable component of the imaging room to facilitate accurate positioning of patients. The position of the viewing window, which is connected to the control room, should provide the best possible view of the device and patient during the imaging procedure. Moreover, there should be sufficient cupboard and shelf systems and hanging accessories for the equipment in the room. The CT simulator control room should be planned with direct access to the imaging room for each CT simulator. An adequate working area should be reserved for workstations and monitor devices with network points. The other requirements considering patient amenities are similar to those of the bunker support module as mentioned above.

The examination module consists of multi-purpose clinical rooms, where evaluations of patients in initial consultations and examinations are performed during treatment and after completion of therapy, and support areas such as waiting areas, patient toilets, clean/dirty utility rooms, and storage. This area can also be used for the evaluation of emergency patients. In the explanations of the selected standards (Section B.4.3), the sizes of the examination rooms range from 9.3 m^2 to 16 m^2; the lowest and highest values are observed in the FGI (2014) and DH (2013a) standards, respectively. However, as mentioned in Section 4.3.1. On the medical necessities of the chemotherapy department, for the examination rooms to be planned within the department, the design codes given in the 2010 Ministry of Health Guidelines of Turkey in the section on polyclinics can be taken as a reference.

Therefore, the examination rooms should be at least 20 m^2 regarding the assumption that a doctor, a nurse or a medical secretary, a patient and a patient's relative will be present within the room. At least 13 m^2 of empty floor area and 100 cm of clearance on the three sides of the patient's stretcher should be provided within the rooms. The necessary measures should be taken to ensure patient privacy in the rooms. Moreover, all examination rooms should receive direct natural light through appropriately designed windows so that users can see natural views outside. There should be also a system for reducing the light in the room to facilitate the use of the tools that the doctor will utilize during examinations.

The mold module consists of spaces where instruments such as immobilization appliances and masks are produced and tested for patient suitability. The spatial planning of this module has changed considerably with developing technology. In the past, immobilization molds were made with materials such as gypsum and foam over a long period of time with great effort. However, this has been transformed into easy and fast processes with special molding materials, laying the patients on ready-made substrates. Therefore, the detailed explanations and equipment lists in the examined standards need to be updated. On the other hand, this module is still needed for mask production, lead molds, adjustments and trial immobilization of appliances on patients, and storage of those materials.

A lead mold room of a minimum of 20 m^2 should be planned in the mold module in close proximity to the CT simulator room to test the molds there before the actual treatment. There must be enough storage space for the equipment in this room with an exhaust outlet and handwashing station. Additionally, there must be an appliance fitting room where instruments such as immobilization devices and masks are produced and tested on the patient. Since the patient will usually have to be undressed during these procedures, a patient changing room should be adjacent to this room. Moreover, since the procedure can be long and uncomfortable for patients, the room should provide a light, airy environment and be as comfortable as possible. Other design considerations are as follows:

- a stainless steel patient stretcher,
- a handwashing basin, mirror, and shelf,
- a hot water bath with filling and discharging facilities for thermoplastic mask production,
- alignment lasers at the same height as in the radiotherapy bunkers,
- a chair for guests accompanying the patients,
- coat hooks,
- a workstation with a computer network point, and
- storage for raw supplies and prepared appliances.

There are other clinical support areas that should be provided within radiation oncology departments, which are treatment planning offices, staff stations, medication rooms, clean and dirty supply rooms, wheelchair/stretcher holding bays, and storage for equipment and consumables. Wheelchair/stretcher holding bays and clean supply rooms could be arranged as decentralized spaces for ready access from the patient care areas with direct access through an internal corridor. The treatment planning offices should be located in a quiet area, but close to the radiotherapy bunkers.

4.3.3. Inpatient Care Services

The main treatment areas of inpatient care services are patient bedrooms. These rooms could be designed in single-bed or multi-bed layouts. While private hospitals of Turkey prefer single-bed patient rooms, the majority of patient rooms in state and university hospitals are arena-type multi-bed rooms. However, with the recently built city hospitals, a different awareness has been developed, and a trend has been initiated in which intensive care units consist of single-bed rooms, while acute care services have patient rooms for up to two people.

The advantages and disadvantages of single-bed and multi-bed patient rooms have been evaluated and discussed in many studies. Such comparisons are also included in the examined standards given in Section C.4, and some conclusions are reached. While some standards require only single-bed patient rooms, some standards state that hospitals should include both single- and multi-bed patient rooms. On the other hand, the MH regulations (2010, 2011b, 2012) of Turkey state that while the maximum capacity of a room is two patients in acute care inpatient services, intensive care patient areas should be designed for one patient in either room or arena type. However, single rooms are recommended in both cases for the sake of infection control, patient privacy, patient safety, and long-term economics (MH, 2010, 2012). The Turkish codes are found reasonable and in accordance with the requirements of the day. However, if there is renovation work and it is not possible to maintain the patient capacity conditions presented in the codes, each patient room could be designed for a maximum of three patients for acute care inpatient services.

The total number of beds in an inpatient care service depends on the service type (acute or intensive care) and the service needs of the individual healthcare facility. Depending on the number of beds and planning layout, inpatient care service wards can be arranged as a single service or could be divided into clusters. According to the Turkish regulations (MH, 2011b), intensive care inpatient services with a bed number of 10 or less can be arranged as a single service. However, services with more than 10 beds should be divided into multiple units of up to 6 beds (MH, 2011b). Moreover, pediatric inpatient care rooms should be separated from units serving adult populations and include provisions for family support.

The design of an inpatient care bedroom should be considered to comprise three separate functional zones: (1) patient care, (2) family, and (3) staff. In order to encourage family involvement in care, bedrooms should provide a designated area for family members. However, the interference of families with the clinical work within the room should be avoided, and minimizing overlaps and conflicts between the activities in each zone should be the primary design goal (Figure 4.8.).

Each patient room should be equipped with a clinical handwashing basin close to the entrance, a medical gas panel, a soiled linen hamper, storage for patients' and families' personal belongings, a recliner/pull-out chair for families, a wall- or ceiling-mounted clock, a telephone, and a privacy curtain (for shared bedrooms). Each bed should have access to daylight. However, the amount of daylight should be controllable. The height of the windowsill should be low enough to provide the maximum view from the patient's bed. The Turkish regulations (MH, 2010) indicate that each intensive care patient room should have a view through the windows, and the distance between each bed and the windows should not exceed 12 m.

Bed spacing and clearances are critical considerations in determining final room sizes. In the standards examined within the scope of this thesis, there are differences in terms of the number of clearances. Moreover, aside from these differences between the standards, the Turkish legislation contains contradictions within itself. The

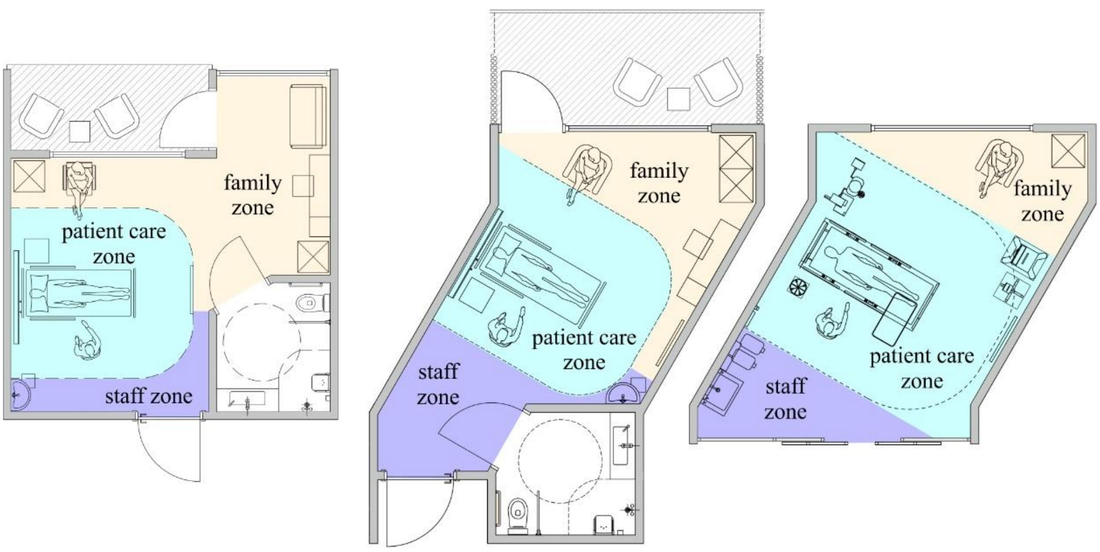


Figure 4.8. Functional zones of chemotherapy bay, acute care patient room and intensive care patient room, respectively

comparison of clearance requirements of selected standards can be seen in Table C.5. For acute care inpatient services, while the DVA (2011) and FGI (2014) standards call for lower clearances, the majority of standards propose a clearance of 120 cm. Therefore, it can be concluded that a minimum of 120 cm of clearance should be maintained from three sides of the patient’s bed (excluding head of the bed), and the minimum distance between beds should be 120 cm in multi-bed patient rooms for easy movement of staff, appliances, and patient beds. By the same token, in intensive care inpatient services, the beds should be arranged in such a way that there is a minimum clearance of 150 cm from three sides of the patient’s bed and a minimum of 30 cm from the head of the bed to the wall (Figure 4.9.). Any fixed obstruction, including furniture, bed screens, or walls, must be avoided within these margins to facilitate resuscitation and other medical applications appropriately.

Similar to the clearance values, there are different considerations for required room areas in the examined standards (Table C.5). Moreover, there are inconsistencies within the Turkish legislation. However, when the explanations are compared with room size values, it is realized that the higher values are seen in the standards that require family zones within patient rooms. Therefore, it is inferred that while acute care patient rooms should have a minimum area of 20 m^2 in single-bed rooms and 15 m^2 per bed in multiple-bed rooms, intensive care patient rooms should have a minimum of 24 m^2 of floor area (Figures 4.10., 4.11 and 4.12.).

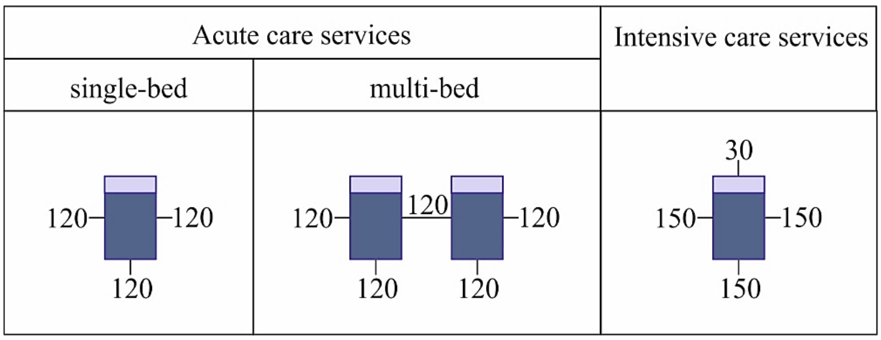


Figure 4.9. Proposed clearance requirements for inpatient care service patient rooms

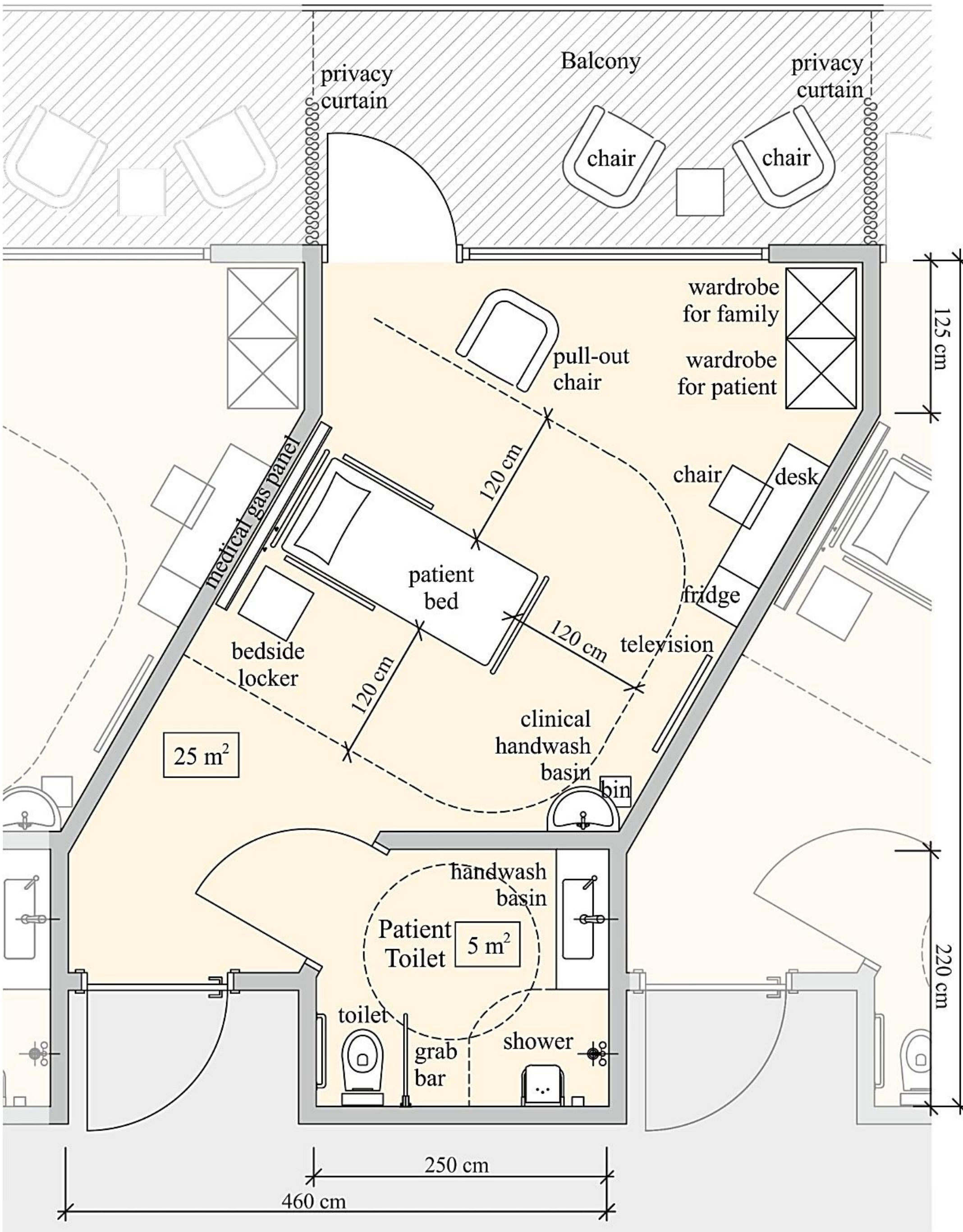


Figure 4.10. Proposed acute care inpatient room

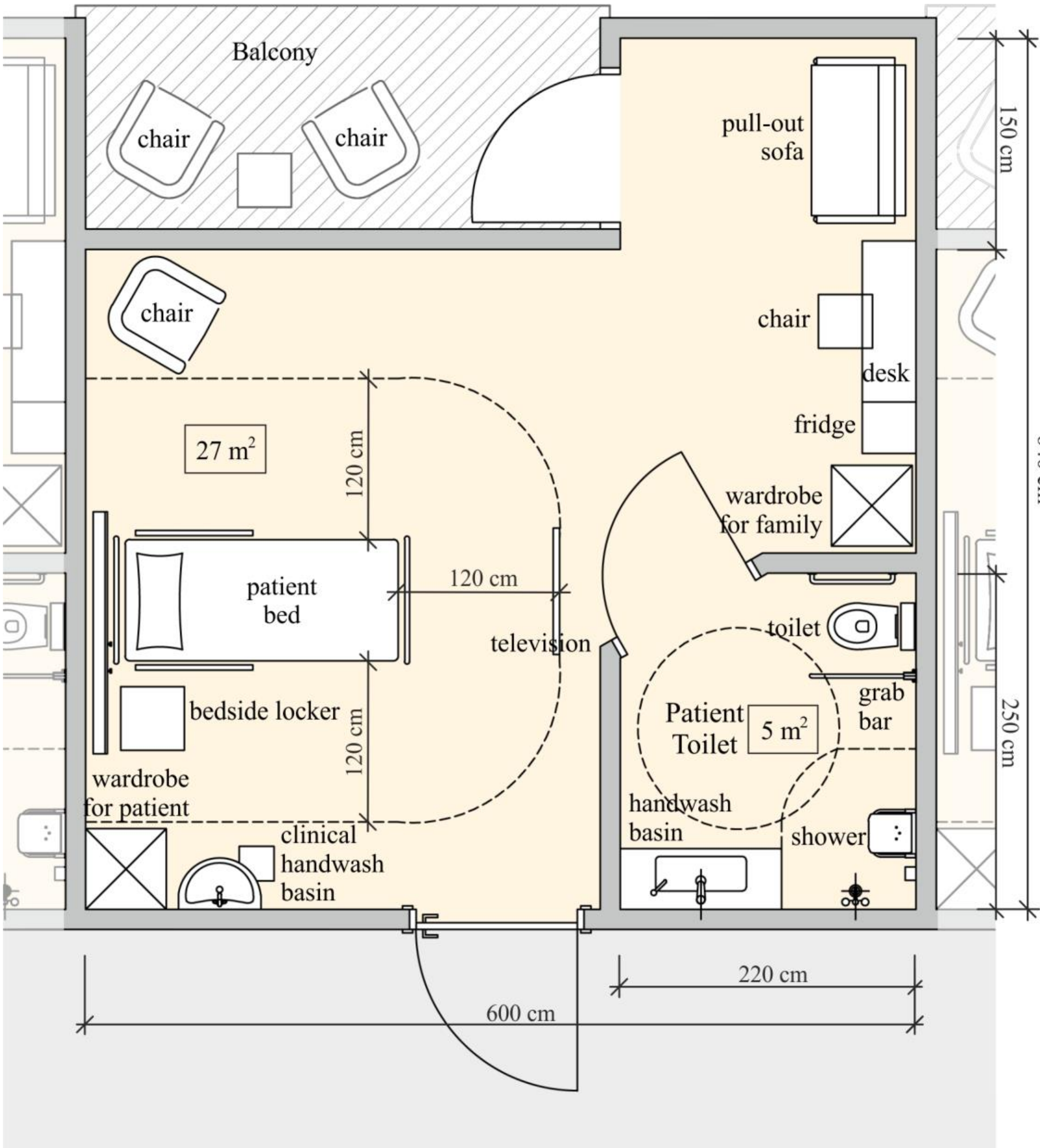


Figure 4.11. Proposed acute care inpatient room

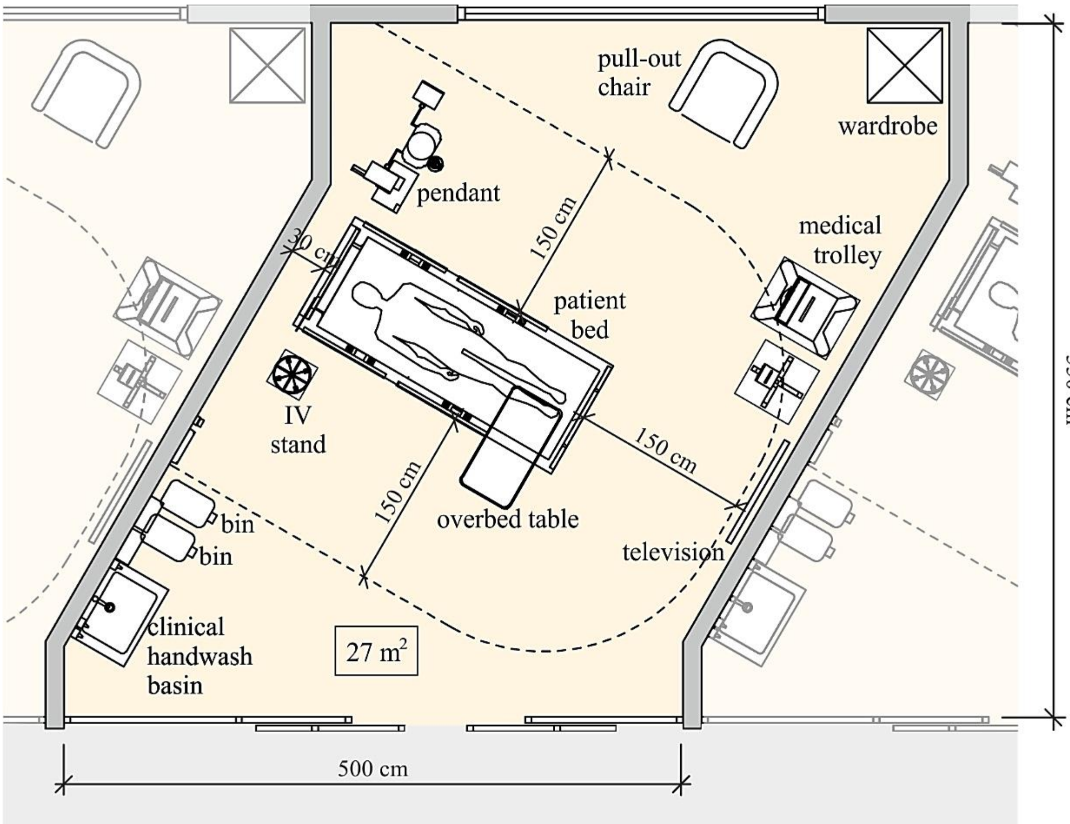


Figure 4.12. Proposed intensive care inpatient room

According to the MH regulation (2010), at least one isolation patient room should be provided in each inpatient service. Isolation patient rooms should be close to the entry and away from other patient areas and main corridors to limit the travel distance of immunosuppressed/infectious patients in the service. Each room should have only one bed, with a minimum of 15 m^2 of floor area (MH, 2010). Additionally, each of the isolation rooms should have an anteroom of a minimum of 4 m^2 for handwashing, dressing, and holding clean/dirty materials.

According to the examined standards, each patient room needs direct access to a bathroom. However, according to the Turkish legislation (MH, 2011b, 2012), bathrooms are prohibited in sterile areas of intensive care services, and hospitals in Turkey are designed according to this legislation. Therefore, only for acute care inpatient services, each patient (including patients in isolation rooms) should have access to a bathroom without leaving his or her room in the general corridor. The bathrooms cannot be smaller than 4.5 m^2, and should include toilets, showers, and handwashing sections. Bathrooms can have a significant impact on the bedroom regarding views to and from the bed (Figure 4.13.). Because of that, bathrooms should be positioned appropriately to ensure maximum visibility of patients from the corridor and the nurse stations of the service.

Patient rooms for unsealed-source brachytherapy treatment require different planning. To prevent radiation from passing through the room into the surrounding areas, the enclosing structure of these rooms must be shielded. Radiation protection includes thick concrete walls, lead coating (if needed), and shielded doors and windows. Moreover, there should be a specially designed drainage system in the bathroom areas to deal with radioactive waste. Due to radiation concerns, a monitoring system should be established for observation and communication.

Clinical support areas of inpatient care services are composed of:

- staff stations,
- procedure rooms (for acute care inpatient services),
- medication rooms,
- assisted bathroom,
- clean workroom,

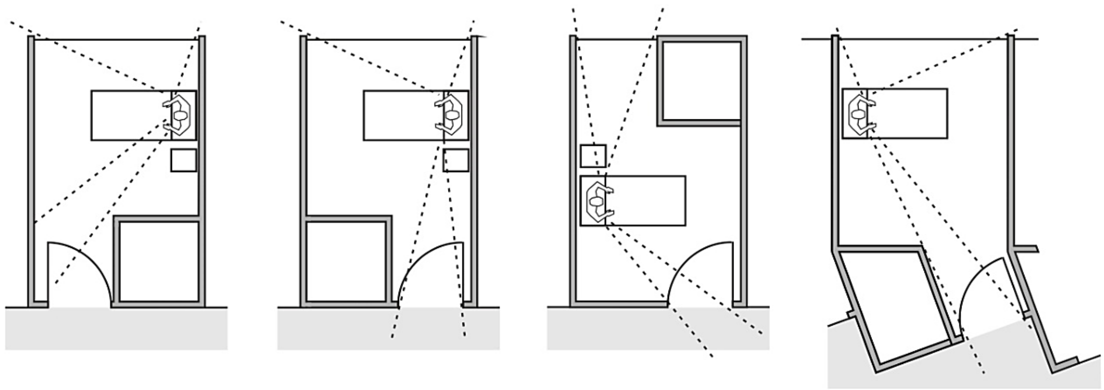


Figure 4.13. Four sample patient room layouts

- clean/dirty utility rooms,
- disposal rooms, and
- storage areas.

There needs to be a main nurse station within each cluster, which is located centrally and ideally in close proximity to the service entrance. This position serves three key functions: providing access control of the unit, providing surveillance of the surrounding patient rooms, and acting as a central location for all staff information and interaction. Staff stations should provide space for clinical handwashing, resuscitation equipment, and monitoring equipment. If telemetry monitoring and pneumatic tube system are authorized in the service, they should be located at or adjacent to the central nurse station for ease of control.

Additionally, a procedure room is required to carry out clinical procedures in private. However, in services composed of all single-bed patient rooms, like intensive care services, this room may be omitted. A medication room is needed for preparing, dispensing, storing, and administering medications including controlled drugs, medicines requiring refrigeration, and consumables such as syringes and needles. In order to maximize convenience and minimize travel distance, medication rooms, as highly used support areas, should be located near the nurse stations (Figure 4.14.). Moreover, the room should contain a work counter, handwashing station, lockable refrigerator, lockable storage for controlled drugs, and sharps containers.

Assisted bathrooms are required for intensive care inpatient services, and should have a minimum width of 350 cm, a minimum of 180 and 120 cm of clearance at the two sides for staff movement around a stretcher. Other support areas such as clean utility room, dirty utility room, and clean linen room may be decentralized in larger inpatient services to provide staff with shorter travel distances, and reduce the potential of cross-infection. Storage areas should have separate spaces for clean linen, general equipment, stretchers/wheelchairs, and emergency equipment in order to keep the main circulation corridor of the service free of objects.

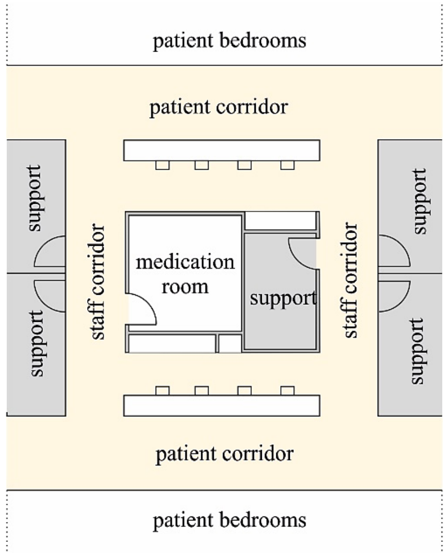


Figure 4.14. A sample schematic plan of a nurse station

4.4. Patient & Family/Visitor Experience

The first few moments in a healthcare facility campus create indelible and enduring memories for individuals. It is critical that the built environment transmit a positive first impression versus a negative one that is vague, confusing, or worse. If the healthcare facility lacks spatial hierarchy, it is unsettling for patients and visitors to fall into a lobby suddenly. Therefore, there should be a well-designed lobby as a landmark at the entrance immediately visible from outside so that drivers can drop off their passengers – both patients and visitors – in front of it. This is critical for effective navigational orientation and a positive first impression among patients and visitors.

People want to be seen, expected, and invited. In addition, considering the psychologically vulnerable state of cancer patients together with their relatives, the design of these entrance areas of cancer treatment services is of great importance. Therefore, as the second step, the abovementioned public entry should direct patients to a main reception desk and a waiting area. This combined area is the nucleus of motion, where multiple functions are supported (Figure 4.15.). The reception desk

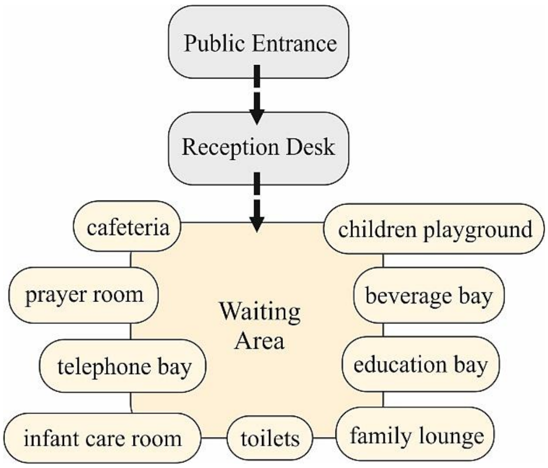


Figure 4.15 Schematic diagram of entrance and waiting-related spaces

welcomes patients, families and visitors; controls access to the patient areas; and prevents unauthorized entries. After that, time is spent in the waiting room before patient admission operations, clinical procedures, submission of test results, or other follow-up procedures.

The waiting area could be separated into inpatient and outpatient waiting. However, the total area must be capable of accommodating the patient, family and visitor capacity. The number of patients can be easily estimated from the number of treatment rooms (i.e. chemotherapy seats, radiation oncology bunkers, inpatient bedrooms). However, the number of patients’ companions is more difficult to determine and it changes from country to country, even from city to city, depending on the culture of the society. The design codes given in the 2010 MH guidelines in the sections on inpatient treatment units and outpatient clinics can be taken as a reference for calculating the number of people, which states that an average of 1.8 companions come to the outpatient clinics with each patient. Therefore, the total number of companions could be calculated by multiplying the estimated number of patients by 1.8. Moreover, inpatient waiting should have space for patients in wheelchairs, on stretchers, or in beds.

The entrance and waiting areas of hospitals should be designed with legibility where there is a certain hierarchy of space; public and private places are clearly distinguished; entrances and exits are obvious; and different parts of the building have different qualities, such as varied uses of colors, material shifts, daylight, mass/void hierarchy, textures, proportions, and scales. Therefore, the connection points of different services, functions, and supportive areas, with the waiting areas should be easily accessible and understandable. Directional plates or similar visual aids should be provided at a comfortable eye-level height to promote wayfinding. The required amenities around the waiting room to support patients, families, and visitors are:

- children’s playground bay/room,
- beverage bay/pantry,
- health education bay/room,
- toilets,
- infant feeding and nappy changing room,
- telephone bay,
- place for meditation and prayer,
- cafeteria, and
- family lounges for intensive care inpatient services.

Children’s playground areas should provide appropriate spaces for children to spend time and expend excess energy. They can be designed as bays or as rooms, but it is essential to locate them near enough to waiting rooms so that parents can supervise their children. Beverage bays where occupants can drink water or hot beverages free of charge could be enough for the waiting areas of inpatient care services. However, due to expectative long waiting periods of chemotherapy and radiotherapy procedures, a pantry including a handwashing basin, a countertop, a small fridge, a microwave oven, and cupboards is recommended. Health education bay or rooms should be designed to provide a small cancer library supported with a television showing educational cancer-related videos for patients and relatives who want to learn more about the disease.

Toilets, infant feeding rooms and nappy changing rooms should be located at a visible point. The number of public toilets should be determined by dividing the total estimated number of users by twelve (see Section 4.5.). A single-toilet layout with its own hand basin and a proper door in a doorframe is more preferable to cabin style toilets due to privacy and confidentiality issues. Cabin-style toilets should be separated for men and women, and each toilet area cannot be smaller than 100 × 140 cm. Single toilets cannot be less than 3 m^2, including the hand-washing area. Additionally, each department should have at least one disabled toilet with hand-washing area. The size of these rooms should be compatible with the related regulations of the MH and Turkish Statistical Institute.

Telephone bays should not be in a highly public area, such as immediately next to the main admission counter or window, to ensure the confidentiality of patients. The optimum location for telephone bays is in a distant corner of the waiting room or, preferably, in an alcove next to the waiting room. Additionally, at least one dedicated quiet place to support meditation and prayer needs to be provided.

Family lounges are required, especially for intensive care inpatient services where overnight accommodations of companions within patient rooms are forbidden. Families who travel from different cities and cannot stay somewhere else need a place to sleep. In particular, cancer patients may require lengthy periods of hospitalization in intensive care services. Therefore, healthcare facilities should provide adequate spaces for their companions' overnight accommodations. Those rooms should be furnished with sofas, chairs that can transform into sleeping units, and a small kitchen that includes facilities for food storage, food preparation and dishwashing. If a panty is planned within the entrance area, the kitchen area in family lounges could be eliminated.

Aside from the required amenities mentioned above, additional patient support services such as wig attachment and prosthetic services, complementary therapies and shopping spots are important design features for cancer treatment services. These areas should ideally be planned within the departments; otherwise, they should be located at the closest point. Furthermore, there should be a cafeteria located near the entrance and waiting area for patients, families, staff, and visitors. It is preferred to connect the cafeteria to the entrance with the help of a corridor.

The third step after the entrance areas is the treatment rooms in the scope of patient and family experience. In recent years, the role of family members has changed from being concerned bystanders to being members of the health care team. Consequently, the concept of patient- and family-centered care has emerged, and its effectiveness has been proven in various studies. Those phrases are frequently accompanied by terms such as ‘partnership’ and ‘collaboration’. Because of that, healthcare facilities have been proposed to address the needs of not only the patient, but also their family members. Moreover, in order to encourage family involvement in care, treatment areas such as chemotherapy rooms or inpatient care bedrooms should provide seating and storage for the personal belongings of family members to facilitate family interaction with treatment without limiting the movement of staff. Additionally, patients and their companions should be considered together, and architectural plans should be developed to ensure that medical staff are in close contact with both patients and their relatives while exchanging information.

In acute care inpatient services, although there are family zones in each patient room, additional family and visitor spaces called ‘day rooms’ should be available to minimize the impact of noise and activity in patient rooms. Dayrooms are actually multipurpose rooms, which may be used as dining areas, celebration or mourning spaces, or a space for media and internet access. Therefore, these rooms should be designed with a flexible understanding to be adaptable for diverse activities.

4.5. Healthy Working Environments

Emotional and psychosocial effects of cancer, especially on patients and their relatives, have been examined in Section 2.1.1., and the results of relevant studies have been presented. In this context, it is clear that there is a high level of stress within cancer treatment services. A healthy working environment is ideal and essential when it comes to maintaining a positive outcome in a stressful atmosphere, and the most important thing that affects the morale and satisfaction of staff and how productive and efficient they can be is their working environment. A healthy workplace increases performance and reduces costs associated with absenteeism, medical claims, and repeated processes due to accidents or mistakes.

In this context, a healthy environment not only supports the need for medical attention, it also includes the physical environment of the workplace and the safety of the staff. Therefore, as explained in the section on internal function relations, areas in which only staff members are active should be located as far away as possible from patient-related areas, and their circulation should be isolated. Moreover, dedicated staff access could be identified separately from patient registration and waiting areas. This is one of the most essential design goals in terms of both creating a calm working and resting area and ensuring the security and confidentiality of staff.

Although the number of rooms to be planned depends on the number of staff when the unit is fully functional, required staff areas mainly involve:

- offices,
- staff lounges with mini kitchen,
- on-call rooms, especially for intensive care inpatient services,
- meeting/seminar/conference rooms,
- changing rooms and lockers,
- toilets, and
- educational areas such as a library.

Offices are specialized work spaces of staff that are essential for daily operations. These spaces could be planned as rooms for one or two people, or as open office arrangements according to the number of staff and the layout of the department. The 2010 Ministry of Health guidelines state that for administrative personnel an area of 8 to 12 m^2 should be allocated for each person for room-type offices, and 5 m^2 of space should be reserved per person in open offices. Even though, 8 m^2 is considered to be quite small for a single-person office space, 12 m^2 for one-person offices and 16 m^2 for two-person offices would be more sufficient. For open office systems, 5 m^2 per person has been found to be quite inadequate regarding additional area requirements for personalized working spaces. Apart from desks, shelves, chairs and cabinets, a personalized working space should provide area for plants, closets for coats, spaces for personal items etc. In terms of open office area requirements, the DH standard (2013a) is considered to be more appropriate, which states that approximately 6.5 m^2 should be provided for each person. All offices should receive direct or indirect natural light through appropriately designed windows so that staff can see outside views.

Another important requirement to create a healthy working environment is to provide resting spaces for staff to take a break from their work between shifts. Regular breaks help to relieve muscle fatigue and eyestrain, and restore concentration level. Therefore, centralized or decentralized staff lounges should be provided and sized to accommodate all staff. According to the facility management, separate lounges could be requested for clinic and non-clinic staff. The room should be equipped with comfortable furniture, working equipment, and a mini kitchen for small snacks and beverages. Decorative items and daily objects would help staff move away from the universe of cancer and allow for a pause from the challenging working conditions of cancer treatment services. The lounges should receive direct natural light and provide outside views which will give the staff a moment of being and a feeling of ease and refreshment.

On-call rooms are required for sleeping and personal care accommodations for intensive care inpatient service staff on 24-hour on-call work schedules. They should be located close to the inpatient services that they serve and shall include:

- furnishings for sleeping and rest (bed, sofa, etc.),
- individually secured storage for personal items,
- a communication system, and

- a bathroom including a toilet, shower, and hand-washing station.

The size of changing rooms and the number of toilets should be determined according to the number of staff working in the department. However, it is required to plan a minimum of 1.4 m^2 cabin area for each person in changing rooms. Moreover, for the toilets to be planned for staff within the department, the design codes given in the 2010 MH regulation within the sections on inpatient treatment units and clinics can be taken as a reference. Therefore, the number of toilets should be determined by dividing the total number of staff by twelve. In cabin-style toilets, each toilet area cannot be smaller than 100 × 140 cm, and should be separated for men and women. Single toilets cannot be less than 3 m^2, including the hand-washing area. Additionally, each department should have at least one disabled toilet with hand-washing area. The size of those rooms should be compatible with the related regulation of the MH and Turkish Statistical Institute. Besides the changing rooms, private lockers for staff in or near the staff lounges are required for storage of small personal items.

Meeting, seminar, conference and educational rooms should be planned and positioned to accommodate participants from outside the unit when necessary. These rooms should have sufficient furniture for seating and the necessary media and sound systems. Acoustic measures should be taken to prevent sound from leaving and entering the rooms, and to provide comfortable working environments.

4.6. Interior Design

It is known from previous studies that healthcare facilities that have poor interior designs are associated with adverse health effects such as increased anxiety, the need for analgesic drugs, insomnia and higher delirium rates. Moreover, environments that are carelessly arranged and inadequately decorated can communicate negative messages regarding value and the absence of caring to the occupants. On the other hand, natural and home-like physical environments can alleviate psychological stress and have a positive effect on patients' healing and well-being.

The entrance point of a healthcare facility together with the lobby or atrium should be considered as a landmark and a symbolic gateway. It will give a message about the quality of both the health center and its clinical care. Therefore, instead of rigid seating rows, harsh floor and wall surfaces, and dull colors, entrance areas should be designed as inviting and pleasant spaces with different kinds of plants, diffused natural light, comfortable seating, a palette of warm colors, and textured floor and wall surfaces. In this way, entrance lobbies will evolve from having purely circulation functions to being socialized public spaces where people talk to each other, spend time near a piece of art or water feature, or just sit and enjoy the atmosphere.

Thus, minimizing the institutional image of the department and a providing friendly environment should be among the prime design objectives of waiting areas. Paintings depicting natural images (instead of abstract images) and various art objects should be displayed. The furniture used within the space should be chosen to create natural and home-like physical environments. Various groups of seating areas should be provided to maintain the freedom of patients to choose to be involved with fellow patients or to be alone with oneself or with family members. Moreover, continuity should be provided between the entrance space and the landscape arrangement of the buildings. The slope of any ramp should be designed at up to five percent considering stretcher/wheelchair users and elderly people. Elevation differences should not be used at all considering the comfort of all users.

Hospital buildings are generally structures with many functions. For this reason, it is inevitable to encounter long corridors, labyrinth-like routes, and confusing floor plans unless proper planning is done from the user's point of view. These confusing spaces prevent inhabitants from using their own mental maps and increase their stress levels. Therefore, to minimize the tangled image of hospitals, long double-loaded windowless corridors and monotonous appearances of floors, walls, and ceilings should be avoided. More easily navigated healthcare buildings should be created by utilizing memorable visual connections like landmarks in the form of plants, pictures, skylights and clerestories, material shifts, changes in color schemes, water elements, different floor patterns, works of art, etc. These visual features connect with the inhabitants non-verbally, help hospital buildings to gain an identity, and establish the genius loci (Figure 4.16.).

Although it is indispensable to support wayfinding with the help of easily-understandable directional and informational signage, different types of non-verbal markers can also be effective. For instance, aside from painted stripes on the floor, break up points on hospital routes with visual connections to the exterior landscape, natural light at the end of a corridor, and different ceiling heights, textures and colors can all aid in spatial orientation in healthcare facilities.

Hospital users prefer different types of materials and textures around themselves. Materials that trigger tactile sensations and with which users can interact are especially desirable. However, overly rough or bright textural surfaces of the walls, floorings, and other fittings should not be used due to possible complaints about dizziness and nausea regarding optical illusion effects.

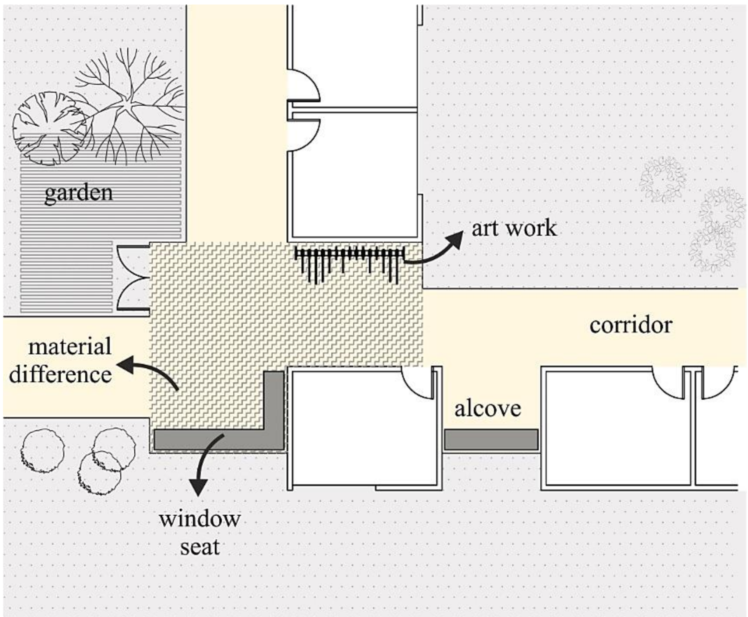


Figure 4.16. Schematic drawing of circulation spaces

Materials used in heavy-duty spaces such as public areas and treatment rooms should be designed for ease of maintenance. Considering the insufficiency of cancer patients' immune systems, hygienic factors are particularly important in material selection. Therefore, furnishings and the surfaces of walls, floors and ceilings should be as durable and seamless as possible, and able to be cleaned without extensive effort. On the other hand, this should not be allowed to make the design monotonous, uninspired, and institutional. Because of that, a balance should be maintained between an inspired interior design and ease of maintenance. For example, wood as a symbol of life and nature could be an alternative material for healthcare facilities both structurally and non-structurally to benefit from its therapeutic advantages.

Hospital furniture should be selected with respect to the physical conditions of patients. Therefore, instead of very low and soft seating, sofas and chairs that have higher seating surfaces should be preferred regarding ease of sitting down and standing up. Additionally, adequate furniture should be provided for patients, families, and staff to store and display their personal belongings. Personal items help to reconcile the generic and phlegmatical environment of the hospital with a sense of homeliness and control for the patient. Moreover, decorative items and daily objects mean a break for staff to get away from the universe of disease and the working environment.

Hospital users demand diversity in colors. However, the choice of colors should be made very carefully considering the function of the space and the length of time one will spend there. Moreover, when considering colors, not only walls, but also floors, ceilings, furniture and all other architectural aspects should be taken into account. Warm colors such as yellow and orange promote social interaction, while cool colors such as green and blue cause the body to produce calming hormones. Therefore, in public spaces (i.e. waiting areas and lounges) a palette of warmer colors would be appropriate, whereas, spaces for long-term hospital patients and staff should be decorated with colder colors. In any case, too much use of one color, too much variation in color, and dark hues of any colors should be avoided.

It is proven that access to natural light and access to views are among the most critical factors affecting the healing of patients. Additionally, increased natural light and views of natural elements have a positive effect on work performance and job retention, giving the staff a feeling of ease and refreshment. For this reason, spaces where occupants try to sit, rest, or work for long periods of time, such as waiting rooms, lounges, and offices, should particularly receive direct natural light through appropriately designed windows so that patients, relatives and staff can enjoy natural views outside (Figure 4.17.). In that sense, a landscape design in front of those areas is highly recommended, which should consist of mainly vegetation and water elements. The positioning and orientation of seats and desks should be determined to maximize the access to the view. Moreover, the height of the windowsills should be low enough to provide the maximum view from the patient's bed.

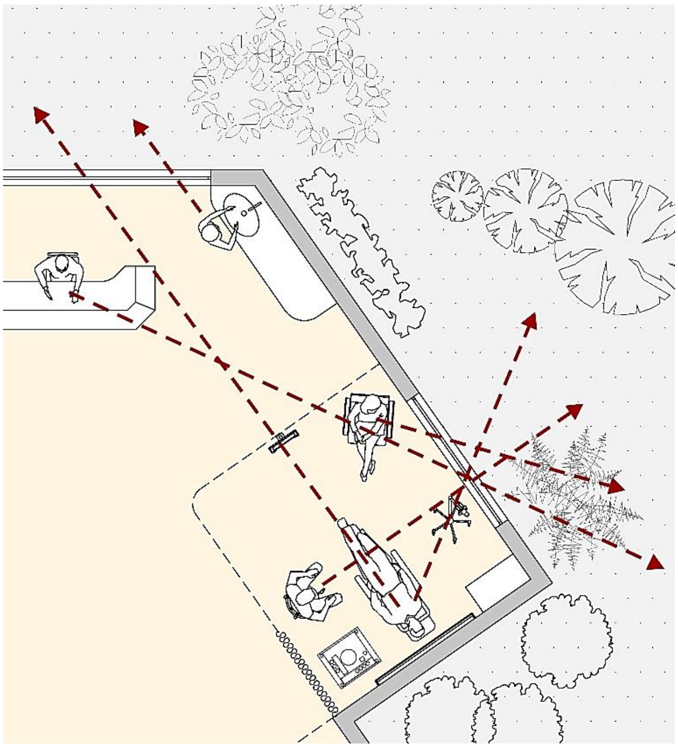


Figure 4.17. Access to view opportunities of proposed chemotherapy arena plan

For cancer patients, the existence of natural light would provide an opportunity to stimulate their thoughts and shift the focus away from their disease, while having positive value as an escape from the metaphor of darkness in a symbolic way. For instance, natural light within the darkness of the radiation oncology department, which has thick concrete walls for protection against radiation, has a refreshing effect on the mind and provides a feeling of ease and energy for patients and staff. Therefore, although radiation oncology departments are generally located on basement floors for statical reasons, skylights should be provided to allow daylight within the department and to create a vertical connection with nature (Figure 4.18.).

In terms of artificial lighting designs, studies show that hospital users demand diversity in lighting. Therefore, lighting systems with different characteristics and tones should be planned within patient and staff areas and, apart from medical applications, patients and staff should be able to control all light sources and their intensities as they want. This allows for personal control of the ambient conditions, which enhances the patient's comfort and reduces anxiety and stress.

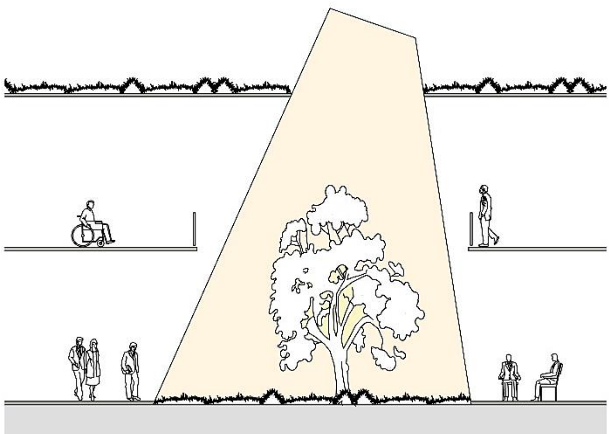


Figure 4.18. Schematic drawing of a skylight in healthcare facilities

For radiation oncology departments, the nature of the treatment and the dominating presence of the equipment generally result in anxiety and a depressing experience for patients. For this reason, innovative design features such as murals and paintings should be used to create a calming and pleasant environment.

4.7. Social Interaction and Privacy

Healthcare facilities as public areas need to provide supportive, flexible, and social spaces for all. Studies state that there is a positive relationship between a person's health status and number of social connections. Additionally, interesting activities or conversations can distract patients' minds from their situations for a while, that giving the day meaning and creating hope for the future among patients and family members. Entrance atriums, lobbies, waiting areas, cafeterias, family and staff lounges, dayrooms, terraces, balconies, courtyards, and gardens are some of the spaces in which social interactions with other patients, families, and visitors are supported. Therefore, every design arrangement should be considered to make those spaces proper for socialization. People should find appropriate places to talk, sit, eat, laugh or cry, and celebrate something comfortably, without disturbing others.

Although single-bed patient rooms are more preferable than double or multi-bed rooms according to studies, multi-bed patient rooms could provide an opportunity for social recognition and entertaining activities in one's spare time. On the other hand, the addition of comfortable chairs and sofas to single-bed rooms can also promote interactions with staff, relatives, and patients from other rooms, thus supporting the maintenance of social relations in the environment. At this point, it is essential to distinguish unwanted interactions with others from desirable and controllable ones. For instance, in chemotherapy and inpatient care rooms, this can be accomplished by careful design of privacy curtains, well-positioned and easily deployed wall partitions, proper bed/chair orientation, strategically located furniture for personal objects, and proper door and window orientation. Additionally, various seating arrangements in public spaces such as waiting rooms, atriums and lounges should allow the user to choose to be involved with fellow patients or to be alone with oneself or other family members.

Therefore, it can be concluded that although users of hospitals need well-designed social spaces for respite and communication, they are highly vulnerable in terms of privacy as they try to maintain their daily habits in hospital conditions as much as possible during hospitalization or working hours. This is even more evident in patients who are confined to bed or have limited ability to respond.

Patient confidentiality should be a high priority in every respect, especially in public areas of hospitals such as lobbies and waiting rooms, which are generally crowded spaces. It is unacceptable to ask patients and families to submit personal data in a public area in front of an open desk or through a tiny cutout in a glass window. Hospital environments should thus be designed to meet the working needs of staff without compromising patient privacy. Neutral zones should be provided where medical and administrative staff can meet without the visual and auditory surveillance of others.

To maintain privacy during registration and admission procedures, conversations between patients/families and staff should be conducted within semi-private rooms instead of alcoves or, worse, at open desks. These rooms should be organized to be easily accessible from waiting areas. A space for two seats for patients and family members, a workspace for staff, and a desk between them is required within the room. Other related offices of staff could be connected through a corridor from the staff side of the room (Figure 4.19.).

In addition to admission and registration rooms, window seats and alcoves should be designed throughout the healthcare facility to provide semi-private places for informal conversation among families, patients and staff. These semi-private nodes are recommended to be planned along corridors, near dayrooms, between inpatient care rooms, at the ends of hallways, and around treatment rooms (Figure 4.15.). Particularly, in terms of cancer treatment services, these places are essential

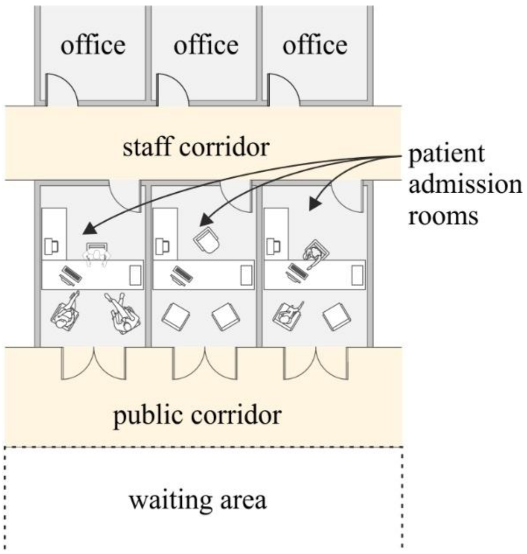


Figure 4.19. Schematic drawing of patient intake rooms

considering the hard times and experiences of patients and their families in terms of coping with the patients' prognosis and treatment process. These people need places other than patient rooms or public areas to talk, cry, or consult medical staff in private. In this regard, the key design goal fort healthcare design is to create spaces with flexible possibilities for users (patients, families, visitors, and staff) to be alone or with others, and to allow them to control their privacy levels.

4.8. Safety

Healthcare facilities are open to the public 24 hours a day and accommodate a community of generally stressed people with limited mobility. Therefore, these buildings should be designed to create a safe environment inside and outside for all hospital users. The site plan should be planned in such a way that control and safety of the facility can be ensured, with access roads clearly defined and easily accessible in case of emergency. The key elements for creating a safe environment are the provision of appropriate external lighting and information, and security services in building entrances and car parks.

A reliable life safety program should be established to protect occupants, building materials, structures, and building functions. By limiting the development and spread of a fire within its area of origin, the need for total evacuation of the occupants could be avoided. Therefore, the facility needs careful planning in terms of life and fire safety regarding structural fire resistance, building fire partitioning, fire detection systems, smoke control, emergency power, and emergency exit lighting.

In addition to taking necessary precautions against fires and disasters, caution should be exercised against personal attacks and theft. Necessary measures should be taken to protect the personal belongings of patients, relatives and staff. The physical environment should be planned to support all safety measures of the health institution. For instance, continuity should be provided between the interiors and the landscape arrangements of the buildings. The slope of any ramp should be designed at up to five percent considering stretcher/wheelchair users and elderly people. Elevation differences should be completely avoided regarding the comfort of all users. Moreover, to minimize accidents within children's playground areas, necessary design considerations for shading, boundaries, soft and absorptive wall and floor materials, and adequate visual connectivity with adjacent areas must be applied.

Radiation safety is of importance in cancer treatment services, especially in the design of radiation oncology departments. In radiotherapy process areas such as linear accelerator and simulation rooms, in order to provide the necessary radiation protection, reinforced concrete walls, floors and ceilings are required in accordance with the legislation. Layouts should be designed to prevent the escape of radioactive particles. Moreover, openings into the room, including doors, ductwork, vents, and electrical raceways and conduits, should be baffled to prevent direct exposure to other areas of the facility. In Turkey, the Turkish Atomic Energy Authority [TAEK] conducts the authorization and supervision activities regarding the safe use of radioactive materials. People or institutions that would use radioactive materials apply for a license together with the required documents determined by the TAEK. The related TAEK department performs radiation controls in order to determine the suitability of the conditions where the radiation source is present and working according to codes of radiation safety regulations with the intent of protecting people and the environment against ionizing radiation. As a result, the TAEK issues a license as a basis for authorization to use radioactive materials and radiation equipment, and to control them regarding radiation protection.

4.9. Landscape Design and Outdoor Relations

Until recently, hospitals were perceived as only interior areas of built environments. However, especially in light of recent studies about the impact of natural areas on human health, hospitals should be regarded as campuses rather than a series of buildings. In this context, the barriers between the meanings of ‘indoor’ versus ‘outdoor’ should be reconsidered by transactive layering of space. Therefore, healthcare facilities should establish a continuum between exterior and interior realms through the provision of social amenities that extend both outward and inward.

Courtyards and landscape areas of healthcare facilities should be included in the early briefs of design the process as therapeutic areas for both formal and casual interactions among patients, families, staff, and visitors. It is recommended to reserve green areas that are at least equal to the footprint of the building itself to meet the needs properly. Although there is a general tendency to assume that garden areas would be used by patients and their families, those areas should be designed for equal use by patients, family members, visitors, and staff.

It is known from previous studies that exposure to natural landscapes and greenery as a positive distraction and a temporary escape help to reduce stress hormones and blood pressure. Therefore, the ground surfaces of healthcare gardens should present an extensive palette of textures, such as stone, grass, sand, pebbles, etc., to enhance distraction and provoke sensations. However, this mixture of hard and soft surfaces should also support universal design code so that all users, regardless of age or physical capability, can utilize the area. In addition to ground pavements, water elements such as ponds, fountains, and small waterfalls are highly recommended to provide a memorable and positive sensory experience. Designing seating and view terraces around these amenities would be effective to enhance the sensory impact.

Moreover, a well-designed garden could affect health outcomes by providing options for personal preferences. This sense of control reduces stress, increases the ability to cope with stress, and improves overall well-being. Therefore, providing alternative routes to wander, different places to sit, and varying activities that one can choose from are important design goals of successful landscaping. In this regard, there should be places for physical therapy, individual or group counseling, exercise, sitting, walking, listening, and observation within the garden. For instance, a partially covered lawn offering a sense of protection and sufficient enclosure could be an ideal place for exercise, which may be an extension of a public lounge within the building. Furthermore, as mentioned in Section 4.6, there should be a children’s playground space within the public areas of cancer treatment services. An outdoor playing field, adjacent to the indoor playground is recommended, which should be easily visible and accessible from indoors, providing safe, clean, and shady spots to sit and join different activities.

It is known that there is a positive relationship between a person's health status and his or her of social connections. Therefore, landscape design aimed at increasing social and emotional support has positive effects on decreasing stress and minimizing harmful effects on health. In this context, well-designed terraces, balconies, and courtyards present a great opportunity for users of hospitals to reach the outdoors easily and socialize with others (Figure 4.20). For instance, a dayroom or a family lounge opening onto a balcony or terrace could be an effective social space where patients, companions, visitors, and even staff could meet and talk to each other in an informal way. For old and new hospitals with open space limitations, if it is not possible to realize all the suggestions mentioned in this section, necessary landscape arrangements within courtyards, terraces, balconies and rooftops should be done to make them available for the use of all occupants.

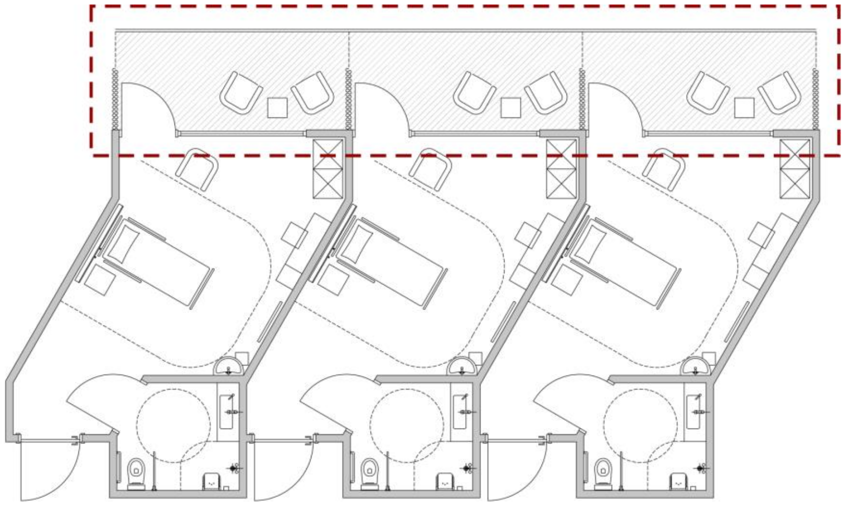


Figure 4.20. Balconies of patient rooms as social outdoor areas

CONCLUSION AND DISCUSSION

Cancer is a major cause of morbidity and mortality, with approximately 14 million new cases and 8 million cancer-related deaths each year (World Health Organization, 2018). This trend is projected to continue at an increasing rate, affecting all countries and all regions of the world, regardless of level of income. Therefore, cancer awareness among global political circles and societies is expanding. To compensate the burden of cancer as a major obstacle to human development and well-being, the issue of cancer control emerged and has been adapted by several countries, comprising comprehensive actions for preventive measures, early detection, treatment, education, and the organization of healthcare services. Moreover, studies on cancer science continue intensively, and new preventative and therapeutic techniques are discovered every year. With the rapid development of technology over the last few decades, major advances have been made in cancer treatment methods, and with the help of national cancer control programs around the world survival rates have increased significantly.

Significant progress in the comprehension and diagnosis of cancer has led to dramatic changes in the quality of cancer therapy and care. The provision of adequate healthcare facilities to ensure easy access to high-quality treatment therefore became an important design problem. However, academic studies on healthcare architecture have not been progressing at the same rate as those on medical issues. In particular, in terms of cancer treatment service design, resources are limited to the healthcare architectural standards and guidelines of some high-income countries such as Australia, the United Kingdom and the United States. However, it has not been possible to obtain similar relevant data from middle- and low-income countries such as Russia, Cuba or Romania. Regarding the design principles of cancer treatment services, the situation is quite challenging in Turkey. The information available on this subject in the healthcare standards of Turkey is very limited, and the existing information often contradicts not only the obtained standards of high-income countries but also itself.

Thus, there is clearly a need for a study on the architectural principles of cancer care in accordance with the medical practices, health manpower, and cultural characteristics of Turkey.

In the second half of the 20th century, several countries published national cancer control plans. Particulary following the developments in the field of cancer diagnosis and treatment methods, many other countries joined the struggle, and many of those with existing control plans made revisions about actions for preventive measures, early detection, treatment, education, and the organization of healthcare services. Turkey, however, reacted rather late to the challenge of increasing cancer mortality and the first version of the Turkish National Cancer Control Program was published in 2008. Today, there are several action plans in force in areas such as tobacco control, alcohol control, combatting obesity, asbestos control, and radon mapping. Moreover, the cancer-related services of hospitals belonging to the Ministry of Health and universities have been rearranged and grouped in terms of some medical and equipment requirements. However, although the cancer centers of the recently built city campus hospitals provide better healthcare environments, due to a lack of adequate planning principles and comprehensive understanding of patient-centered care approaches, majority of these cancer centers still need to be reconfigured with the intent of increasing effectiveness and user satisfaction, and to achieve better patient-centered care and population health outcomes.

Although there is a popular assumption that patients are not interested in their surroundings due to their illnesses, studies show that a patient's healthcare experience is affected considerably by the quality of the physical environment, and most patients are highly sensitive to and articulate about their architectural surroundings. This situation is even more important for cancer patients due to their weakened physical and psychological conditions, and their extended stays in healthcare facilities. In the last few decades, many studies have been done on the healing environment concept, which have led to changes in healthcare perceptions. There is a considerable amount of studies on these issues conducted with experimental-control group patterns, and there are some especially comprehensive studies on the effects of design features such as natural light, access to views, landscape design, or decoration on the users of healthcare facilities. However, among those works, only a limited number of studies have focused on oncology environments and the psychosocial effects of the hospital for cancer patients. Moreover, the application of the inferences from such research to the design phase remains unclear.

Consequently, particular attention needs to be given both to identifying design solutions for healthcare facilities that could provide modern treatment methods and to obtaining a therapeutic atmosphere in which treatment is delivered, which is becoming a necessity rather than a choice for hospitals. In the examined standards for cancer treatment services, references to the healing environment concept are quite insufficient and very abstract. For that reason, the main objective of this thesis has been to present a design guide to cancer treatment services for healthcare architects that is compatible with the conditions of Turkey and consistent with the principles of the healing environment concept.

Within the scope of this thesis, the current legislation of Turkey and the relevant regulations of some other countries have been examined and analyzed in terms of the planning of cancer treatment services. Those countries, which are Australia, Canada, the United Kingdom, and the United States, have been selected, first of all, according to the share of population with cancer worldwide, and secondly by looking at the last three years' awards in major competitions on healthcare architecture at the global level. Although cancer treatments are mainly applied in chemotherapy departments, radiation oncology departments, inpatient care services, and surgical services, the planning principles of surgical services were not addressed in this thesis. This is because, surgical oncology is usually performed in standard operating rooms and does not require any special changes for cancer patients. Thus, analysis and examination of the selected regulations were conducted for chemotherapy departments, radiation oncology departments, and inpatient care services within the categories of general settlement principles, internal function relations, clinical areas, clinical support areas, staff support areas, and patient and public areas.

In addition to the mentioned legislations, the findings of studies on the healing environment concept have been used to identify the design principles for therapeutic environments. Those studies were chosen from a literature survey considering their comprehensiveness and result-oriented approaches. Additionally, statistical data about the health manpower of Turkey, and relevant parts of some other Turkish regulations have been applied for a coherent framework.

The analyses were conducted by filtering the inferences and findings of the selected standards and the studies on the concept of the healing environment, and then combining them with the applications and preferences of the Turkish healthcare system. Finally, the resulting design principles were revealed for the criteria of general settlement principles, internal function relations, medical necessities, patient and family/visitor experience, healthy working environments, interior design, social interaction and privacy, safety, and landscape design and outdoor relations. Those analysis criteria were established to include all of themes studied, discussed and examined within the present conceptual framework. The resulting principles were given as explanations and also as proposal plans, diagrams, and schematic drawings.

This research constitutes a basis for the architectural design principles of three cancer treatment services, and could serve as a platform for future studies. In this study, cancer treatment services have been examined separately without considering the overall flows and functional relations in healthcare facilities. Future research will be needed to explore how these three examined services can be combined with each other and with other units in the hospital. Additionally, in this thesis only three of the most basic cancer treatment services were examined. This work could be extended to include both other treatment services, such as bone marrow transplant units and proton treatment departments, and cancer-related diagnostic services such as nuclear medicine units. Moreover, although the services examined in this report are considered as units of an integrated health facility, the planning of a stand-alone cancer treatment hospital together with its diagnostic services and supply chain could be a topic of future study.

As mentioned above, in this thesis, the planning principles of cancer treatment services are primarily examined in reference to the current legislation of Turkey and some high-income countries. Although the standards of low- and middle-income countries are not included in this study due to the lack of information, cancer service designs of hospitals in those countries may be a source of inspiration for future studies considering Turkey as one of them in terms of economic level. It is arguable that whether the relevant regulations of low- and middle-income countries would provide more helpful information about hospital planning than the standards examined in the thesis. However, examining the hospital designs of countries known worldwide in terms of cancer control, such as Cuba, is thought to be a quite valuable avenue for the subsequent development of this study.

Although the design principles of countries that are economically similar or very advanced in the field of cancer provide background on this subject, the implementation and impact of these principles should be considered specifically for Turkey regarding variations in healthcare policies, human resources, customary medical applications, and the experiences and culture of the society. For instance, it is known that due to the aging trend of populations and changes in healthcare delivery approaches towards patient-centered care, home care services are becoming more important, and have started to be adopted especially in some high-income countries and countries that have sufficient health manpower and resources. However, this approach is not yet applicable for Turkey. In Turkey, due to limited healthcare human resources, multi-functional hospitals that are capable of serving more patients with less staff capacity provide more effective and efficient healthcare.

Consequently, although this thesis has aimed to present an architectural guideline for Turkey, the suggestions offered here may be adopted by other countries since cancer treatment applications are medically similar around the world and there are no distinctions between countries in terms of the architectural design principles of the healing environment concept. However, for all countries, including Turkey, many other factors play an active role in transformation of architectural guidelines to obligatory regulations. Healthcare trends, economic conditions, commercial and investment priorities, political decisions and legal aspects of individual countries are issues to be evaluated by the relevant authorities in producing legislation from this guideline proposal. Additionally, it is very important that any design guideline becoming a official mandatory document allow for architectural diversity and creativity, permit technological innovations to be reflected in the architecture, and remain open to the articulations of future studies on the effects of architecture on human psychology and well-being for proper and sustainable architectural legislation.

REFERENCES

Altman, I. & Wohlwill, J. K. (1976). *Human Behavior and Environment.* London: Plenum Press.

Altman, I. & Wohlwill, J. K. (1983). *Behavior and the Natural Environment*. New York: Plenum Press.

Alvermann, M. M. (1979). Toward improving geriatric care with environmental intervention emphasizing a homelike atmosphere: An environmental experience. *Journal of Gerontological Nursing, 5*(3), 13-17.

American Cancer Society. (2015a). *Common types of cancer treatment.* Retrieved May 11, 2019, from https://www.cancer.org/treatment/understanding-your-diagnosis/after-diagnosis/common-cancer-treatments.html

American Cancer Society. (2015b). *What is immunotherapy?* Retrieved May 11, 2019, from https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy/what-is-immunotherapy.html

American Cancer Society. (2016a). *Cancer Treatment & Survivorship Facts & Figures 2016-2017*. Atlanta: American Cancer Society.

American Cancer Society. (2016b). *Stem cell transplant for cancer*. Retrieved May 11, 2019, from https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/stem-cell-transplant.html

American Cancer Society. (2017). *Cancer surgery - What it is, how it helps*. Retrieved May 11, 2019, from https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery/cancer-surgery-what-it-is-how-it-helps.html

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders, text revision (DSM-IV-TR).* 4th ed. Washington, DC: APA.

Andritsch, E., Stöger, H., Bauernhofer, T., Andritsch, H., Kasparek, A.K., Schaberl-Moser, R., … Samonigg, H. (2013). The ethics of space, design and color in an oncology ward. *Palliative and Supportive Care, 11*(3), 215-221.

Anthopoulus, P., & Georgi, J. (2011). Landscape Preference Evaluation for Hospital Environmental Design. *Journal of Environmental Protection, 2*(5), 639-647.

Aripin, S. (2006). Healing architecture: a study on the physical aspects of healing environment in hospital design. *40th Annual Conference of the Architectural Science Association*, 342-349.

Aripin, S. (2007). 'Healing architecture': Daylight in hospital design. *Conference on Sustainable Building South East Asia.* Malaysia: Universiti Teknologi Malaysia, 173-181.

Arman, M., Rehnsfeldt, A., Lindholm, L., Hamrin, E. & Eriksson, K. (2004). Suffering related to healthcare: A study of breast cancer patients' experiences. *International Journal of Nursing Practice, 10*(6), 248–256.

Australasian Health Infrastructure Alliance [AHIA]. (2016a). *Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0360 – Intensive Care - General.* Sydney.

Australasian Health Infrastructure Alliance [AHIA]. (2016b). *Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0520 - Operating Unit.* Sydney.

Australasian Health Infrastructure Alliance [AHIA]. (2016c). *Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0600 – Radiation Oncology Unit.* Sydney.

Australasian Health Infrastructure Alliance [AHIA]. (2017a). *Australasian HFG Standard Components - Bed Room/Outboard Ensuite*. Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/1-bed-room-outboard-ensuite-15m2-0.

Australasian Health Infrastructure Alliance [AHIA]. (2017b). *Australasian HFG Standard Components - Clean Utility/ Medication Room*. Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/clean-utility-medication-room-12m2-0.

Australasian Health Infrastructure Alliance [AHIA]. (2017c). *Australasian HFG Standard Components - Consult Room.* Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/consult-room-0.

Australasian Health Infrastructure Alliance [AHIA]. (2017d). *Australasian HFG Standard Components - CT Scanning.* Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/ct-scanning-procedure-room-0.

Australasian Health Infrastructure Alliance [AHIA]. (2017e). *Australasian HFG Standard Components - Procedure Room.* Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/procedure-room-16m2-0.

Australasian Health Infrastructure Alliance [AHIA]. (2017f). *Australasian HFG Standard Components - Treatment Bay – Chemotherapy.* Australasian Health Infrastructure Alliance database. Retrieved May 20, 2019, from https://healthfacilityguidelines.com.au/component/treatment-bay-chemotherapy-9m2-1

Australasian Health Infrastructure Alliance [AHIA]. (2018a). *Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0340 – Inpatient Accommodation Unit.* Sydney.

Australasian Health Infrastructure Alliance [AHIA]. (2018b). *Australasian HFG Standard Components – 1 Bed Room - Inboard Ensuite, Type 1.* Australasian Health Infrastructure Alliance database. Retrieved September 10, 2019, from https://www.healthfacilityguidelines.com.au/component/1-bed-room-inboard-ensuite-type-1

Australasian Health Infrastructure Alliance [AHIA]. (2018c). *Australasian HFG Standard Components – 2 Bed Room - Inboard Ensuite, Type 1*. Australasian Health Infrastructure Alliance database. Retrieved September 10, 2019, from https://www.healthfacilityguidelines.com.au/component/2-bed-room-inboard-ensuite-type-1

Australasian Health Infrastructure Alliance [AHIA]. (2019a). *Australasian Health Facility Guidelines Part B- Health Facility Briefing and Planning 0360 – Intensive Care Unit*. Sydney.

Australasian Health Infrastructure Alliance [AHIA]. (2019b). *Australasian HFG Standard Components – Patient Bay – Acute Treatment.* Australasian Health Infrastructure Alliance database. Retrieved September 10, 2019, from https://www.healthfacilityguidelines.com.au/component/patient-bay-acute-treatment

Australasian Health Infrastructure Alliance [AHIA]. (2019c). *Australasian HFG Standard Components – Patient Bay – Intensive Care*. Australasian Health Infrastructure Alliance database. Retrieved September 10, 2019, from https://www.healthfacilityguidelines.com.au/component/patient-bay-intensive-care

Australasian Health Infrastructure Alliance [AHIA]. (2019d). *Australasian HFG Standard Components – 1 Bed Room – Intensive Care.* Australasian Health Infrastructure Alliance database. Retrieved September 10, 2019, from https://www.healthfacilityguidelines.com.au/component/1-bed-room-intensive-care

Baldwin, S. (1985). Effects of furniture arrangement on the atmosphere of wards in a maximum-security hospital. *Hospital & Community Psychiatry, 36*(5), 525-528.

Beauchemin, K. M. & Hays, P. (1998). Dying in the dark: Sunshine, gender and outcomes in myocardial infarction. *Journal of the Royal Society of Medicine, 91*(7), 352-354.

Beer, A. R. & Higgins, C. (2000). *Environmental Planning for Site Development*. London, UK: E & FN Spon.

Best, M., Aldridge, L., Butow, P., Olver, I. & Webster, F. (2015). Conceptual analysis of suffering in cancer: a systematic review. *Psycho-oncology,* 24(9), 977-986.

Biley, F. (1993). Ward design: Creating a healing patient environment. *Nursing Standard, 8*(5), 31-35.

Blaxter M. (2009). The case of the vanishing patient? Image and experience. *Sociology of Health & Illness*, *31*(5), 762-778.

Boswell, K., Finlay, F., Jones, R. & Hill, P. (2000). Perceived ideal out-patient department and hospital ward for children, adolescents and their families. *Clinical Child Psychology and Psychiatry*, *5*(2), 213-219.

Bower, B. (2005). Mood brighteners. *Science News, 167*(17), 261.

Brown, K. K. & Gallant, D. (2006). Impacting patient outcomes through design: Acuity adaptable care/universal room design. *Critical Care Nursing Quarterly, 29*(4), 326-341.

Bruce, M. (2006). A systematic and conceptual review of posttraumatic stress in childhood cancer survivors and their parents. *Clinical Psychology Review, 26*(3), 233-256.

Cama, R. (2009). *Evidence-Based Healthcare Design*. Canada: John Wiley & Sons.

Campbell, S. S., Kripke, D. F., Gillin, J. C. & Hrubovcak, J. C. (1988). Exposure to light in healthy elderly subjects and Alzheimer's patients. *Physiology & Behavior*, *42*(2), 141 - 144.

Canadian Standards Association [CSA]. (2016). *Canadian healthcare facilities*. Canada.

Cancerquest. (2018). *Emotional and Psychosocial Effects of Cancer.* Retrieved May 11, 2109, from https://www.cancerquest.org/patients/psychosocial-problems

Capuron, L., Ravaud, A., Gualde, N., Bosmans, E., Dantzer, R., Maes, M. & Neveu P. J. (2001) Association between immune activation and early depressive symptoms in cancer patients treated with interleukin-2-based therapy. *Psychoneuroendocrinology*, *26*(8), 797-808.

Cardon, K. (2009). Caring for caregivers: Designing environments for recruitment and retention Part 2. *Healthcare Design*. Retrieved May 11, 2019, from https://www.healthcaredesignmagazine.com/architecture/caring-caregivers-designing-environments-recruitment-and-retention-part-2/

Carlsen, K., Jensen, A. B., Jacobsen, E., Krasnik, M. & Johansen, C. (2005). Psychosocial aspects of lung cancer. *Lung Cancer*, *47*(3), 293-300.

Cathcart F. (2006). Psychological distress in patients with advanced cancer. *Clinical Medicine*, 6(2), 148-150.

Chan, M. (2014). Foreword. Steward, B. W., Wild, C. P. (Eds.). *World Cancer Report 2014*. France: International Agency for Research on Cancer.

Chand, S. (2002). Architecture and hospital. *Architecture Australia*, *91*(4).

Coad, J., & Coad, N. (2008). Children and young people's preference of thematic design and color for their hospital environment. *Journal of Child Healthcare, 12*(1), 33-48.

Cohen, L., Cole, S. W., Sood, A. K., Prinsloo, S., Kirschbaum, C., Arevalo, J. M., … Pisters, L. (2012) Depressive symptoms and cortisol rhythmicity predict survival in patients with renal cell carcinoma: Role of inflammatory signaling. *PLoS ONE*, *7*(8), e42324.

Cole, R. J., Robinson, J., Brown, Z. & O'Shea, M. (2008). Re-contextualizing the notion of comfort. *Building Research and Information*, *36*(4), 323-336.

Commission for Architecture and the Built Environment [CABE]. (2004). *The role of hospital design in the recruitment retention and performance of NHS nurses in England.* Retrieved May 11, 2019, from http://www.cabe.org.uk/publications

Curtis, S., Gesler, W., Priebe, S. & Francis, S. (2009). New spaces of inpatient care for people with mental illness: A complex 'rebirth' of the clinic? *Health Place, 1*5(1), 340-348.

Daykin, N., Byrne, E., Soteriou, T. & O'Connor, S. (2008). The impact of art, design and environment in mental healthcare: a systematic review of the literature. *The Journal of The Royal Society for the Promotion of Health, 128*(2), 85-94.

Department of Health [DH]. (2004). *Health Building Note 26 Facilities for surgical procedures: Volume 1*. United Kingdom.

Department of Health [DH]. (2013a). *Health Building Note 02-01: Cancer Treatment Facilities.* United Kingdom.

Department of Health [DH]. (2013b). *Health Building Note 04-01: Adult Inpatient Facilitie*s. United Kingdom.

Department of Health [DH]. (2013c). *Health Building Note 04-02 Critical Care Units*. United Kingdom.

Department of Veterans Affairs [DVA]. (2008). *Radiation Therapy Service Design Guide.* Washington.

Department of Veterans Affairs [DVA]. (2009). *Ambulatory Care Design Guide (Hospital-Based)*. Washington: Department of Veterans Affairs.

Department of Veterans Affairs [DVA]. (2011). *Medical/Surgical Inpatient Units & Intensive Care Nursing Units.* Washington.

Department of Veterans Affairs [DVA]. (2016a). *Chapter 277: Radiation Therapy Service.* Washington.

Department of Veterans Affairs [DVA]. (2016b). *Surgical and Endovascular Services Design Guide*. Washington.

Devlin, A. S., & Arneill, A. B. (2003). Healthcare environments and patient outcomes. *Environment and Behavior, 35,* 665-694.

Dijkstra, K., Pieterse, M. & Pruyn, A. (2006). Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: Systematic review. *Journal of Advanced Nursing, 56*(2), 166-181.

DiMatteo, M. R., Lepper, H. S. & Croghan, T. W. (2000). Depression is a risk factor for non-compliance with medical treatment: Meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of Internal Medicine, 160*(14), 2101-2117.

Djulbegovic, B., Kumar, A., Soares, H. P., Hozo, I., Bepler, G., Clarke, M., & Bennett, C. L. (2008). Treatment success in cancer: New cancer treatment successes identified in phase 3 randomized controlled trials conducted by the National Cancer Institute–sponsored cooperative oncology groups, 1955 to 2006. *Archives of Internal Medicine, 168*(6), 632-642.

Douglas, C. H. & Douglas M. R. (2004). Patient-friendly hospital environments: Exploring the patients' perspective. *Health Expectations, 7*(1), 61-73.

Douglas, C. H. & Douglas, M. R. (2005). Patient-centered improvements in health-care built environments: perspectives and design indicators. *Health Expectations, 8*(3), 264-276.

Eceoğlu, A. (2010). *Değişen Kullanım İhtiyaçları Karşısında Hastane Yapılarında Giriş Mekanlarının Şekillenmesi* (Unpublished master's thesis). Mimar Sinan Fine Arts University.

Edvardsson, J. D., Rasmussen, B. H., & Riessman, C. K. (2003). Ward Atmospheres of Horror and Healing: A Comparative Analysis of Narrative. *Health, 7*(4), 377-396.

Edvardsson, J. D., Sandman, P. O. & Rasmussen, B. H. (2005). Sensing an atmosphere of ease: A tentative theory of supportive care settings. *Scandinavian Journal of Caring Sciences, 19*(4), 344-353.

Edvardsson, J. D., Sandman, P. O. & Rasmussen, B. H. (2006). Caring or uncaring – meanings of being in an oncology environment. *Journal of Advanced Nursing, 55*(2), 188-197.

Egnew, T. R. (2005) The meaning of healing: Transcending suffering. *Annals of Family Medicine, 3*(3), 255-262.

Eisen, S. L., Ulrich, R. S., Shepley, M. M., Varni, J. W. & Sherman, S. (2008). The stress-reducing effects of art in pediatric healthcare: Art preferences of healthy children and hospitalized children. *Journal of Child Healthcare, 12*(3), 173-190.

Epstein-Lubow, G., Baier, R. R., Butterfield, K., Gardner, R., Babalola, E., Coleman, E. A. & Gravenstein, S. (2014). Caregiver presence and patient completion of a transitional care intervention. *The American Journal of Managed Care, 20*(10), 349-444.

Evans, G. W. (2003). The built environment and mental health. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 80*(4), 536 - 555.

Forman, D. & Ferlay, J. (2014). Global and regional burden of cancer. In *World Cancer Report 2014 (16-53).* France: International Agency for Research on Cancer.

Francis, S. & Glanville, R. (2001). *Building a 2020 Vision: Future Healthcare Environments.* London, UK: The Stationery Office.

Francis, M., & Hester, R. (1990). *The Meaning of Gardens*. USA: The MIT Press.

Frank, A.W. (1992). Twin nightmares of the medical simulacrum. In *Jean Baudrillard: The Disappearance of Art and Politics.* London: Macmillan.

Gates, M. (1991). Transcultural comparison of hospital and hospice as caring environments for dying patients. *Journal of Transcultural Nursing, 2*(2), 3-15.

Gesler, W., Bell, M., Curtisc, S., Hubbardb, P. & Francis, S. (2006). Therapy by design: Evaluating the UK hospital building program. *Health and Place, 10*(2), 117–128.

Global Burden of Disease Collaborative Network (2017). *Global Burden of Disease Study 2016 Results.* Seattle, United States: Institute for Health Metrics and Evaluation (IHME).

Goodwin, J. S., Zhang, D. D. & Ostir, G. V. (2004). Effect of depression on diagnosis, treatment, and survival of older women with breast cancer. *Journal of the American Geriatrics Society, 52*(1), 106-111.

Gordon, I. E. (1989). *Theories of Visual Perception*. Chichester: Wiley.

Grassi L., Holland, J. C., Johansen, C., Koch, U. & Fawzy F. (2005). Psychiatric concomitants of cancer, screening procedures, and training of health care professionals in oncology: the paradigms of psycho-oncology in the psychiatry field. In *Advances in Psychiatry Vol II.* (pp 59–66). World Psychiatric Association.

Grassi, L., Rosti, G., Lasalvia, A. & Marangolo, M. (1993). Psychosocial variables associated with mental adjustment to cancer. *Psycho-Oncology, 2*(1), 11-20.

Grol, R., Wensing, M., Mainz, J., Jung, H. P., Ferreira, P., Hearnshaw, H., … Szecsenyi, J. (2000). Patients in Europe evaluate general practice care: An international comparison. *British Journal of General Practice, 50*(460), 882-887.

Hagerman, I., Rasmanis, G., Blomkvist, V., Ulrich, R., Eriksen, C. A. & Theorell, T. (2005). Influence of intensive coronary care acoustics on the quality of care and physiological state of patients. *International Journal of Cardiology, 98*(2), 267-270.

Hartig, T., Mang, M., & Evans, G. W. (1991). Restorative Effects of Natural Environmental Experiences. *Environmental and Behavior, 23*(1), 3-26.

Hauge, A. L., Thomsen, J. & Berker, T. (2010). User evaluations of energy efficient building - Literature review and further research. *Zero emission buildings Proceedings of Renewable Energy Conference 2010*. Norway: Tapir Academic Press.

Hayman, J. A., Langa, K. M., Kabeto, M. U., Katz, S. J., DeMonner, S. M., Chernew, … Fendrick, A. M. (2001). Estimating the cost of informal caregiving for elderly patients with cancer. *Journal of Clinical Oncology, 19*(13), 3219-3225.

Hegel, M. T., Moore, C. P., Collins, E. D., Kearing, S., Gillock, K. L., Riggs, R. L., … Ahles, T. A. (2006). Distress, psychiatric syndromes, and impairment of function in women with newly diagnosed breast cancer. *Cancer, 107*(12), 2924-2931.

Hem, E., Loge, J. H., Haldorsen, T. & Ekeberg, Ø. (2004). Suicide risk in cancer patients from 1960 to 1999. *Journal of Clinical Oncology*, *22*(20), 4209-4216.

Henrikkson, M. M., Isometsa, E. T., Hietanen, P. S., Aro, H. M. & Lönnqvist, J. K. (1995). Mental disorders in cancer suicide. *Journal of Affective Disorders, 36*(1-2), 11-20.

HermanMiller Healtcare. (2010). *Patient rooms: A changing scene of healing*. Retrieved May 11, 2019, from https://www.hermanmiller.com/content/dam/hermanmiller/documents/research_summaries/wp_Patient_Rooms.pdf

Hesse, B. W., Beckjord, E., Rutten, L. J. F., Fagerlin, A., & Cameron, L. D. (2015). Cancer communication and informatics research across the cancer continuum. *American Psychologist, 70*(2), 198-210.

Horsburgh, C.R, Jr. (1995). Healing by design. *The New England Journal of Medicine, 333*(11), 735-40.

Høybye, M. T. (2013). Healing environments in cancer treatment and care. Relations of space and practice in hematological cancer treatment. *Acta Oncologica, 52*(2), 440-446.

Høybye, M. T. & Tjørnhøj-Thomsen, T. (2014). Encounters in cancer treatment: intersubjective configurations of a need for rehabilitation. *Medical Anthropology Quarterly, 28*(3), 305-322.

Ingham, B. & Spencer, C. (1997). Do comfortable chairs and soft light in the waiting area really help reduce anxiety and improve the practice's image? *Health Psychology Update*, *28*, 17-20.

Ingold, T. (2000). *The perception of the environment: Essays on livelihood, dwelling and skill*. London: Routledge.

Institute of Medicine (IOM). (2001). *Crossing the quality chasm: A new health system for the 21st century.* Washington, DC: National Academy Press.

Institute of Medicine (IOM). (2008). *Cancer care for the whole patient: Meeting psychosocial health needs.* Washington, DC: The National Academies Press.

Jacobsen, P. B., & Andrykowski, M. A. (2015). Tertiary prevention in cancer care: Understanding and addressing the psychological dimensions of cancer during the active treatment period. *American Psychologist, 70*(2), 134-145.

Jedeloo, S., van Staa, A. V., Latour, J. M. & van Exel, N. J. (2010). Preferences for healthcare and self-management among Dutch adolescent with chronic conditions: A Q-methodological investigation. *International Journal of Nursing Studies*, *47*(5), 593-603.

Jencks, M. K. (1995). *A view from the front line*. London: Maggie's Cancer Caring Centre.

Johnson, D. (2005). *Psychology of Colors*. Retrieved May 11, 2019, from https://www.infoplease.com/color-psychology

Jones, P. B. (2002). Rewarding experiences. *The Architectural Review, 211*(1261), 62.

Kangas, M., Henry, J. L. & Bryant, R. A. (2002). Posttraumatic stress disorder following cancer. A conceptual and empirical review. *Clinical Psychology Review, 22*(4), 499-524.

Kaplan, R. & Kaplan, S. (1989). *The experience of nature: A psychological perspective.* Cambridge, US: Cambridge University Press.

Katon, W. J. (2003). Clinical and health services relationships between major depression, depressive symptoms, and general medical illness. *Biological Psychiatry, 54*(3), 216-226.

Kerfoot, K. & Neumann, T. (1992). Creating a healing environment: the nurse manager’s challenge. *Nursing Economics, 10*(6), 423–425.

Keswick, M. (1995). Breast cancer: a view from the frontline. *The Breast*, 205-210.

Kotkamp-Mothes, N., Slawinsky, D., Hindermann, S. & Strauss, B. (2005). Coping and psychological well-being in families of elderly cancer patients. *Critical Reviews in Oncology-Hematology, 55*(3), 213-229.

Kurtz, M. E., Kurtz, J. C., Given, C. W. & Given, B. A. (2004). Depression and physical health among family caregivers of geriatric patients with cancer-a longitudinal view. *Medical Science Monitor, 10*(8), 447-456.

Kutluk, T. (2017). Çocukluk çağı kanserlerinde erken tanı doğru tedavi hayat kurtarıyor. *Popüler Sağlık, 12,* 41-43.

Lage, A. & Romero, T. (2018). Back and forth between cancer treatment and cancer control programs: Insights from the Cuban experience. *Seminars in Oncology 45*, 12–17.

Lam, W. M. C. (1977). *Perception and Lighting as Formgivers for Architecture*. New York: McGraw-Hill Book Company.

Lawson, B. (2002). Healing architecture. *The Architectural Review, 211*(1261), 72.

Lawson, B. (2010). Healing architecture. *Arts & Health: An International Journal for Research, Policy and Practice, 2*(2), 95-108.

Lawson, B. & Phiri, M. (2003). *The architectural healthcare environment and its effect on patient health outcomes*. Sheffield: NHS Estates.

Leather, P., Beale, D., Santos, A., Watts, J., & Lee, L. (2003). Outcomes of Environmental Appraisal of Different Hospital Waiting Areas. *Environment and Behavior*, *35*(6), 842–869.

Leder, D. (1990). *The Absent Body*. Chicago: University of Chicago Press.

Lee, S. Y. & Brand, J. L. (2005). Effects of control over office workspace on perceptions of the work environment and work outcomes. *Journal of Environmental Psychology, 25*(3), 323-333.

Malkin, J. (1991). *Hospital interior architecture: creating healing environments for special patient populations*. New York: Van Nostrand Reinhold.

Malenbaum, S., Keefe, F. J., Williams, A. C., Ulrich, R. & Somers, T. J. (2008) Pain in its environmental context: Implications for designing environments to enhance pain control. *Pain*, *134*(3), 241-244.

Marcus, C., & Barnes, M. (1995). *Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Considerations*. Martinez: USA: The Center of Health Design.

Markus, T. A. (1967). The function of windows: A reappraisal. *Building Science*, *2*(2), 97-121.

Martin, C. (2000). Putting patients first: integrating hospital design and care. *The Lancet*, *356*(9228), 518.

Martin, D., Nettleton, S., Buse, C., Prior, L. & Twigg, J. (2015). Architecture and healthcare: a place for sociology. *Sociology of Health & Illness*, *37*(7), 1007-1022.

Martin, D.P., Hunt, J.R., Hughes-Stone, M., & Conrad, D.A. (1990). The planetree model hospital project: An example of the patient as partner. *Hospital & health services administration, 35(4)*, 591-601.

Massie, M. J. (2004) Prevalence of depression in patients with cancer. *Journal of the National Cancer Institute Monographs,* (32), 57-71.

McAllister, C. L. & Silverman, M. A. (1999). Community formation and community roles among persons with Alzheimer's disease: a comparative study of experiences in a residential Alzheimer's facility and a traditional nursing home. *Qualitative Health Research, 9*(1), 65-85.

Miller, A. D., Mishra, S. R., Kendall, L., Haldar, S., Pollack, A. D., & Pratt, W. (2016). Partners in care: Design considerations for caregivers and patients during a hospital stay. In *CSCW '16 Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (pp. 756-769). USA, California: ACM. Retrieved May 11, 2109, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4852166/

Ministry of Health [MH]. (2010). *Türkiye Sağlık Yapıları Asgari Tasarım Standartları 2010 Yılı Kılavuzu.* Ankara: Ministry of Health.

Ministry of Health [MH]. (2011a). *Türkiye'de Özellikli Planlama Gerektiren Sağlık Hizmetleri. A*nkara: Ministry of Health.

Ministry of Health [MH]. (2011b). *Yataklı Sağlık Tesislerinde Yoğun Bakım Hizmetlerinin Uygulama Usul ve Esasları Hakkında Tebliğ.* Ankara: Ministry of Health.

Ministry of Health [MH]. (2012). *Mevcut ve Yeni Yapılacak Sağlık Tesislerinde Uyulması Gereken Asgari Teknik Standartlar Genelgesi.* Ankara: Ministry of Health.

Ministry of Health [MH]. (2013). 2013-2018 *Ulusal Kanser Kontrol Planı*. Ankara: Ministry of Health.

Ministry of Health [MH]. (2016a). *Sağlık İstatistikleri Genel Bilgi Kitapçığı*. Ankara: Ministry of Health.

Ministry of Health [MH]. (2016b). *Türkiye Kanser Kontrol Programı*. Ankara: Ministry of Health.

Ministry of Health [MH]. (2018). *Özellikli Sağlık Hizmetleri.* Retrieved May 11, 2019, from https://khgmozellikli.saglik.gov.tr/svg/ozellikli_hizmetler.php?plaka=17&srs=21

Moore, R.J., Chamberlain, R.M. & Khuri, F.R. (2004). Communicating suffering in primary stage head and neck cancer. *European Journal of Cancer Care, 13*(1), 53–64.

Morriss, R. (2001). Seasonal Affective Disorder: Practice and Research. *British Medical Journal*, *323*(7320), 1074.

Mroczek, J., Mikitarian, G., Vieira, E. K. & Rotarius, T. (2005). Hospital design and staff perceptions: An exploratory analysis. *The Healthcare Manager*, *24*(3), 233-244.

National Cancer Institute. (2015a). *Stem Cell Transplant.* Retrieved May 11, 2019, from https://www.cancer.gov/about-cancer/treatment/types/stem-cell-transplant

National Cancer Institute. (2015b). *Surgery*. Retrieved May 11, 2019, from https://www.cancer.gov/about-cancer/treatment/types/surgery

National Cancer Institute. (2017). *Types of cancer treatment*. Retrieved May 11, 2019, from https://www.cancer.gov/about-cancer/treatment/types

National Cancer Institute. (2018). *Psychological Stress and Cancer*. Retrieved May 11, 2019, from https://www.cancer.gov/about-cancer/coping/feelings/stress-fact-sheet

National Health Service [NHS]. (2007). *Cancer Reform Strategy*. Retrieved May 11, 2019, from https://www.nhs.uk/NHSEngland/NSF/Documents/Cancer%20Reform%20Strategy.pdf

Nesmith, L. (1995). *Health Care Architecture: Designs for the Future*. Washington, USA: The American Institute of Architects Press.

Nightingale, F. (1859). *Notes on nursing: What is it, and what is not.* London: Harrion and Sons.

Norbergh, K. G., Hellzén, O., Sandman, P. O. & Asplund, K. (2002). The relationship between organizational climate and the content of daily life for people with dementia living in a group dwelling. *Journal of Clinical Nursing, 11*(2), 237-246.

Nordin, K. & Glimelius, B. (1999). Predicting delayed anxiety and depression in patients with gastrointestinal cancer. *British Journal of Cancer, 79*(3-4), 525-529.

Ormenisan, D. (2014). International Multidisciplinary Scientific Conference on Social Sciences and Arts. *SGEM2014 Conference Proceedings* (Book 4, Vol. 1, pp. 1031-1046).

Parker, P. A., Baile, W. F., de Moor C. & Cohen, L. (2003). Psychosocial and demographic predictors of quality of life in a large sample of cancer patients. *Psycho-Oncology, 12*(2), 183-193.

Poulton, E. C. (1972). *Environment and Human Efficiency*. Springfield, Illinois: Charles C Thomas Publisher.

Prieto, J. M., Blanch, J., Atala, J., Carreras, E., Rovira, M., Cirera, E. & Gasto, C. (2002). Psychiatric morbidity and impact on hospital length of stay among hematologic cancer patients receiving stem-cell transplantation. *Journal of Clinical Oncology, 20*(7), 1907-1917.

Radley, A., & Taylor, D. (2003). Images of recovery: A photo-elicitation study on the hospital ward. *Qualitative Health Research, 13*(1), 77-99.

Rodgers, B.L. & Cowles, K.V. (1997). A conceptual foundation for human suffering in nursing care and research. *Journal of Advanced Nursing, 25*(5), 1048-1053.

Rodiek, S. (2002). Influence of an Outdoor Garden on mood and Stress in Older Persons. *Journal of Therapeutic Horticulture*, *13*(3), 13-21.

Rogers, M. E. (1970). *An Introduction to the Theoretical Basis of Nursing*. Philadelphia: Davis.

Rollins, J. A. (2009). The influence of two hospitals' designs and policies on social interaction and privacy as coping factors for children with cancer and their families. *Journal of Pediatric Oncology Nursing, 26*(6), 340-353.

Rubin, H. R., Owens, A. J. & Golden, G. (1998). *Status report: An investigation to determine whether the built environment affects patients' medical outcomes*. USA: The Center for Health Design.

Schreuder, E., Heel, L., Goedhart, R., Dusseldorp, E., Schraagen, J. M. & Burdorf, A. (2015). Effects of newly designed hospital buildings on staff perceptions: A pre-post study to validate design decisions. *Health Environments Research and Design, 8*(4), 77-97.

Schultz, R. & Beach, S. R. (1999). Caregiving as a risk factor for mortality: The caregiver health effects study. *Journal of the American Medical Association, 282*(23), 2215-2219.

Schweitzer, M., Gilpin, L. & Frampton, S. (2004). Healing spaces: elements of environmental design that make an impact on health. *Journal of Alternative & Complementary Medicine, 10*(1), 71-83.

Segrin, C., Badger, T. A., Meek, P., Lopez, A. M., Bonham, E. & Sieger, A. (2005). Dyadic interdependence on affect and quality-of-life trajectories among women with breast cancer and their partners. *Journal of Social and Personal Relationships, 22*(5), 673-689.

Segrin, C., Badger, T. A., Dorros, S. M., Meek, P. & Lopez, A. M. (2007). Interdependent anxiety and psychological distress in women with breast cancer and their partners. *Psycho-Oncology, 16(*7), 634-643.

Söderback, I., Söderström, M., & Schalander, E. (2004). Hotricultural therapy: The healing garden and gardening in rehabilitation measures at Danderyd Hospital Rehabilitation Clinic, Sweden. *Pediatric Rehabilitation, 7*(4), 245-260.

Spichiger, E. (2009). Being in the hospital: An interpretive phenomenological study of terminally ill cancer patients' experiences. *European Journal of Oncology Nursing, 13*(1), 16-21.

Spiegel, D., Bloom, J. R., Kraemer, H. C. & Gottheil, E. (1989). Effect of psychosocial treatment on survival of patients with metastatic breast cancer. *Lancet, 2*(8668), 888-891.

Spiegel, D. & Giese-Davis, J. (2003). Depression and cancer: Mechanism and disease progression. *Biological Psychiatry, 54*(3), 269-282.

Spijker, A., Trijsburg, R. W. & Duivenvoorden, H. J. (1997). Psychological sequelae of cancer diagnosis: a meta-analytical review of 58 studies after 1980. *Psychosomatic Medicine, 59*(3), 280-293.

Spitzer, R. L., Kroenke, K., Linzer, M., Hahn, S. R., Williams, J. B., deGruy, F. V., … Davies, M. (1995). Health-related quality of life in primary care patients with mental disorders: Results from the PRIME-MD 1000 study. *Journal of the American Medical Association, 274*(19), 1511-1517.

Stanton, A. L., Rowland, J. H. & Ganz, P. A. (2015). Life after diagnosis and treatment of cancer in adulthood: Contributions from psychosocial oncology research. *The American Psychologist, 70*(2), 159-174.

Staricoff, R. L. (2004). *Arts in Health: A Review of the Medical Literature*. London: Arts Council England.

Staricoff, R. L., Duncan, J. & Wright, M. (2001). A study of the effects of the visual and performing arts in healthcare. *Hospital Development, 32(6),* 25–28.

Staricoff, R. L. & Loppert, S. (2003). Integrating the arts into healthcare: Can we effect clinical outcomes? In *The Healing Environment: Without and within* (pp. 63-79). London: RCP.

Stommel, M., Given, B. A. & Given, C. W. (2002). Depression and functional status as predictors of death among cancer patients. *Cancer, 94*(10), 2719-2727.

Strang, P. (1997). Existential consequences of unrelieved cancer pain. *Palliative Medicine, 11*(4), 299-305.

The Facility Guidelines Institute [FGI]. (2014). *For Design and Construction of Hospitals and Outpatient Facilities.* Dallas: The Facility Guidelines Institute.

Timmermann, C., Uhrenfeldt, L. & Birkelund, R. (2013). Cancer patients and positive sensory impressions in the hospital environment - a qualitative interview study. *European Journal of Cancer Care, 22*(1), 117-124.

Todd, W. (2007). A room with more than a view. *The Next American City, 14,* 40.

Torricelli, M. C., Setola, N. & Borgianni, S. (2013). How architecture promote right to health in hospital. *Proceedings of the 19th CIB World Building Congress, Brisbane 2013: Construction and Society*. Australia: Queensland University of Technology.

Trill, M. D. (2012). Psychological aspects of depression in cancer patients: an update. *Annals of Oncology, 23*(10), 302-305.

Turkish Statistical Institute. (2016). *Ölüm nedeni istatistikleri, 2015.* Retrieved May 11, 2019, from http://www.tuik.gov.tr/PreHaberBultenleri.do?id=21526

Ullán, A. M., Belver, M. H., Serrano, I., Delgado, J. & Badía, M. (2012). Perspectives of youths and adults improve the care of hospitalized adolescents in Spain. *Journal of Pediatric Healthcare, 26*(3), 182-192.

Ulrich, R. S. (1981). Natural versus urban scenes: Some psycho-physiological effects. *Environment and Behavior, 13*(5), 523-556.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science: New Series, 224*(4647), 420-421.

Ulrich, R. S. (1991). Effects of Interior Design on Wellness: Theory and Recent Scientific Research. *Journal of Healthcare Design, 3*, 97-109.

Ulrich R. S. (1992). How design impacts wellness. *Healthcare Forum Journal, 35*(5), 20–25.

Ulrich, R. S. (1999). Effects of Gardens on Health Outcomes. In *Healing Gardens: Therapeutic Benefits and Design Recommendation* (pp. 27-86). USA: John Wiley & Sons.

Ulrich, R. S., Quan, X., Zimring, C. & Joseph, A. (2004). *The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity.* Concorde, California: The Center for Health Design.

Ulrich, R. S., & Parsons, R. (1992). Influences of Passive Experiences with Plants on Individual Well-being and Health. *In The Role of Horticulture in Human Well-Being and Social Development*. Oregon: Timber Press.

Ulrich, R. S., Simons, R. & Miles, M. (2003). Effects of environmental simulations and television on blood donor stress. *Journal of Architectural and Planning Research, 20*(1), 38–47.

Ulrich, R.S., Zimring, C., Zhu, X., DuBose, J., Seo, H. B., Choi, Y., … Joseph, A. (2008). A review of the research literature on evidence-based healthcare design. *HERD, 1*(3), 61-125.

Van der Lee, M. L., van der Bom, J. G., Swarte, N. B., Heintz, A. P., de Graeff, A. & van den Bout, J. (2005). Euthanasia and depression: a prospective cohort study among terminally ill cancer patients. *Journal of Clinical Oncology, 23*(27), 6607-6612.

Verberder, S. (2010). *Innovations in Hospital Architecture*. Oxon: Routledge Taylor & Francis Group.

Verdeber S. & Reuman D. (1987) Windows, views, and health status in hospital therapeutic environments. *The Journal of Architectural and Planning Research, 4*(2), 120-133.

Walch, J. M., Rabin B. S., Day, R., Williams, J. N., Choi, K. & Kang, J.D. (2005). The effect of sunlight on postoperative analgesic medication use: A prospective study of patients undergoing spinal surgery. *Psychosomatic Medicine, 67*(1). 156-163.

Walker, L. G., Heys, S. D., Walker, M. B., Ogston, K., Miller, I. D., Hutcheon, A. W., … Eremin, O. (1999). Psychological factors can predict the response to primary chemotherapy in patients with locally advanced breast cancer. *European Journal of Cancer, 35*(13), 1783-1788.

Watson, J. (1985). *Nursing: The Philosophy and Science of Caring*. Boulder, Colorado: Colorado University Press.

Watson, M., Haviland, J.S., Greer, S., Davidson, J. & Bliss, J. M. (1999). Influence of psychological response on survival in breast cancer: a population-based cohort study. *Lancet, 354*(9187), 1331-1336.

Weiss, G. L. & Lonnquist, L. E. (2000). *The Sociology of Health, Healing, and Illness*. Upper Saddle River, NJ: Prentice Hall.

Wignall, D. (2007). Future hospital design embraces patients, families and staff. *Engineers Journal,* 111-113.

Williams, M. A. (1988). The physical environment and patient care. *Annual Review of Nursing Research, 6,* 61-84.

World Health Organization [WHO]. (2014). *Basic Documents*. WHO Press: Switzerland.

World Health Organization [WHO]. (2018). *Cancer Fact Sheet*. Retrieved May 11, 2019, from http://www.who.int/mediacentre/factsheets/fs297/en/

Wolff, J. L. & Roter, D. L. (2011). Family presence in routine medical visits: a meta-analytical review. *Social Science & Medicine, 72*(6), 823-831.

Yundt, S. (2009) The future of the patient room: Challenges and controversies. *Healthcare Design, 9*(3), 32-36. Retrieved May 11, 2019, from https://www.healthcaredesignmagazine.com/architecture/future-patient-room-challenges-and-controversies/

APPENDICES

A. CHEMOTHERAPY DEPARTMENT

This section covers the basic physical requirements of a chemotherapy department in a healthcare facility in terms of general settlement principles (1), functional relationships (2), treatment areas (3), clinical support areas (4), staff areas (5), and patient/public areas (6), respectively.

A.1. General Settlement Principles

According to the CSA standard (2016) of Canada, the interdisciplinary care approach is of particular importance for carrying out patient- and family-centered care and effective operations. Therefore, the relationships between the basic elements of a cancer program should support effective systems and processes with an interdisciplinary care approach (CSA, 2016). In this respect, the units that require a direct connection with the chemotherapy department are the outpatient oncology clinics, emergency services, building entrance and parking area, and rehabilitation services (Table A.1.) (CSA, 2016). In the DH standard (2013a) of the United Kingdom, it is stated that although chemotherapy departments are largely independent, they require good access to pharmacy, imaging, and emergency units.

In the standards examined within the scope of this thesis, only the CSA (2016) and DH (2013a) standards explain the general settlement principles of the chemotherapy department. Within those regulations, the need for proximity to the pharmacy and emergency services is particularly emphasized. In addition, the relation of the chemotherapy department with the imaging unit, ambulatory care, and garden/therapy areas is considered as significant. A summary of the subject is presented in Table A.2.

Table A.1. *Functional relations of chemotherapy department with other units according to the CSA standard (2016)*

Related service	Component impacting the relationship	Objective	Alternatives to direct adjacency of services
Essential relationships (required)			
Pharmacy	Sterile products	To provide direct delivery of chemotherapy drugs	A satellite pharmacy could be included with the department
Important relationships (recommended)			
Ambulatory care	The area as a whole	Provide access to clinical specialists and expansion during peak periods Sharing of selected support services	
Emergency services	Patient treatment cubicles	Transfer of patients requiring emergency intervention	
Building entry and parking	Building entry and adjacent parking	Provide ease of access for patients utilizing services for extended periods over multiple visits	Provide direct access from elevators from a building entry and parking
Exterior garden/therapy area	Garden/therapy area	Provide direct patient/family access to exterior garden/therapy areas for leisure and mobilization activities	Provision of secured roof top areas

Table A.2. *Comparison of functional relationships of chemotherapy department with other units in different standards*

Standard	Pharmacy	Imaging	Emergency service	Ambulatory care	Garden/therapy area
CSA	X		X	X	X
DH	X	X	X		

A.2. Internal Function Relations

According to the CSA standard (2016) of Canada, the entry of the chemotherapy department should be adjacent to the waiting area but outside the patient care area. Clinical support and clean supply rooms should be centralized or decentralized in such a way as to have direct access from an inner corridor for ready access from patient areas, depending on the design and functional program requirements (CSA, 2016). Moreover, staff areas should be planned separately from patient areas for safety and privacy (CSA, 2016).

In the DH standard (2013a) of the United Kingdom, the components of a chemotherapy department are listed as follows:

- waiting/consultation,
- examination module,
- chemotherapy treatment rooms,
- satellite pharmacy,
- clinical support areas, and
- offices.

The examination module entails the pre-treatment consultations of chemotherapy patients, oral chemotherapy treatments, phlebotomy, and units for education and evaluation of patients during treatment (DH, 2013a). Figure A.1 summarizes the relationships between the various functions within the chemotherapy department according to the standard (DH, 2013a).

In the DVA standard (2009) of the United States, it is stated that general areas in a chemotherapy department such as waiting, counseling, and patient education areas are to be located in the front, clinical areas and clinical support areas in the middle, and staff areas in the back of the department. The designated internal function relations diagram of a chemotherapy department is presented in Figure A.2.

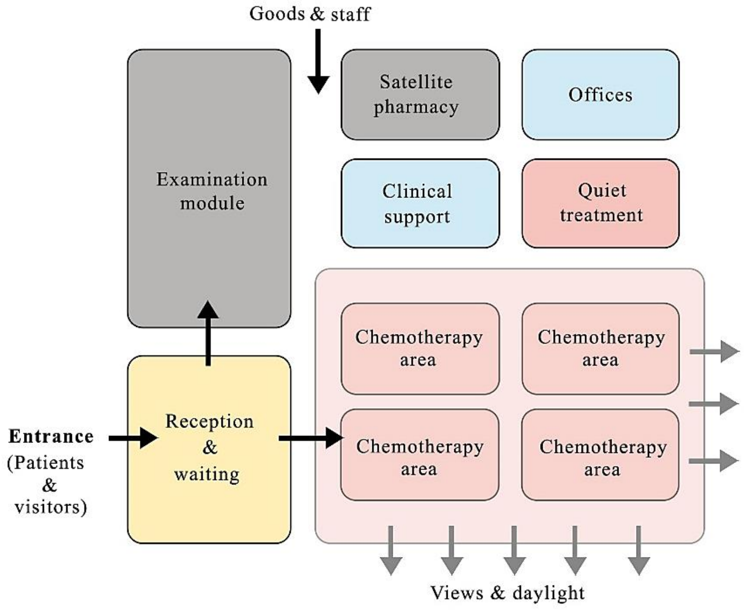


Figure A.1. Internal function relations of a chemotherapy unit according to the DH standard (2013a)

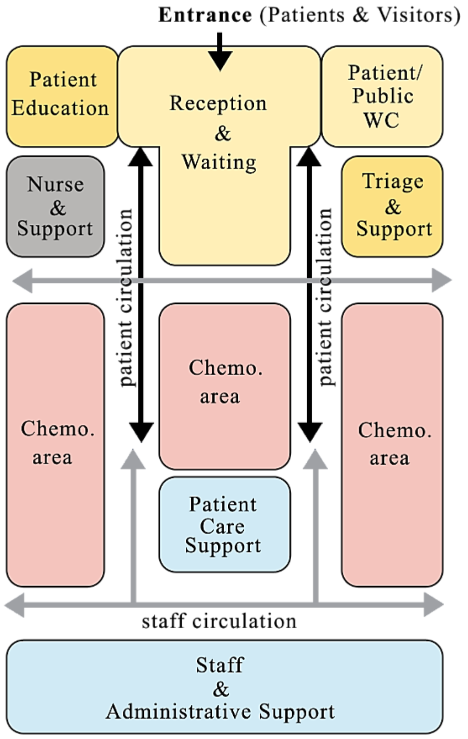


Figure A.2. The designated internal function relations diagram of a chemotherapy department according to the DVA standard (2009)

There is no information in the FGI (2014) standard, the AHIA (2016c) standard, or the regulations of the Ministry of Health of Turkey regarding the internal function relationships of chemotherapy departments. It is common for all other standards to plan the patient-related areas such as consultation/waiting areas and staff-related areas such as offices at opposite ends to distinguish the flow of the public and medical zones.

A.3. Treatment Areas

Treatment areas of a chemotherapy department could be arranged in arena, cubicle, single private room, or airborne isolation room layouts. The AHIA standard (2017f) of Australia describes the planning of arena-type chemotherapy treatment spaces, each consisting of 9 m^2. According to the standard (AHIA, 2017f), each patient care area should be equipped with:

- treatment chair/bed,
- treatment trolley,
- medical gas unit consisting of oxygen, vacuum, and medical air,
- examination lamp,
- chair and stool,
- overbed table,
- television,
- nurse call and emergency system,
- storage for personal items, and
- privacy curtain surrounding the area.

Furthermore, a clinical handwash basin, wall-mounted dispensers of paper towels, soap, etc. and a closed bin should be provided in the room (AHIA, 2017f). A sample arena-type chemotherapy plan, elevation, and axonometric drawing as presented in the standard (AHIA, 2017f) are given in Figures A.4. and A.5.

In the CSA standard (2016) of Canada, it is stated that all patient care areas should be planned so that they can be observed directly from the staff stations. Within the rooms,

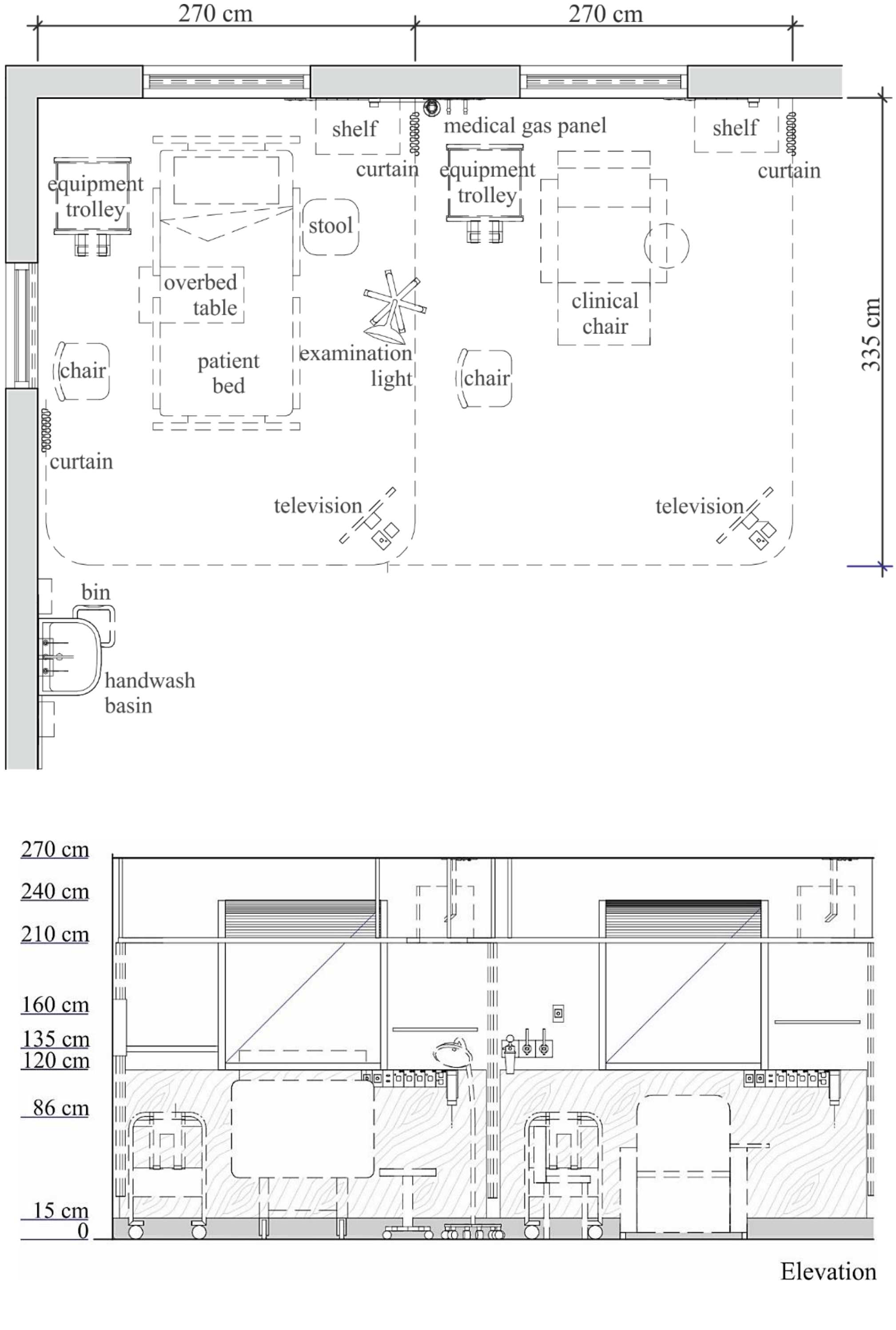


Figure A.3. Sample plan and elevation of a chemotherapy arena according to the AHIA standard (2017f)

Figure A.4. Sample axonometric drawing of a chemotherapy arena according to the AHIA standard (2017f)

closed storage equipment should be used to provide infection control, patient-focused care, and flexibility (CSA, 2016). Moreover, closed waste disposal boxes should be easily accessible from patient care areas (CSA, 2016). Airborne isolation rooms should be located away from the main corridor and other patient rooms, and close to the entrance of the unit to limit the travel distance of patients with immunodeficiency or infectious diseases to the treatment area (CSA, 2016).

In the DH standard (2013a) of the United Kingdom, it is recommended to plan both arena-type and individual treatment rooms for chemotherapy procedures. The number of rooms and arenas should be determined considering the number of potential patients in the region where the chemotherapy unit will be established (DH, 2013a). Due to the weakened immune systems of the patients caused by cytotoxic drugs used in chemotherapy, easy-to-clean surface materials should be used to provide non-infectious environments and prevent contamination in the treatment unit (DH, 2013a). According to the standard (DH, 2013a), chemotherapy arenas should consist of a maximum of six patient care areas, each of which is at least 10 m^2 in size. Moreover, medical oxygen and vacuum units should be located between each of two patient care areas for emergencies (DH, 2013a). The single treatment rooms, which should be at least 12 m^2 in size, need to be planned in a quiet area for patients seeking reclusion (DH, 2013a).

In the FGI standard (2014) of the United States, it is stated that the chemotherapy treatment spaces could be planned in arena-type, cubical-type, or single room layouts. Those treatment spaces should be planned separately from waiting and administrative areas, and away from the view of other patients and visitors, in terms of patient privacy (FGI, 2014). If the arena system has been used, each patient care area should be at least 70 ft^2 (6.04 m^2) (FGI, 2014). On the other hand, while at least 80 ft^2 (7.43 m^2) should be provided in patient care area per patient in cubical-type arrangements, for single room systems, each room must have a floor space of at least 100 ft^2 (9.29 m^2) (FGI, 2014). In addition, there should be at least 5 ft (1.52 m) of clear space between beds or seats in arena-type treatment rooms. Moreover, for cubicle-type and single treatment rooms, at least 3 ft (0.91 m) of clearance should be left on at least three sides of the bed or seat (FGI, 2014). According to the standard (FGI, 2014), an appropriate number of airborne isolation rooms should be planned within the department. Those spaces should only be arranged as single-bed rooms containing a handwash station at the entrance and a toilet (FGI, 2014).

In the DVA standard (2009) of the United States, chemotherapy treatment spaces are described in arena schemes, and it is stated that the arenas should consist of a maximum of 8 patient care areas with a minimum area of 110 ft^2 (10.22 m^2) each. In each patient care area, there should be:

- medical gas unit consisting of oxygen, vacuum, and medical air,
- treatment stretcher/chair,
- chair and stool,
- television,
- nurse call and emergency system,
- wall-mounted coat hook, and
- privacy screen surrounding the area (DVA, 2009).

A sample tripartite chemotherapy arena plan according to the standard (DVA, 2009) is presented in Figure A.5.

No information is available on the clinical areas of the chemotherapy department in the regulations of the Ministry of Health of Turkey, and the CSA standard (2016) does not provide a comprehensive explanation of the issue. Moreover, in terms of treatment space layouts, the DVA (2009) and AHIA (2016c) standards mention only arena-type patient care areas; the DH standard (2013a) addresses arena- and room-type; and the FGI standard (2014) includes arena-, cubicle-, and room-type chemotherapy areas (Table A.3.). In addition, the FGI (2014) and CSA (2016) standards state that a sufficient number of airborne isolation rooms should be planned within the department.

A.4. Clinical Support Areas

In the CSA standard (2016) of Canada, it is stated that there should be working areas around the patient care spaces where staff can maintain direct visual contact with the patients. In addition, drug supply and clean/soiled rooms should be located to be easily accessible from patient care areas (CSA, 2016).

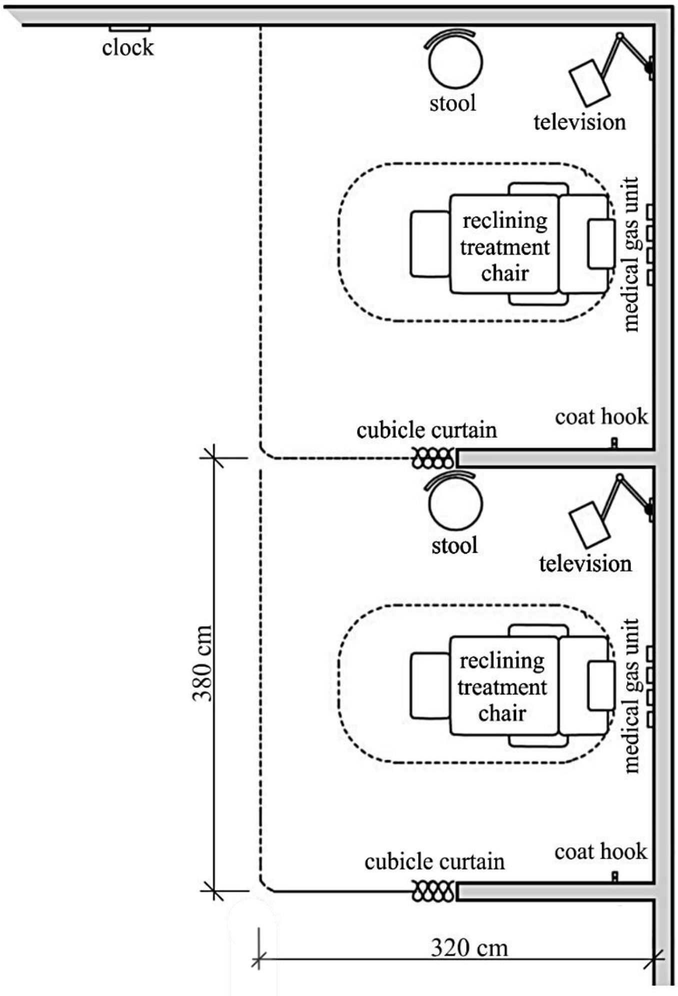


Figure A.5. Sample plan of a chemotherapy arena according to DVA standard (2009)

Table A.3. *Comparison of chemotherapy treatment areas in different standards*

	AHIA	**CSA**	**DH**	**FGI**	**DVA**	**MH**
Arena-type patient care area (per patient)	9 m^2	no area information	10 m^2 (max. 6)	70 ft^2 (6.04 m^2)	110 ft^2 (10.22 m^2) (max. 8)	-
Cubicle-type patient care area (per patient)	-	-	-	80 ft^2 (7.43 m^2)	-	-
Single treatment room	-	no area information	12 m^2	100 ft^2 (9.29 m^2)	-	-

In the DH standard (2013a) of the United Kingdom, clinical support areas of a chemotherapy department should be directly accessible from clinical areas and consist of:

- chemotherapy preparation room,
- examination and consulting rooms
- interview room,
- staff communication base,
- dispensary for non-chemotherapy drugs,
- assisted shower room,
- trolley/bed parking bay,
- clean/dirty utility rooms, and
- linen, equipment and consumables, and fluid storage.

The examination module entails the pre-treatment consultations of chemotherapy patients, oral chemotherapy treatments, phlebotomy, and units for education and evaluation of patients during treatment (DH, 2013a). Injectable cytotoxic drugs used for chemotherapy should be prepared in a special aseptic unit (DH, 2013a). Those units can be planned either at the central pharmacy adjacent to the chemotherapy department or as satellite pharmacy units within the department (DH, 2013a). Chemotherapy preparation rooms are planned to store ready-to-use sterile packages and to prepare chemotherapy drugs for treatment (DH, 2013a). According to the standard (DH, 2013a), this room can be arranged either as a central facility of 16 m^2, which will operate 24 hours, or in the form of satellite stations of 9 m^2 per treatment arena (DH, 2013a) (Figure A.6.). The prepared drugs are hazardous and must be stored in locked facilities (DH, 2013a). For this reason, the delivery of those drugs must be safe and traceable; delivery via pneumatic tubing is therefore not feasible due to the risks involved (DH, 2013a). A sample schedule of accommodation presented in the standard for a 24-patient-capacity department is given in Table A.4.

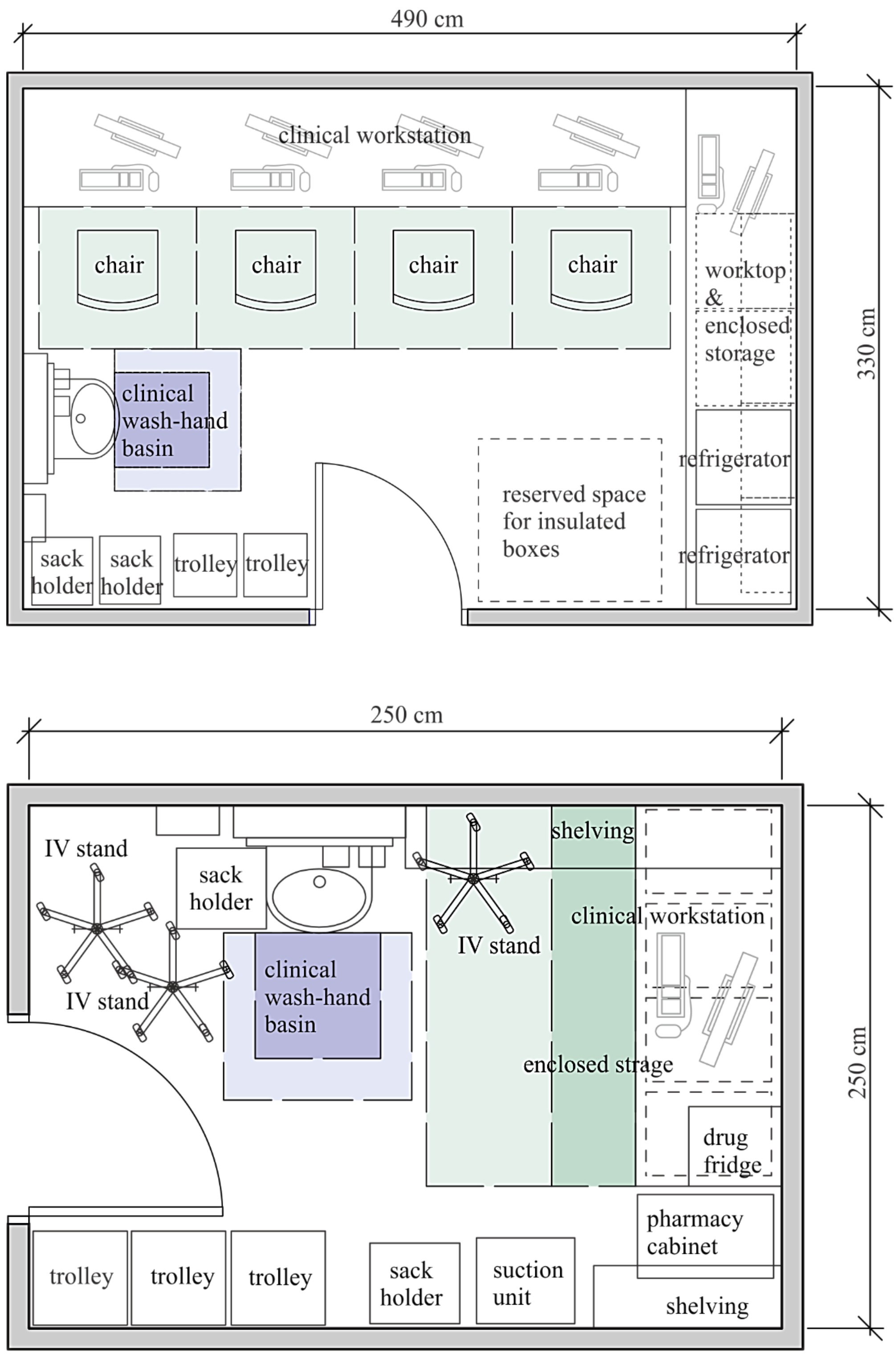


Figure A.6. Sample plans of chemotherapy preparation rooms of 12 m^2 and 9 m^2 according to the DH standard (2013a)

Table A.4. *Clinical support areas for a 24-patient-capacity chemotherapy department according to the DH standard (2013a)*

Room name	**Quantity × Net area**	**Notes**
Chemotherapy preparation room	1 × 16 m^2	Alternatively, satellite rooms of 9 m^2 can be planned for each 6-patient arena
Staff station	4 × 11 m^2	The minimum required area for two medical staff; one station should be planned for each 6-patient arena
Parking bay: trolley/bed	2 × 4 m^2	
Clean utility room	1 × 16 m^2	
Soiled utility room	1 × 8 m^2	
Shower room: assisted	1 × 8 m^2	
Store: linen	1 × 3 m^2	
Store: equipment and consumables	1 × 12 m^2	
Store: fluids	1 × 12 m^2	
Examination module		
Examination/physical therapy room	4 × 12 m^2	
Consulting/examination room	4 × 16 m^2	
Interview room	1 × 12 m^2	7 places
Dispensary	1 × 8 m^2	For non-chemotherapy drugs
Staff communication base	1 × 11 m^2	The minimum required area for two medical staff
Clean utility room	1 × 16 m^2	
Dirty utility room	1 × 8 m^2	
Store: linen	1 × 3 m^2	
Store: equipment and consumables	1 × 8 m^2	

In the FGI standard (2014) of the United States, the clinical support areas of a chemotherapy department consist of:

- medication preparation room,
- nurse station,
- clean/soiled workrooms,
- clean supply room,
- soiled holding room, and
- equipment and supply storage.

The drug preparation room should be positioned to be under the visual control of the nurses (FGI, 2014). Within the room, there should be:

- a workbench,
- a handwashing station,
- a lockable refrigerator,
- locked storage for controlled medicines, and
- a waste bin for sharp and piercing tools (FGI, 2014).

A clean workroom and supply rooms should be planned separately from and without any direct connection with the soiled working room and holding rooms (FGI, 2014). Clean workrooms should be equipped with workbenches, handwashing stations, and storage cabinets for sterile materials (FGI, 2014). Clean supply rooms are designed for storage and retention as part of the system within the healthcare facility regarding distribution of clean and sterile materials (FGI, 2014). Therefore, they do not require a workbench and handwashing station (FGI, 2014).

Soiled workrooms should be equipped with a workbench, handwashing stations, a clinical service sink with a bedpan washer, and closed storage cabinets (FGI, 2014). A clinical service sink and workbench are not required for those rooms being used only to hold soiled material. However, if there is no bedpan washer in the soiled working room, it is acceptable to place that system in the soiled holding rooms or in the toilets of patient rooms (FGI, 2014). If this is not the case, only the handwashing basin, hand hygiene station, and closed storage cabinets should be planned in the soiled holding rooms (FGI, 2014).

In the DVA standard (2009) of the United States, the chemotherapy preparation module, clean supply rooms, soiled holding room, and general storage areas are listed as the clinical support areas of chemotherapy. The chemotherapy preparation module consists of an anteroom (approximately 9 m^2), a clean hall serving as an airlock, a drug preparation room (min. 10 m^2), and a service room (approximately 4 m^2) (DVA, 2009) (Figure A.7.). The drug preparation room is required to be under sterile conditions (DVA, 2009). Therefore, a secondary wall system is suggested for a clean hall and drug preparation room to maintain clean room conditions (DVA, 2009). According to the standard (DVA, 2019), the anteroom should be equipped with:

- card entry system,
- stainless steel-covered ceiling and walls,
- stainless steel floor cabinets,
- handwashing basin,
- wall-mounted towel paper and soap dispensers,
- telephone,
- refrigerator,
- clock,
- waste boxes, and
- wall-mounted coat hooks.

Within the clean hall, an open shelving system for clear aprons and consumables, closed boxes for dirty laundry, and coat hooks are required (DVA, 2009). The drug preparation room should be air-conditioned with a laminar flow system for biological safety (DVA, 2009). The main accoutrements provided in the drug preparation room are:

- intravenous visual inspection cabin,
- workbench,

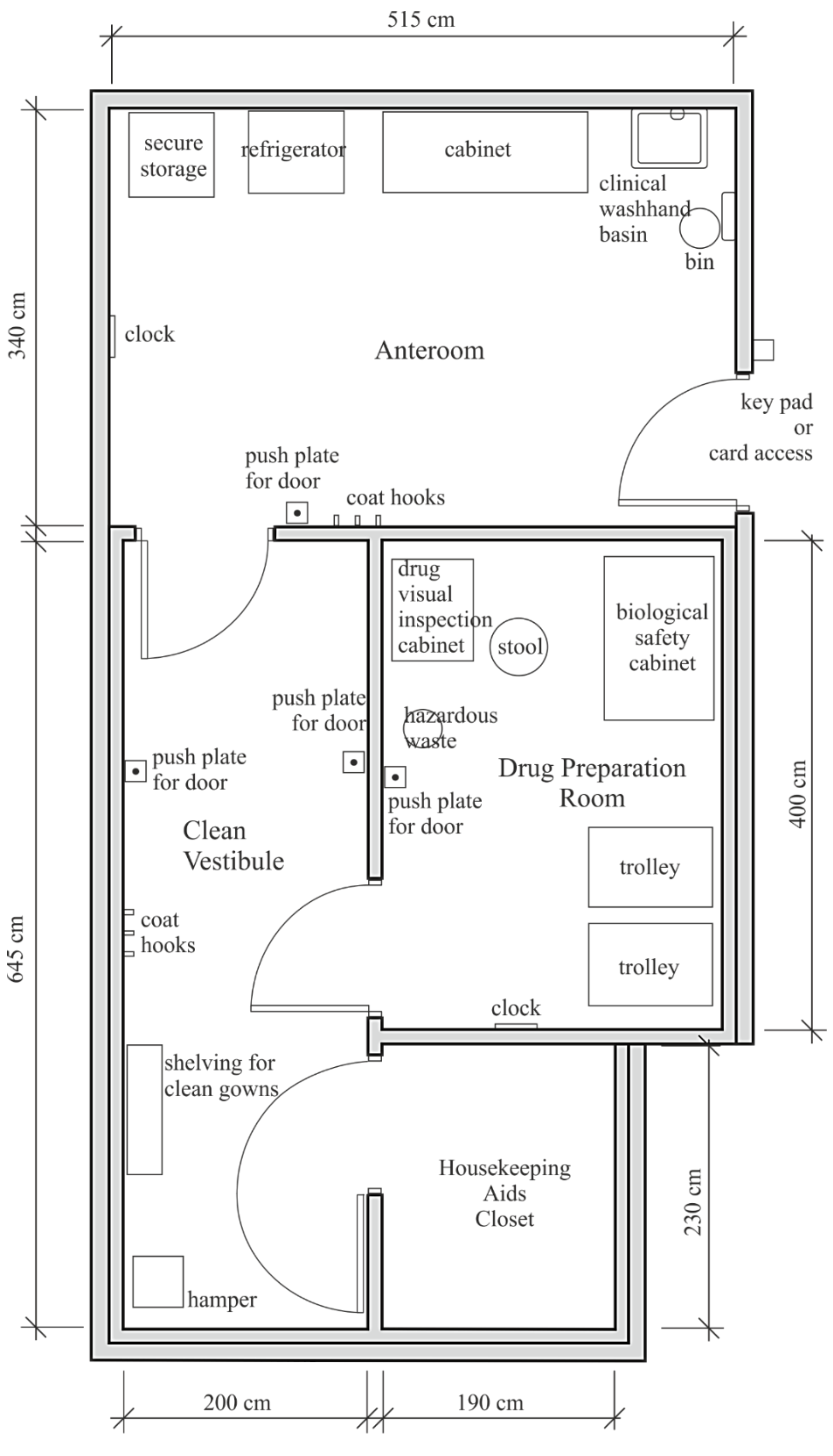


Figure A.7. Sample plan of a chemotherapy preparation module according to the DVA standard (2009)

- lockable refrigerator,
- locked storage for controlled medicines,
- waste boxes for sharp and puncturing instruments,
- stool, and
- clock (DVA, 2009).

No information is available on the clinical support areas of the chemotherapy department in the AHIA standard (2016) or the regulations of the Ministry of Health of Turkey, and the CSA standard (2016) has not provided a comprehensive explanation of the issue. In the other examined standards, the chemotherapy preparation room, clean supply room, soiled holding room, and staff stations are usually described as the required clinical support areas. A summary of this subject is presented in Table A.5.

A.5. Staff Areas

In the CSA standard (2016) of Canada, it is stated that staff areas should be away from patient areas due to security and confidentiality issues; however, no requirement list or size information has been given.

In the DH standard (2013a) of the United Kingdom, offices, an open-plan administration area, a seminar room, a staff rest room, a pantry/refreshment area, a cleaners' room, a changing area, and toilets are required for staff use in chemotherapy departments. A sample schedule of accommodation in terms of staff areas presented in the standard for a 24-patient-capacity department is given in Table 4.6.

In the FGI standard (2014) of the United States, it is stated that a rest room of a minimum of 100 ft^2 (9.29 m^2) and easily accessible toilets with handwashing basins are required for the staff.

Table A.5. *Comparison of chemotherapy clinical support areas in different standards*

Room name	FGI	DVA	AHIA	DH	CSA	MH
Chemotherapy preparation room	no area information	330 ft^2 (30.66 m^2)	-	1 × 16 m^2	-	-
Clean supply room	no area information	no area information	-	2 × 16 m^2	no area information	-
Soiled holding room	no area information	no area information	-	2 × 8 m^2	no area information	-
Nurse station	no area information	-	-	5 × 11 m^2	no area information	-
Storage	no area information	-	-	38 m^2	-	-
Clean workroom	no area information	-	-	-	-	-
Soiled workroom	no area information	-	-	-	-	-
Examination room	-	-	-	4 × 12 m^2	-	-
Consulting room				4 × 16 m^2		
Interview room	-	-	-	1 × 12 m^2	-	-
Trolley/bed parking bay	-	-	-	2 × 4 m^2	-	-
Dispensary	-	-	-	1 × 8 m^2	-	-
Assisted shower room	-	-	-	1 × 8 m^2	-	-

Table A.6. *Staff areas for a 24-patient-capacity chemotherapy department according to the DH standard (2013a)*

Room name	Quantity × Net area	Notes
Office - one person	3 × 8 m^2	
Office - two persons	1 × 12 m^2	
Administration area - open plan	6 × 6.6 m^2	
Seminar room	1 × 16 m^2	10 places
Staff rest room	1 × 19 m^2	10 places
Pantry/refreshment area	1 × 8 m^2	
Cleaners’ room	2 × 8 m^2	
WC - ambulant	3 × 2 m^2	
Changing area	33 × 1.4 m^2	suggested apportionment 2/3 female to 1/3 male

According to the DVA standard (2009) of the United States, staff access should be separate from patient registration and waiting areas, and the resting and changing rooms should be kept away from the inpatient and outpatient circulation. According to the standard (DVA, 2009), the staff areas consist of offices, toilets, changing rooms, rest rooms, conference rooms, and libraries.

No information is available on the staff areas of the chemotherapy department in the regulations of the Ministry of Health of Turkey, while the CSA (2016) and FGI (2014) standards do not offer a comprehensive explanation of the issue. The other examined standards are parallel with each other in that offices, rest rooms, changing rooms, toilets, and seminar/conference rooms are described as required staff areas.

A.6. Patient and Public Areas

In the CSA standard (2016) of Canada, it is stated that the entry area for patients and relatives should be adjacent to the waiting area but outside the patient care zone.

In the DH standard (2013a) of the United Kingdom, it is stated that waiting areas of patients and relatives can be planned either as single and centralized areas or as sub-areas linked to the treatment areas, depending on the size and organization of the department. In addition, patient support services such as wig attachment and prosthetic services, information/education services, and complementary therapies are important for the chemotherapy department (DH, 2013a). According to the standard (DH, 2013a), those areas should be ideally planned within the department; otherwise, they should be located at the closest possible point. A sample schedule of accommodation in terms of patient and public areas presented in the standard for a 24-patient-capacity department is given in Table A.7.

According to the FGI standard (2014) of the United States, waiting areas having water dispensers and telephones, toilets with handwash basins, locked storage cabinets where patients can put their belongings, and a kitchen with a handwashing sink, countertop, refrigerator, microwave oven, and storage cabinets should be provided for patients and relatives.

Table A.7. *Patient and public areas for a 24-patient-capacity chemotherapy department according to the DH standard (2013a)*

Room name	Quantity × Net area	Notes
Reception desk	2 × 5.5 m^2	
Waiting area: 25 places	25 × 2.5 m^2	Children's play area and 10% wheelchair places will be provided
Waiting area: 6 places (for examination module)	6 × 2.5 m^2	Children's play area and 10% wheelchair places will be provided
Information/resource area	1 × 12 m^2	3 persons
Nappy changing room	1 × 5 m^2	
Infant feeding room	1 × 6 m^2	
Public WC: semi-ambulant	2 × 2.5 m^2	
Public WC: independent wheelchair	1 × 4.5 m^2	
Patient WC: semi-ambulant	4 × 2.5 m^2	
Patient WC: independent wheelchair	2 × 4.5 m^2	

In the DVA standard (2009) of the United States, it is noted that waiting places, toilets, patient education services, and shopping areas should be planned at the entrance of the chemotherapy department for patients and their relatives.

No information is available in the AHIA standard (2016) or the regulations of the Ministry of Health of Turkey regarding the patient and public areas of the chemotherapy department, and there is no detailed information in the other examined standards, either. The explanations about this subject matter mostly include the waiting areas for patients and their relatives.

B. RADIATION ONCOLOGY DEPARTMENT

This section covers the basic physical requirements of a radiation oncology department in a healthcare facility in terms of general settlement principles (1), functional relationships (2), treatment areas (3), clinical support areas (4), staff areas (5), and patient/public areas (6), respectively.

B.1. General Settlement Principles

In the AHIA standard (2016c) of Australia, it is stated that the radiotherapy unit could be planned as an independent center or a unit of integrated health facilities. According to the standard, if the radiation oncology department is planned in integrated health campuses, the unit should be planned closely with:

- other cancer treatment services, both inpatient and outpatient,
- education and research facilities,
- medical imaging (CT and MR) department,
- nuclear medicine department, and
- hematology and medical oncology clinics (AHIA, 2016c).

Moreover, it is noted in the standard that a radiation oncology department will usually be located on the ground or an underground level by virtue of the radiation-shielding specifications and the ease of installation and maintenance of specialized and heavyweight equipment (AHIA, 2016c). The location of the department should enable direct access from parking areas and public transportation as much as possible to minimize stress for cancer patients attending on a daily basis (AHIA, 2016c). Additionally, the department is required to maintain access for people with disabilities, inpatients on stretchers/beds, and ambulances (AHIA, 2016c). If the department is planned in integrated health campuses, enclosed links are needed between the department and the main hospital not only for inpatients but also for access to other related departments and the transfer of supplies and goods (AHIA, 2016c).

According to the CSA standard (2016) of Canada, a radiation oncology department requires an interdisciplinary approach to achieve comprehensive patient-centered and family-centered operations. In this respect, the units that are recommended to have a direct connection with the radiation oncology department are the ambulatory care clinics, emergency services, building entrance and parking area, and rehabilitation services (Table B.1.) (CSA, 2016).

In the DH standard (2013a) of the United Kingdom, it is stated that although radiation oncology departments are largely independent, they require good access to the pharmacy, imaging department, surgical services, emergency department, intensive care services, and pathology department.

Table B.1. *General settlement principles of radiation oncology department with other units according to the CSA standard (2016)*

Important relationships (recommended)			
Related service	**Component impacting the relationship**	**Objective**	**Alternatives to direct adjacency of services**
Ambulatory care	The area as a whole	Provide access to clinical specialists and expansion during peak periods Sharing of selected support services	
Emergency service	Patient treatment cubicles	Transfer of patient requiring emergency intervention	
Building entry and parking	Building entry and adjacent parking	Provide ease of access for patients utilizing services for extended periods over multiple visits	Provide direct access from elevators, a building entry and parking
Exterior garden/therapy area	Garden/therapy area	Provide direct patient/family access to exterior garden/therapy areas for leisure and mobilization activities	Provision of secured roof top areas

In the FGI standard (2014) of the United States, it is noted that the location of the radiation oncology unit should be close to the imaging department to facilitate patient imaging examinations before treatment operations.

The DVA standard (2008, 2016a) of the United States indicates that although radiation oncology is generally a stand-alone unit to augment privacy for patients and their families, it should be located close to and on the same floor as ambulatory care, audiology and speech pathology clinics, intensive care services, medical research and development services, and surgical services. Moreover, according to the standard (DVA, 2016a), the imaging department needs to be close to the radiation oncology department, although being on a different floor is acceptable (Table B.2.).

Table B.2. *Functional relationship matrix of radiation oncology department according to the DVA standard (2016a)*

Relationship	**Services**	**Reasons**
2	Imaging department	G, H
3	Ambulatory care	G, H
3	Audiology & speech pathology clinics	H
3	Intensive care services	H
3	Medical research & development services	I
3	Surgical services	H

Relationship	Reasons
1. Adjacent	A. Common use of resources
2. Close/same floor	B. Accessibility of supplies
3. Close /different floor acceptable	C. Urgency of contact
4. Limited traffic	D. Noise and vibration
5. Separating desirable	E. Presence of odors and fumes
	F. Contamination hazard
	G. Sequence of work
	H. Patient convenience
	I. Frequent contact
	J. Need for security
	K. Closeness inappropriate

In the standards examined within the scope of this thesis, the necessity of proximity to the imaging department is emphasized in terms of general settlement principles of the radiation oncology department. In addition, the relation of the radiation oncology department with inpatient care services, ambulatory care clinics, surgical services, and emergency services has been considered as significant. A summary of the subject is presented in Table B.3.

B.2 Internal Function Relations

According to the AHIA standard (2016c) of Australia, the radiation oncology department consists of several components, such as the main entrance/waiting area, outpatient clinics, imaging suite, mold room, and treatment areas. It is emphasized that treatment planning areas should be located close to the imaging areas for the correct functioning of workflows (AHIA, 2016c). Those internal function relationships are summarized in Figure B.1.

Table B.3. *Comparison of functional relationships of radiation oncology department with other units in different standards*

	Imaging	Surgical service	Inpatient care services	Emergency service	Ambulatory care	Pharmacy	Garden & parking	Education & research services
AHIA	X		X		X		X	X
CSA				X	X		X	
DH	X	X	X	X		X		
FGI	X							
DVA	X	X	X		X			X

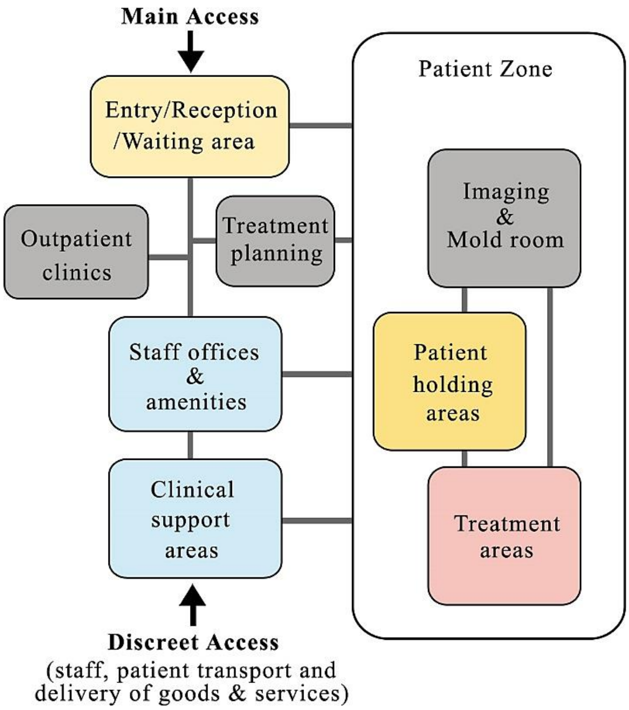


Figure B.1. The functional relationship diagram of a radiation oncology department according to the AHIA standard (2016c)

According to the CSA standard (2016) of Canada, the entrance of the radiation oncology department should be adjacent to the waiting area but outside the patient care zone. Clinical support and clean supply rooms should be centralized based on functional program requirements, or decentralized by having direct access through an internal corridor for ready access from the patient care areas (CSA, 2016). The staff offices and clinical support rooms that are used only by staff, such as treatment planning rooms, should be removed from patient-related areas due to security, privacy, and confidentiality issues (CSA, 2016). In the standard (CSA, 2016), an interdisciplinary care approach that includes all members of the care team (oncologists, nurses, medical physicists, dosimetrists, radiation technology specialists, social workers, dietitians, etc.) is emphasized as the basis of cancer care programs, and that perspective should be reflected in the whole design.

In the DH standard (2013a) of the United Kingdom, components of a radiation oncology department are summarized as:

- radiotherapy treatment areas,
- on-treatment clinic suite,
- treatment planning areas,
- imaging suite,
- mold suite, and
- radiotherapy physics areas.

The on-treatment clinic suite consists of multi-purpose clinical rooms where patients undergoing radiotherapy are seen for examinations and consultations (DH, 2013a). That area can also be used for the evaluation of emergency patients (DH, 2013a). In addition, if pediatric patients are being treated in the department, an anesthesia room should be planned (DH, 2013a). In the standard (DH, 2013a), it was stated that the interview and counseling rooms should be located around the entrance/exit of the simulator and treatment rooms. Those internal function relationships are summarized in Figure B.2.

The DVA standard (2008, 2016a) of the United States indicates that a radiation oncology department consists of:

- reception,
- inpatient and outpatient waiting areas,
- medical staff offices,
- radiotherapy treatment rooms,
- consultation rooms,
- examination rooms,
- imaging rooms,
- treatment planning spaces, and
- clinical and staff support areas.

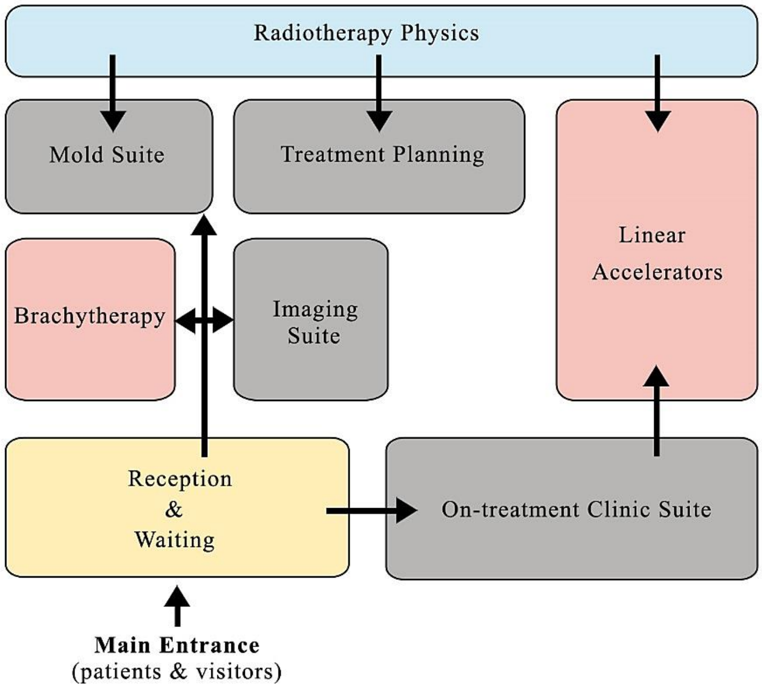


Figure B.2. The functional relationship diagram of a radiation oncology department according to the DH standard (2013a)

According to the standard (DVA, 2008), the waiting area should be separated into inpatient and outpatient waiting. Reception should control the access to the patient areas and channel visitors to the relevant rooms (DVA, 2008). Moreover, separation of patient and staff circulation is essential to provide security, privacy, and confidentiality (DVA, 2008). Additionally, to keep pace with evolutions in technology, flexibility and adaptability should be prominent in the design strategies (DVA, 2008). Those internal function relationships of a radiation oncology department are described by the scheme presented in Figure B.3.

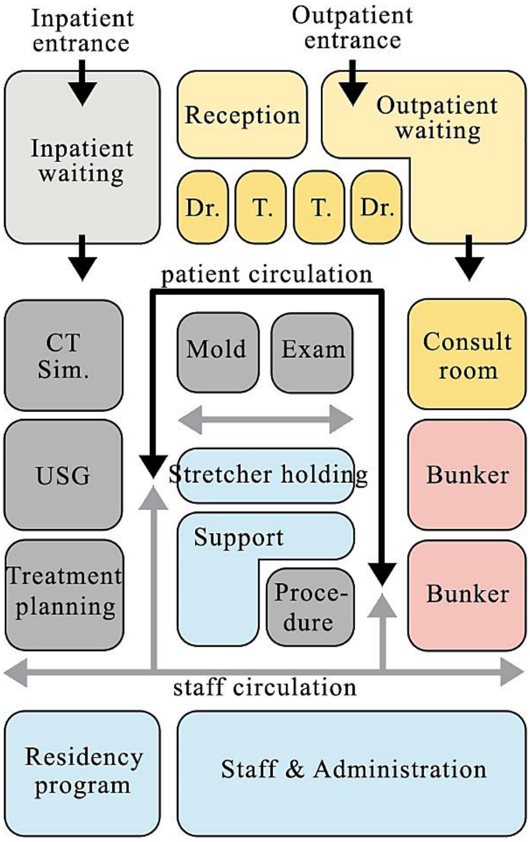


Figure B.3. The functional relationship diagram of a radiation oncology department according to the DVA standard (2008)

In the standards examined within the scope of this thesis, separation of staff areas and clinical support rooms used only by staff from patient-related areas is underlined in terms of internal function relations of the radiation oncology department. In terms of patient flow, the clear transition from the waiting area to the imaging and mold spaces is another aspect in which the standards show parallelism. In addition, it is emphasized that the treatment planning area should be directly accessible from the staff areas, and the treatment bunkers should be located between the patient- and staff-related spaces.

B.3. Treatment Areas

The treatment areas of the radiation oncology unit are called bunkers. Bunkers are specially designed rooms with a reinforced concrete, radiation-shielded vault and a maze-like entryway (AHIA, 2016c; CSA, 2016; DH, 2013a; DVA, 2008; DVA, 2016a; FGI, 2014). Radiation protection needs such as thickness of the primary barrier (walls, floor, and ceiling) and the design of the entry maze should be in accordance with national standards and regulatory requirements (AHIA, 2016c; CSA, 2016; DH, 2013a; FGI, 2014). The requirements and specifications of bunkers are given separately for external and internal radiotherapy applications in the following sections.

B.3.1. External Radiotherapy Treatment Areas

According to the AHIA standard (2016c) of Australia, external radiotherapy bunkers should be placed to be easily accessible from patient areas (change cubicles, sub-waiting, toilets, etc.), treatment planning rooms, and clinical support spaces. In the bunkers, a maze-like entrance corridor and a neutron-shielding door should be designed to prevent the escape of radioactive particles (AHIA, 2016c). The entrance door and maze should be wide enough to allow easy access to the treatment machine, hospital bed, and service equipment (AHIA, 2016c). The main accoutrements needed to be provided in external radiotherapy bunkers are:

- radiotherapy treatment machine,
- oxygen and suction on medical services panel,
- multiple CCTV cameras,
- emergency ‘stop’ switch,
- hand basin,
- benches and storage cupboards for patient machine accessories,
- laser lights for positioning,
- treatment set-up information viewing such as large LCD TV screens,
- monitors and audio equipment for patient contact,
- ceiling art (fixed or projected) and music systems for patient distraction,

- ‘last-man-out’ interlock,
- fixed duress alarm button,
- a significant number of power outlets, and
- nurse call system, including emergency call (AHIA, 2016c).

Although it depends on various factors such as the type of the machine to be used and the function of neighboring rooms, the size of an external radiotherapy bunker is approximately 150 m^2 including the entry maze and radiation-shielding walls (AHIA, 2016c). The optimum radiation oncology department configuration comprises paired bunkers, which assures that the facility can substantially proceed in the case of a malfunction (AHIA, 2016c). If a separate room is planned for the modulator of the radiotherapy device, 15 m^2 should be added to each of the two bunkers (AHIA, 2016c).

The CSA standard (2016) of Canada states that external radiotherapy treatment rooms should be dimensioned by considering the dimensions of the equipment, patient access on a stretcher, medical staff access to the equipment and patient, and service access to the equipment. In order to implement the flexible design principle, radiotherapy treatment rooms should be designed to accommodate the equipment of all major suppliers for high-energy radiotherapy, the infrastructure should facilitate installation of future technologies, and radiation protection measures must meet the requirements of applicable legislation (CSA, 2016). The radiation protection of the rooms should be designed for a minimum of 18 MV photons (CSA, 2016). In rooms designed in this way, an entrance maze should be planned where a very heavy door is not necessary up to 18 MV photons (CSA, 2016). According to the standard (CSA, 2016), these rooms must be located in an area of approximately 99.4 m^2, including the maze and modulator room but excluding the control room. The other considerations within the CSA standard (2016) on this issue can be listed as follows:

- An adequate number of storage spaces must be provided for patient immobilization and positioning devices (vacuum pads, chest and lung panels, thermoplastic shells, etc.).

- A series of drawers should be provided for the storage of specialty products and equipment.
- The clinical handwash basin should be located at the entrance of the room and should include a small shelf for patient-specific denture containers.
- A space should be provided for a linen hamper against the wall.
- Emergency stop buttons must not be blocked by doors in open or closed positions.
- A space should be left for a patient's stretcher/wheelchair near the exit of the room.
- A space with power and data available should be provided for placing two flat panel monitors on either side of the room.

The DH standard (2013a) of the United Kingdom describes the clinical areas of the external radiotherapy unit in detail. The standard (DH, 2013a) states that external radiotherapy bunkers must be radiation-protected and large enough to allow a patient to easily access and move with a bed, stretcher, or wheelchair. The design should also allow the use of any external radiotherapy device, including 360° rotation of the device gantry and tables (DH, 2013a). The entrance of the bunker generally consists of a protected corridor or maze to prevent the escape of radioactive rays (DH, 2013a). Alternatively, heavy protective gates can be planned where a maze is often not provided due to space constraints (DH, 2013a). The other planning considerations to be implemented in external radiotherapy treatment rooms are listed as follows according to the DH (2013a) standard:

- The ceiling of the treatment room should be sufficiently strong.
- In order to gather all services between the control room and the radiotherapy device, a connection must be provided between the wall of the treatment room and the control area. This connection duct and other mechanical ducts shall be designed so as not to compromise the radiation shield provided by the walls and floor.

- Mounting brackets should be provided on the room's ceiling for heavy equipment such as data monitor frames, and rigid support profiles must be installed on the room's walls for alignment lasers.
- A lifting beam or A-frame crane should be located over the center of the radiotherapy device.
- Specialized storage for immobilization devices, vacuum bags, and body castings should be considered. A dedicated shelf or closed cupboards should be provided for these breastplates, lung panels, electron applicators, and their lead end pieces.
- The following facilities should also be provided in treatment rooms:
    1. wall-mounted dispensers for paper towels, paper cups, soap, paper sheets, etc.,
    2. handwashing basin, shelf, and mirror,
    3. chair for patient,
    4. coat hooks,
    5. alignment lasers firmly bolted to the structure,
    6. last-man-out button located near entrance to maze,
    7. safety sign and warning light at entrance to treatment room and within the room,
    8. emergency stops for the linac,
    9. music facilities,
    10. CCTV cameras mounted at a high level to monitor the patient during unaccompanied periods,
    11. two-way communication system between control area and treatment room, and
    12. access to IT, workstations, and wireless connectivity.

According to the DH standard (2013a), although the design of the room depends on the type of device, an external radiotherapy bunker requires approximately 160 m^2 (including maze, but excluding control room). A bunker plan sample is presented in

Figure B.4. The nature of the treatment and the dominating presence of the equipment generally result in anxiety and a depressing experience for patients (DH, 2013a). For this reason, innovative design features such as murals and paintings should be used to create a calming and pleasant environment (DH, 2013a). Moreover, the planning of the room should be done while considering the dignity and privacy of patients (DH, 2013a).

In the FGI standard (2014) of the United States, it is emphasized that radiotherapy treatment rooms should be dimensioned considering the dimensions of the equipment, the patient's access to the equipment on the stretcher, the access of the medical personnel to the equipment and the patient, and the service access to the equipment. The dimensions of radiotherapy equipment should be obtained in coordination with the manufacturer (FGI, 2014). Other architectural details are explained as follows:

- There should be at least 4 ft (1.22 m) of clearance on the other three sides of the treatment table to facilitate bed transfer and provide access to the patient.
- At the entrance of the radiotherapy room, an automatic door with radiation protection, which can be controlled manually in the case of an emergency, should be provided. The door swing must not interfere with equipment or patient transfer space.
- The floor structure of the unit must meet the minimum load requirements for equipment, patients, and staff.
- For ceiling-mounted equipment, the ceilings must have strong support profiles.

In the DVA standard (2008, 2016a) of the United States, the radiotherapy treatment room is defined as a reinforced concrete and radiation-protected space with an entrance maze. The room is entered through a neutron-shielding door operated by an electro-pneumatic system (DVA, 2008). The types and thicknesses of protective materials of the room and the maze should be planned in accordance with standards and regulations and determined by an authorized radiological physicist (DVA, 2008). According to the standard (DVA, 2016a), although the room details vary depending

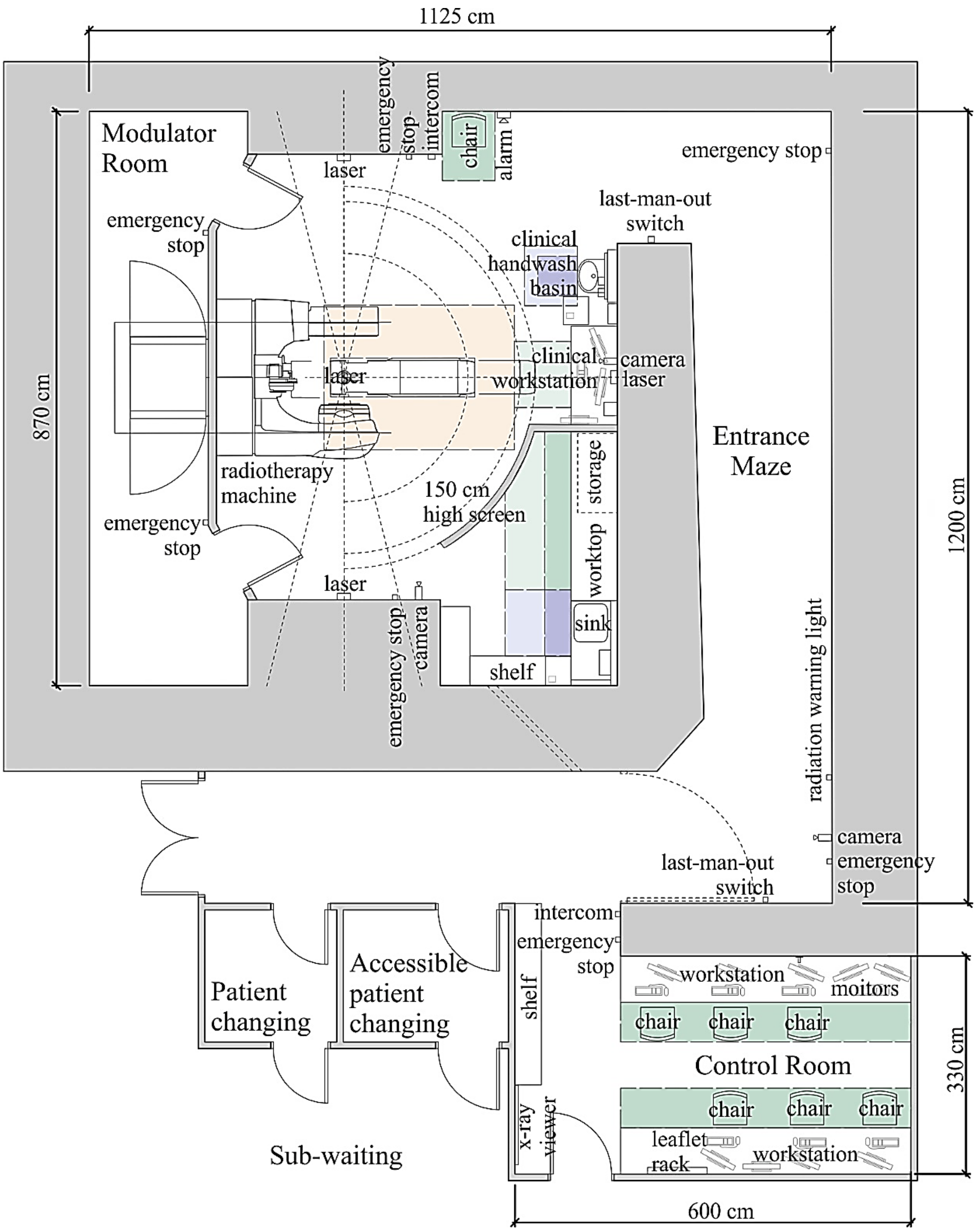


Figure B.4. Sample plan of an external radiotherapy bunker according to the DH standard (2013a) on the device and required radiation protection, the approximate size of the radiotherapy treatment room is 1,240 ft^2 (115.2 m^2). Approximately 720 ft^2 (66.9 m^2) of this area is allocated for operation, while 520 ft^2 (48.3 m^2) is used as wall area for radiation protection (DVA, 2016a). In addition, the entrance maze should be approximately 140 ft^2 (13.1 m^2) (DVA, 2016a). A sample treatment room plan is presented in Figure B.5.

The 2010 MH guideline of Turkey states that the minimum size for radiotherapy bunkers, including compartments, should be 60 m^2; no further details are given.

In the standards examined within the scope of this thesis, except for the 2010 guideline of the Ministry of Health, which does not include detailed information, generally similar requirements are emphasized about the bunkers constituting the clinical areas of the external radiotherapy unit. A summary of the subject in terms of area comparison is presented in Table B.4.

B.3.2. Internal Radiotherapy Treatment Areas

According to the AHIA standard (2016c) of Australia, brachytherapy procedures should be performed in rooms of sufficient size, which are equipped as operating rooms. Due to the use of radioactive materials during the process, radiation protection must be provided within the treatment room (AHIA, 2016c). In addition, the room must have a medical gas panel with oxygen, vacuum, medical air, nitrogen oxide, and nitrogen purge (AHIA, 2016c). According to the standard (AHIA, 2016c), the brachytherapy treatment room, which should be approximately 130 m^2 including the entry maze and radiation-shielding walls, should be located in close proximity to the surgical handwashing (scrub) unit, patient preparation/recovery arena, seed implant storage, sterile storage, and other radiotherapy rooms.

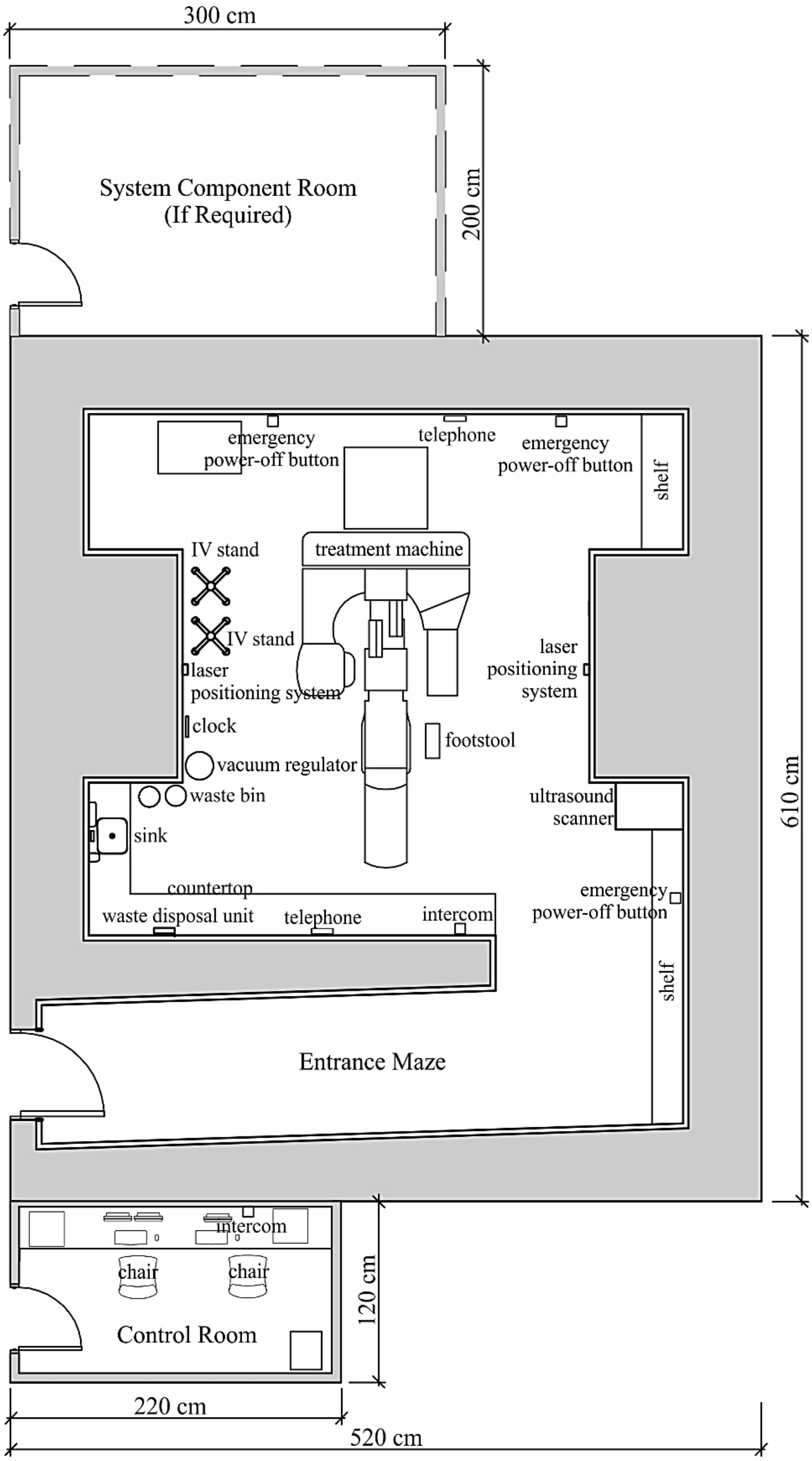


Figure B.5. Sample plan of an external radiotherapy bunker according to the DVA standard (2008)

Table B.4. *Comparison of external radiotherapy treatment room size requirements in different standards*

Space	AHIA	CSA	DH	FGI	DVA	MH
External radiotherapy bunker	150 m^2	99.4 m^2	160 m^2	no area information	115.2 m^2	60 m^2

The CSA standard (2016) of Canada states that brachytherapy can be performed in multi-purpose radiotherapy treatment rooms. Such a room requires approximately 63 m^2 (including maze, but excluding control room), and the required features are listed as follows:

- General-purpose storage with stainless steel countertops should be provided.
- A stainless steel hand hygiene sink (with a towel and soap dispenser) should be provided.
- Open shelving should be provided along one wall.
- Special storage areas must be provided for X-ray applicators.
- Oxygen and vacuum outputs should be planned.
- Telephone, data, and emergency power connections must be provided; nurse call, intercom, and CCTV systems should be planned.
- A door interlock system, warning lights, radiation monitor, and dimmable lighting should be installed.

According to the DH standard (2013a) of the United Kingdom, before the patient receives brachytherapy, an applicator or tube is inserted or implanted in the patient in a surgically equipped room. Therefore, in the design phase, it should be taken into consideration that the patient will be brought to the operation room on a stretcher due to the implantation being performed in a separate operating room from the brachytherapy bunker (DH, 2013a). Brachytherapy is performed in a radiation-shielded room, which is accessed through a maze through a protected door, such as an external radiotherapy treatment room (DH, 2013a). Alternatively, this procedure can also be performed in external radiotherapy treatment rooms; however, this leads to difficulties in the maintenance and efficient use of linear accelerators (machines used in external radiotherapy rooms) (DH, 2013a). The room requires an area of approximately 68 m^2 (including maze, but excluding control room) (Figure B.6.), and the other design considerations are listed as follows:

- The size and design of the brachytherapy treatment room should be appropriate for the procedures to be performed.
- Procedures requiring extensive pre- and post-cleaning should be performed elsewhere and the room should be used only for treatment.
- If the applicator and tube insertions are performed in the brachytherapy treatment room, the room must be designed appropriately for surgical procedures.
- Space requirements for new procedures and technological developments should be considered.
- Open countertop area should be provided in the room and there should be a medical gas panel with oxygen and suction.
- A sink is required for the cleaning of equipment, along with a separate handwashing basin for staff use.
- Adequate storage space should be provided in the room for device applicators, accessories, and other equipment.
- The ‘last-man-out’ buttons should be positioned so that they are visible to the entire room.

In the descriptions of the FGI standard (2014) of the United States, external and internal radiotherapy rooms are not differentiated. Therefore, the information presented for the clinical areas of the external radiotherapy treatment areas section (B.3.1.) is valid for this section.

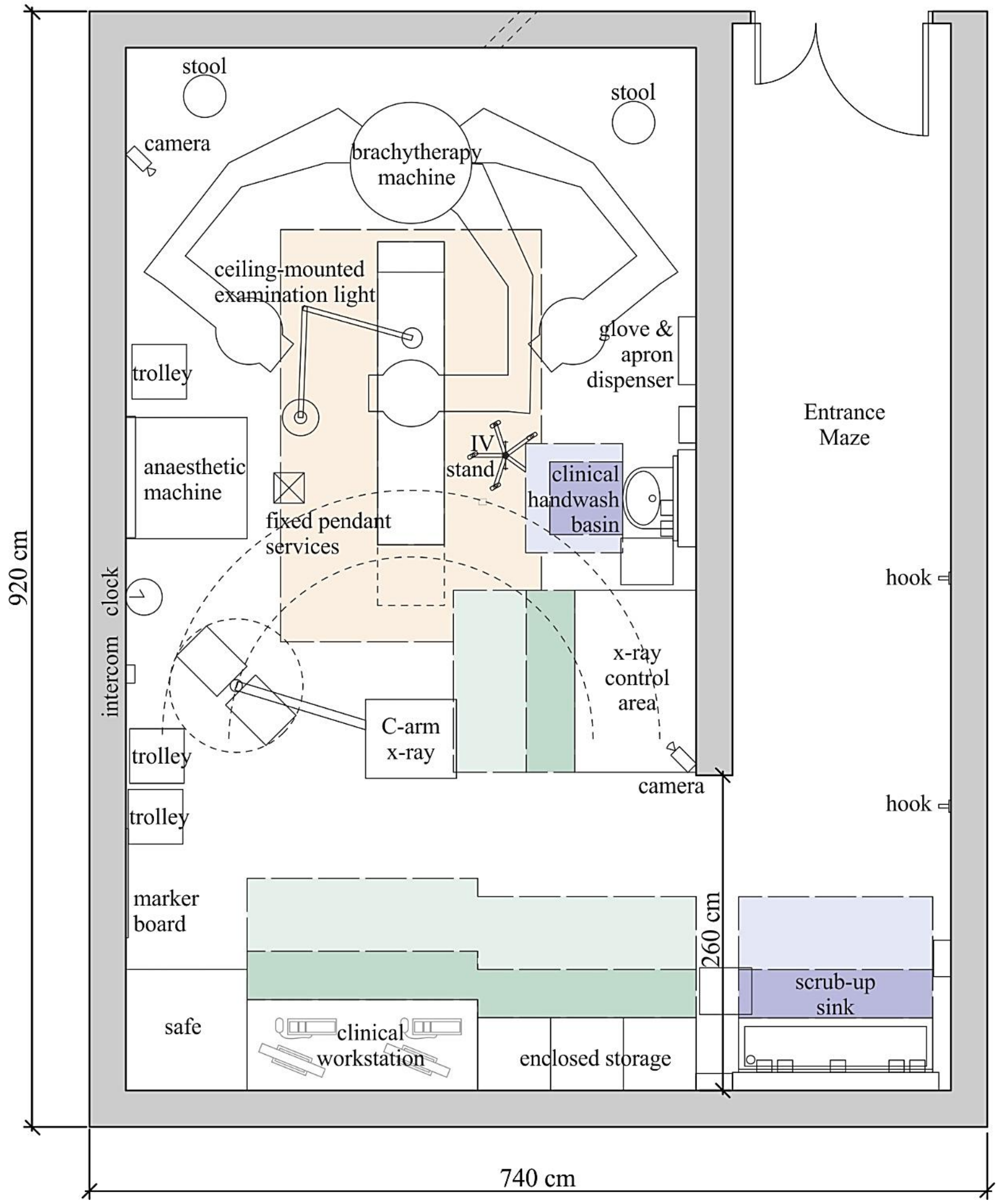


Figure B.6. Sample plan of an internal radiotherapy bunker according to the DH standard (2013a)

In the standards examined within the scope of this thesis, there is no information regarding the clinical areas of the internal radiotherapy treatment rooms in the DVA and MH standards, while the FGI (2014) has not differentiated external and internal radiotherapy. In the remaining three standards, quite different area requirement values are encountered. While the required brachytherapy room area is 63 m^2 and 68 m^2 in the CSA (2016) and DH (2013a) standards, respectively, it is 130 m^2 in the AHIA (2016) standard. The conspicuous diversity in the areas of brachytherapy bunkers is due to differing catheter insertion concepts. The brachytherapy bunkers in which the catheter insertion application is done are equipped as operating rooms and are sized accordingly, like in the AHIA (2016) standard. However, if that application is done in a separate dedicated room or an operating theater, the brachytherapy bunker could be planned to be smaller, as in the requirements of the CSA (2016) and DH (2013a) standards. Therefore, a dedicated procedure room or an operating theater should be provided if the catheter insertion application is not done in the brachytherapy bunker itself. A summary of this subject is presented in Table B.5.

B.4. Clinical Support Areas

The requirements and specifications of clinical support areas are given for (1) bunker support areas, (2) imaging module, (3) examination module, (4) mold module, and (5) other sections, respectively.

Table B.5. *Comparison of internal radiotherapy treatment room size requirements in different standards*

Space	AHIA	CSA	DH	FGI	DVA	MH
Internal radiotherapy bunker	130 m^2	63 m^2	68 m^2	no area information	-	-

B.4.1. Bunker Support Areas

According to the AHIA standard (2016c) of Australia, a control room is required for each radiotherapy bunker to direct the treatment machine, ensure the position of patients with the help of cameras and lasers, control the state of the process, and communicate with patients during treatment if needed (AHIA, 2016c). The standard (AHIA, 2016c) states that floor space of 22 m^2 and 15 m^2 would be enough for external radiotherapy (for each bunker) and brachytherapy (up to four bunkers) control rooms, respectively. The main accoutrements needed to be provided in control rooms are:

- emergency stop switch,
- intercom,
- patient viewing monitors,
- portal imaging computers,
- workstation for image and chart viewing, access to the scheduling system, and space to store treatment records (if not electronic),
- machine control console,
- picture storage and communication system (PACS) monitor, and
- benches/shelving units to suit the equipment (AHIA, 2016c).

Other bunker support areas specified in the AHIA standard (2016c) are listed in Table B.6. together with the number and area sizes for two- and four-bunker units.

The CSA standard (2016) of Canada does not provide detailed information on this issue. However, it is stated that control rooms of 14 m^2 should be planned per bunker, and a radioisotope room of 12 m^2 should be provided as the clinical support area of the brachytherapy unit (CSA, 2016). According to the standard (CSA, 2016), the radioisotope room, equipped with a radiation-shielded door, should have the following equipment:

- general-purpose storage with stainless steel countertops,
- a stainless steel hand hygiene sink,

Table B.6. *Bunker support areas according to the AHIA standard (2016c)*

Room/Space	2 Bunkers	4 Bunkers
External radiotherapy		
Waiting	1 × 7 m^2	1 × 12 m^2
Control room	2 × 22 m^2	4 × 22 m^2
Patient change cubicle	2 × 2 m^2	4 × 2 m^2
Patient change cubicle, accessible	1 × 4 m^2	2 × 4 m^2
Patient toilet	1 × 4 m^2	2 × 4 m^2
Interview room	1 × 9 m^2	2 × 9 m^2
Sub-waiting	2 × 3 m^2	4 × 3 m^2
Handwashing bay	1 × 1 m^2	1 × 1 m^2
Linen bay	1 × 2 m^2	1 × 2 m^2
Equipment store	1 × 9 m^2	2 × 9 m^2
Internal radiotherapy (brachytherapy)		
Control room	-	1 × 15 m^2
Scrub-up bay (2 sinks)	-	1 × 6 m^2
Patient holding/recovery bay	-	1 × 9 m^2
Seed storage and loading	-	1 × 9 m^2
Patient toilet and change	-	1 × 5 m^2
General storage	-	1 × 9 m^2

- paper towel and soap dispensers,
- open shelving along one wall,
- an isotope safe,
- telephone and data connections, and
- warning lights and radiation monitor.

In the DH standard (2013a) of the United Kingdom, it is reported that control rooms of 20 m^2 and 12 m^2 should be provided for each external and internal radiotherapy treatment room, respectively. According to the standard (DH, 2013a), those rooms should comply with the following planning decisions:

- Staff should have easy access to the treatment room maze.
- It should be located in a place where unauthorized access to the operation room can be controlled.
- A CCTV system should be provided for patient observation.
- Monitors in the room should be placed so that they cannot be seen by other patients and patients' relatives due to confidentiality issues.
- The minimum depth of the worktops should be 1000 mm to accommodate computer monitors. This value should be reviewed according to the use of flat screens.
- A minimum length of 9000 mm for worktop space is required for each processing device. Sufficient space must be left between the control desk and the wall to allow easy movement of the radiographs.
- The room must have a large number of sockets, a computer network, and telephone points.
- A data safe must be available to store resource and treatment records.
- Daylight in the room is highly preferable under the condition of protecting monitors from direct sunlight considering glare concerns.

According to the DH standard (2013a), in addition to the control rooms, there are other bunker support areas as listed in Table B.7. The standard (DH, 2013a) states that waiting areas may be planned as sub-waiting areas associated with a single bunker or pair of bunkers or consolidated within a single area, depending on the size and layout of the department. In addition, there should be a children's playground and a wheelchair area comprising 10% of the waiting area (DH, 2013a). The standard (DH, 2013a) includes at least two patient changing rooms for each external radiotherapy bunker. Those rooms should be lockable, adjacent to the bunkers, and positioned so that individuals in the surrounding areas cannot see the patients when they are dressed or undressed (DH, 2013a). Ideally, changing rooms should be "pass through," with the patient entering on one side and leaving into the examination room on the other (DH, 2013a). If a separated waiting area is provided for changed patients, distinction of gender should be ensured (DH, 2013a). Moreover, an anesthetic room (approximately 20 m^2) is required in close proximity to bunkers, especially if children are being treated in the department (DH, 2013a). On the other hand, a play therapy room, which is used to engage pediatric patients' attention by using toys and games in a calming and friendly fashion, could replace the need for anesthesia (DH, 2013a).

Table B.7. *Bunker support areas according to the DH standard (2013a)*

Room/Space		
External radiotherapy	**2 Bunkers**	**4 Bunkers**
Waiting	12 × 2.25 m^2	24 × 2.25 m^2
Control room	2 × 20 m^2	4 × 20 m^2
Radiographer prep room	2 × 10 m^2	4 × 10 m^2
Patient changing room, semi-ambulant	2 × 2 m^2	4 × 2 m^2
Patient change room, independent wheelchair	2 × 4.5 m^2	4 × 4.5 m^2
Patient toilet	1 × 4.5 m^2	2 × 4.5 m^2
Sub-waiting	-	6 × 2.25 m^2
Anesthetic room	1 × 19 m^2	1 × 19 m^2
Play therapy room	1 × 20 m^2	1 × 20 m^2
Internal radiotherapy (brachytherapy)		**1 Bunker**
Waiting		6 × 2.25 m^2
Control room		1 × 12 m^2
Sealed radioactive source preparation room		1 × 12 m^2
Sealed radioactive source storage room		1 × 6 m^2
Recovery room, 2 patients		1 × 28 m^2
Patient toilet		1 × 4.5 m^2
Clean utility		1 × 16 m^2
Dirty utility		1 × 12 m^2
Trolley/bed parking bay		2 × 4 m^2

For brachytherapy treatment, a minimum of 12 m^2 of sealed radioactive source preparation room and 6 m^2 of sealed radioactive source storage should be provided alongside the brachytherapy bunkers (DH, 2013a). The function of those chambers is to provide a suitable environment for the preparation, collection, storage, and transport of solid or sealed radioactive materials used in the brachytherapy process (DH, 2013a). The design of those rooms must comply with the Health and Safety Executive's (HSE) approved code of practice, "Working with ionizing radiation," and the High-activity Sealed Radioactive Sources and Orphan Sources Regulations 2005 ("HASS Regulations") (DH, 2013a). A shielded workbench should be provided for the preparation and handling of radioactive sources that takes place within the room (DH, 2013a). The location of this area should be considered in the structure planning, as it would cause anomalies in localized ground loading due to the weight of the lead shield (DH, 2013a). An example sealed radioactive source storage plan is presented in Figure B.7.

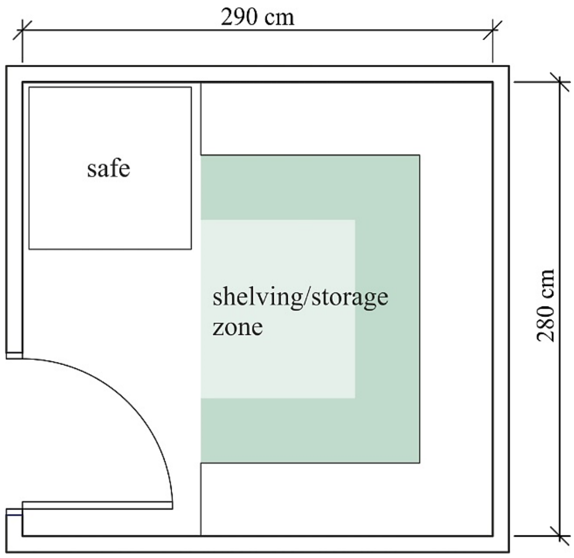


Figure B.7. Sample plan of a sealed radioactive source storage according to the DH standard (2013a)

The FGI standard (2014) of the United States notes that there should be storage areas and an autoclave device for sterilizing the equipment used for the patient during the procedure in close proximity to the radiotherapy bunkers. In addition, it is stated that patient changing spaces and toilets should be provided close to the treatment rooms and waiting areas considering the privacy of patients (FGI, 2014). Patient changing rooms should be planned as two for each bunker, and storage space for valuable items and clothes should be provided (FGI, 2014). At least one of the two changing rooms should be large enough for the patients to be undressed with the help of the staff (FGI, 2014). For brachytherapy bunkers, a pre- and post-procedure patient care area must be provided, which is expected to be immediately accessible from procedure rooms and brachytherapy bunkers (FGI, 2014). The area is required to be planned for a minimum of two patients per bunker and could be arranged as cubicles or rooms according to the department layout (FGI, 2014). In addition, the room needs to be planned considering patient privacy, while permitting visual observation by medical staff (FGI, 2014).

According to the DVA standard (2008, 2016a) of the United States, a control room of 160 ft^2 (14.9 m^2) and a procedure room of 120 ft^2 (11.2 m^2) should be planned per external radiotherapy bunker. The procedure room is required to be equipped with an anesthetic gas system and be large enough to perform catheter insertion applications (DVA, 2008). In addition, there should be at least two patient changing rooms of 35 ft^2 (3.3 m^2) for each bunker (DVA, 2016a).

Among the standards examined within the scope of this thesis, there is no information about the clinical support areas of the external radiotherapy bunkers in the Ministry of Health’s regulations, and the CSA (2016), FGI (2014), and DVA (2008, 2016a) standards do not provide detailed information. In the other standards examined, although the floor areas are different, similar explanations are made about the module content comprising the control room, waiting area, changing rooms, radioactive source room, and storage spaces. A summary of the subject is presented in Table B.8.

Table B.8. *Comparison of bunker support areas in different standards*

Room/Space	**AHIA**	**CSA**	**DH**	**FGI**	**DVA**	**MH**
External radiotherapy						
Waiting	13 m^2	-	-	no area info	-	-
Control room	22 m^2	14 m^2	20 m^2	-	14.9 m^2	-
Storage	12 m^2	-	27 m^2	no area info	-	-
Procedure room	-	-	-	-	11.2 m^2	-
Patient changing	8 m^2	-	13 m^2	no area info	6.6 m^2	-
Patient toilet	4 m^2	-	4.5 m^2	-	-	-
Interview room	9 m^2	-	-	-	-	-
Radiographer prep room	-	-	20 m^2	-	-	-
Anesthetic room	-	-	19 m^2	-	-	-
Play therapy room	-	-	20 m^2	-	-	-
Brachytherapy						
Control room	15 m^2	-	12 m^2	-	-	-
Radioactive source prep room	-	-	12 m^2	-	-	-
Radioactive source storage	9 m^2	12 m^2	6 m^2	-	-	-
Pre/post-procedure room	9 m^2	-	28 m^2	no area info	-	-
Clean utility	-	-	16 m^2	-	-	-
Dirty utility	9 m^2	-	12 m^2	-	-	-
Scrub-up	6 m^2	-	-	-	-	-
Stretcher bay	-	-	8 m^2	-	-	-
Storage & an autoclave device	-	-	-	no area info	-	-

B.4.2. Imaging module

The AHIA standard (2016c) of Australia states that a CT simulator room of approximately 45 m^2 should be planned in the radiation oncology department for every two bunkers. The CT simulator combines the functionality of traditional CT with the features of a three-dimensional radiation treatment planning system and image processing tools (AHIA, 2016c). In the CT simulator room, communication with patients may be difficult due to fan noises from various device systems; the noise varies greatly depending on the type of equipment used (AHIA, 2016c). Therefore, it may be necessary to plan a large cupboard in the room with floor-to-ceiling access in which the device generator is placed (AHIA, 2016c). In that case, the cabinet must have separate airflow for cooling needs (AHIA, 2016c).

The CT simulator room should be adjacent to its support areas, such as the CT simulator control room, patient changing rooms, patient toilets, and sub-waiting areas (AHIA, 2016c). In addition, the room must be near the molding room where stabilization appliances/masks are manufactured (AHIA, 2016c). A sample CT simulator room plan and model is presented in Figure B.8. and Figure B.9., respectively, and the equipment and design criteria that should be applied in the room are listed according to the standard (AHIA, 2016c) as follows:

- Adequate space must be left for the patient’s bed to enter, move, and be placed along either side of the simulator.
- Visual connection must be established with the control room through a lead glass observation window.
- The radiation screening of the room is required to be in accordance with national standards and regulatory requirements.
- Dimmable lighting control systems should be planned.
- Emergency stop buttons must be provided.
- Oxygen and suction outlets should be provided in the medical gas panel.
- CCTV and intercom system should be provided for patient observation.

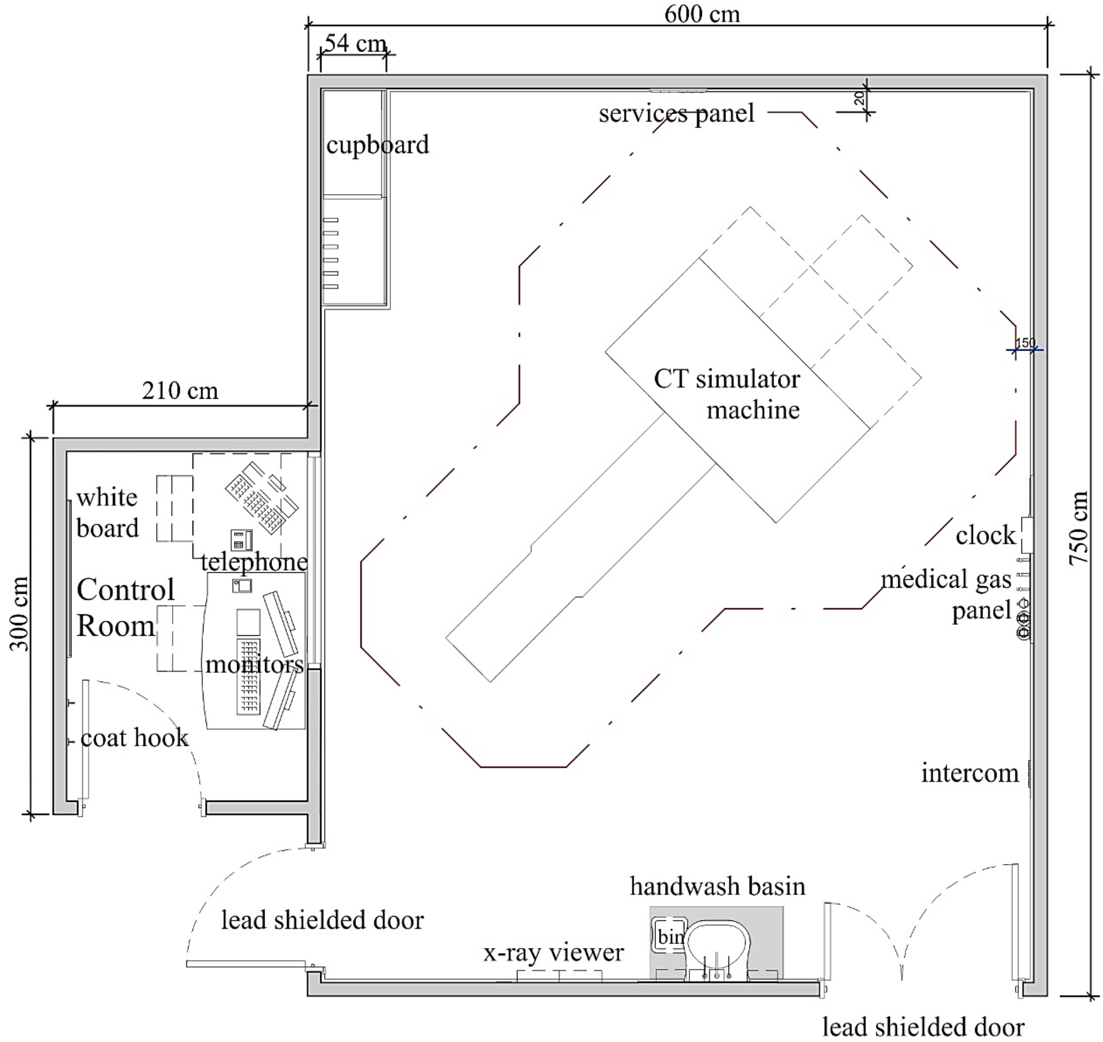


Figure B.8. Sample plan of a CT simulator room according to the AHIA standard (2017d)

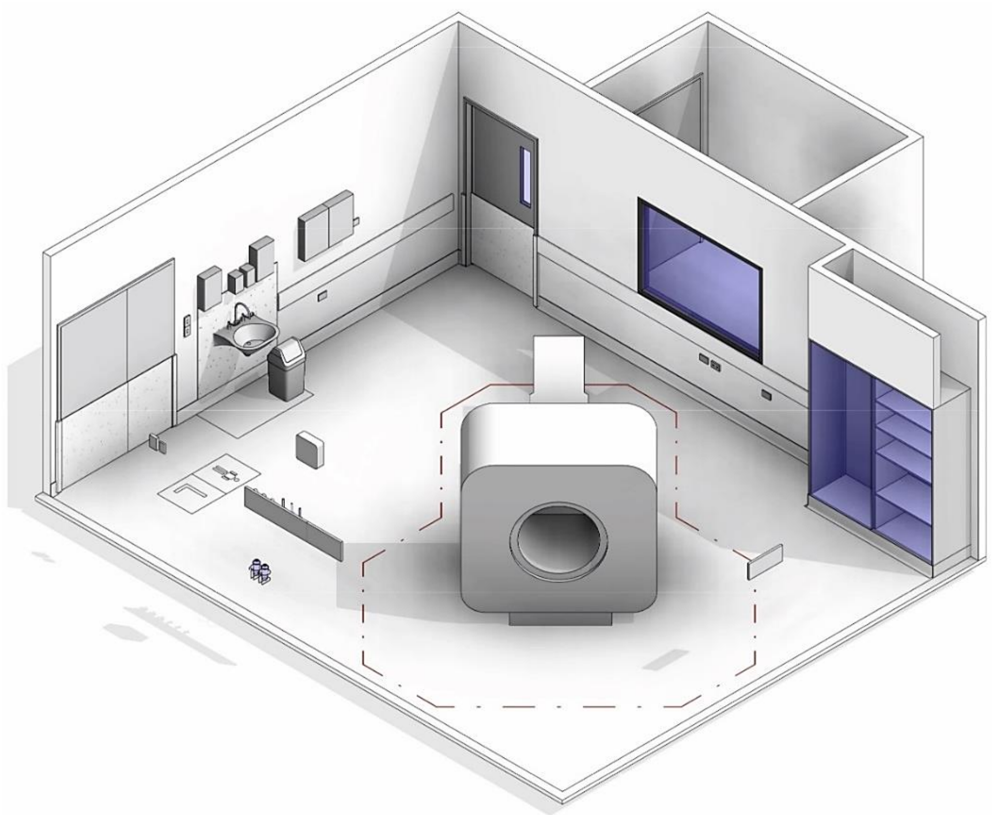


Figure B.9. Sample model of a CT simulator room according to the AHIA standard (2017d)

- Wall and ceiling mounted X-ray laser lights, emergency/nurse call buttons, and handwashing basin should be planned.

The AHIA standard (2016c) states that a control room should be planned adjacent to the CT simulator room and have a floor area of approximately 14 m^2 per CT simulator room. The necessary equipment within the room is listed as follows:

- emergency stop button,
- patient viewing monitor and microphone,
- virtual simulation workstation,
- workstation for image and graphic display,
- PACS monitor and X-ray imaging panels for X-ray examination,

- device control console and computer or simulator control panel, and
- workbenches fitting the equipment (AHIA, 2016c).

In addition to those areas, the AHIA standard (2016c) notes that an image review room of 10 m^2 should be planned per every two bunkers to review the images to be used for treatment and also to perform weekly chart checks and any associated image analysis. There should also be a sub-waiting area and a patient changing room of 5 m^2 for each CT simulation room with a toilet inside (AHIA, 2016c).

The CSA standard (2016) of Canada states that a CT simulator room of approximately 59 m^2 should be provided for each bunker. The protection and dimensions of the CT simulator room and supportive areas should be determined in accordance with the device (CSA, 2016). The room may have maze access that is designed so that it does not require a shielded door between the simulator room and control area (CSA, 2016). The concrete used for protection must meet all density criteria, construction specifications, and other applicable requirements (CSA, 2016). A patient toilet should be located adjacent to the simulation room (CSA, 2016).

According to the DH standard (2013a) of the United Kingdom, the imaging room design should be shaped according to the type of imaging device to be installed; however, it is reported that the room should contain adequate safeguards against potential hazards. Although the orientation of the imaging device in the room depends on the area and local preferences, easy access is required to the couch by trolleys, beds, a portable hoist, and wheelchairs (DH, 2013a). Orthogonal lasers are an indispensable component of the imaging room to facilitate accurate positioning of patients (DH, 2013a). The position of the viewing window should provide the best possible view of the device and patient during the imaging procedure (DH, 2013a). In addition, a CCTV system should be available to ensure that the patient is always visible during the procedure. In the room, there should be sufficient cupboard and shelf systems and hanging accessories for the equipment (DH, 2013a). The area of the imaging room should be approximately 33 m^2 (DH, 2013a).

The DH standard (2013a) notes that a control area of 25 m^2 with direct access to the imaging room should be planned for each imaging room. The area should include a properly shielded viewing window (DH, 2013a). An adequate working area should be reserved for workstations and monitor devices with network points (DH, 2013a). Other room requirements include a telephone, locker/drawer/shelf systems, a lockable cabinet for medicines, and an area for storing contrast media in a suitable temperature-controlled environment (DH, 2013a). In addition to the control room, a radiograph preparation room of 8 m^2 should be designed for each imaging room (DH, 2013a). In this area, data preparation, calculations, image analysis, and data transfer control are performed for treatment (DH, 2013a). If lack of space prevents the provision of a separate room, the control area should be large enough to perform those functions (DH, 2013a). Care should be taken to ensure that patients cannot hear the conversations of medical personnel or see monitors where confidential information is displayed (DH, 2013a).

Moreover, according to the standard (DH, 2013a), there should be at least two patient changing rooms within the imaging module. At least one of them should be of suitable size to allow the changing of disabled patients on stretchers or in wheelchairs (DH, 2013a). Those rooms should be lockable, adjacent to the bunkers, and positioned so that individuals in the surrounding areas cannot see the patients when they are dressed or undressed (DH, 2013a). Ideally, changing rooms should be “pass through,” with the patient entering on one side and leaving into the imaging room on the other (DH, 2013a). If a separated waiting area is provided for changed patients, distinction of gender should be ensured (DH, 2013a). Furthermore, a waiting area for six people and a patient toilet are to be provided within the module. In accordance with the standard (DH, 2013a), an example plan of an imaging room, control room, radiograph preparation area, and patient changing rooms is presented in Figure B.10.

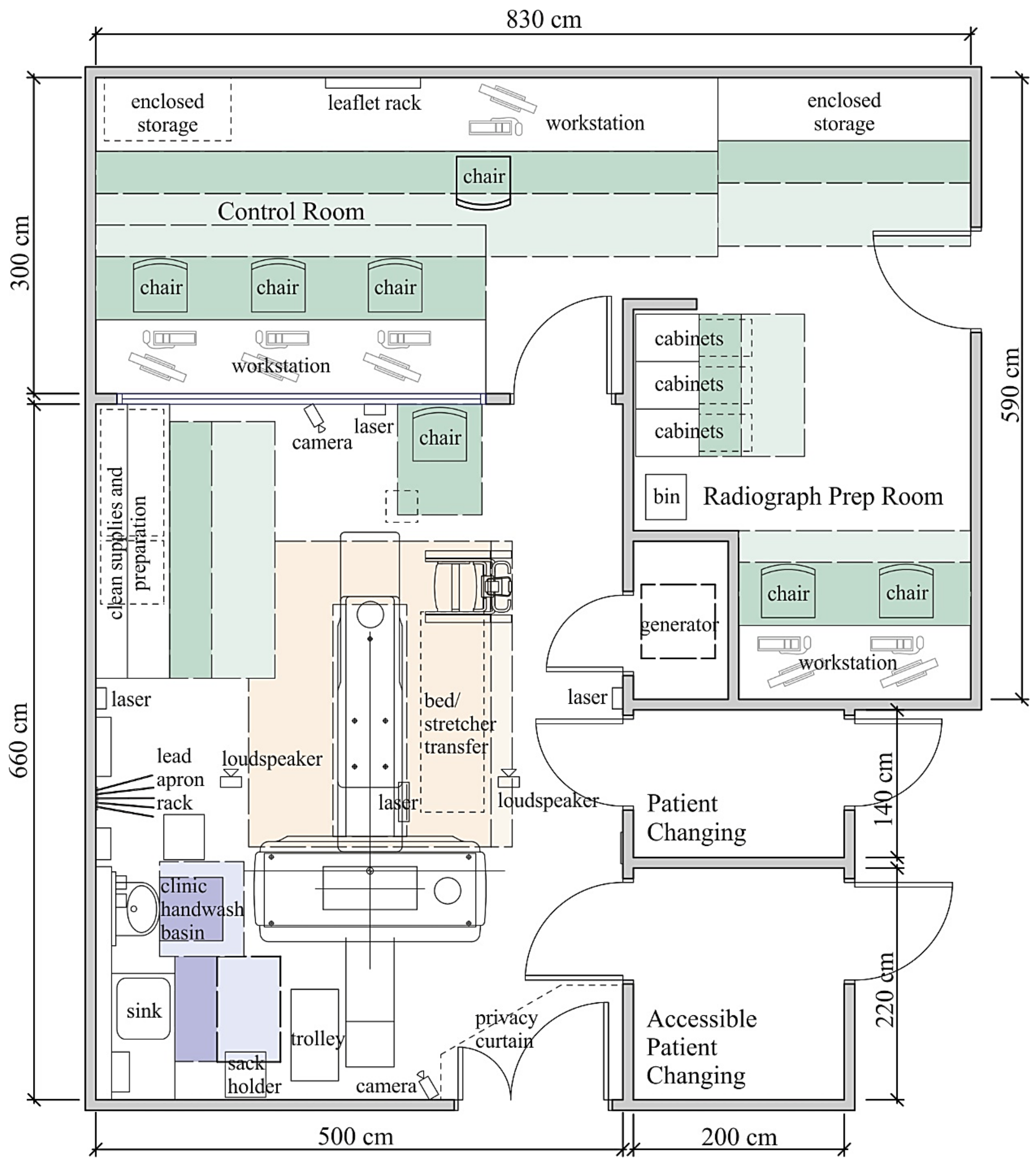


Figure B.10. Sample plan of an imaging module according to the DH standard (2013a)

In the FGI standard (2014) of the United States, it is emphasized that CT simulator rooms should be sized considering the dimensions of the equipment, the patient's access to the equipment on the stretcher, the medical personnel's access to the equipment and the patient, and service access to the equipment.

According to the DVA standard (2008, 2016a) of the United States, CT simulator rooms should be planned considering that an average of 1,600 operations can be performed annually in one room and an area of at least 400 ft^2 (37.2 m^2) should be provided. Moreover, a control room of 120 ft^2 (11.2 m^2) and a film processing room of 120 ft^2 (11.2 m^2) for each CT simulator room should be planned (DVA, 2008; DVA, 2016a). The film processing room should be located next to the simulator room and in a location that is directly accessible, and it should comprise both dark and light rooms due to film printing processes being performed within the room (DVA, 2016a). An example plan for the CT simulator and control room is presented in Figure B.11.

The DVA standard (2008, 2016a) states that in addition to CT simulator rooms, an ultrasound room should be planned in radiation oncology departments considering that an average of 1,900 procedures can be performed annually in one room. The ultrasound room, which should be approximately 180 ft^2 (16.8 m^2), has a general-purpose scanning device that can be used for therapy planning, and also initial and follow-up examinations of patients (DVA, 2016a). A toilet accessible from inside the room should be planned for the patient (DVA, 2016a). An example plan of the ultrasound room is presented in Figure B.12.

There is no information about the imaging module of the radiation oncology department in the MH standards of Turkey, and the FGI standard (2014) also does not include detailed description and information. In the AHIA (2016c), DH (2013a), and DVA (2008, 2016a) standards, the common imaging module spaces are the CT simulator room, CT simulator control room, image review room, and patient areas such as waiting and changing rooms. In addition, the DVA standard (2008, 2016a),

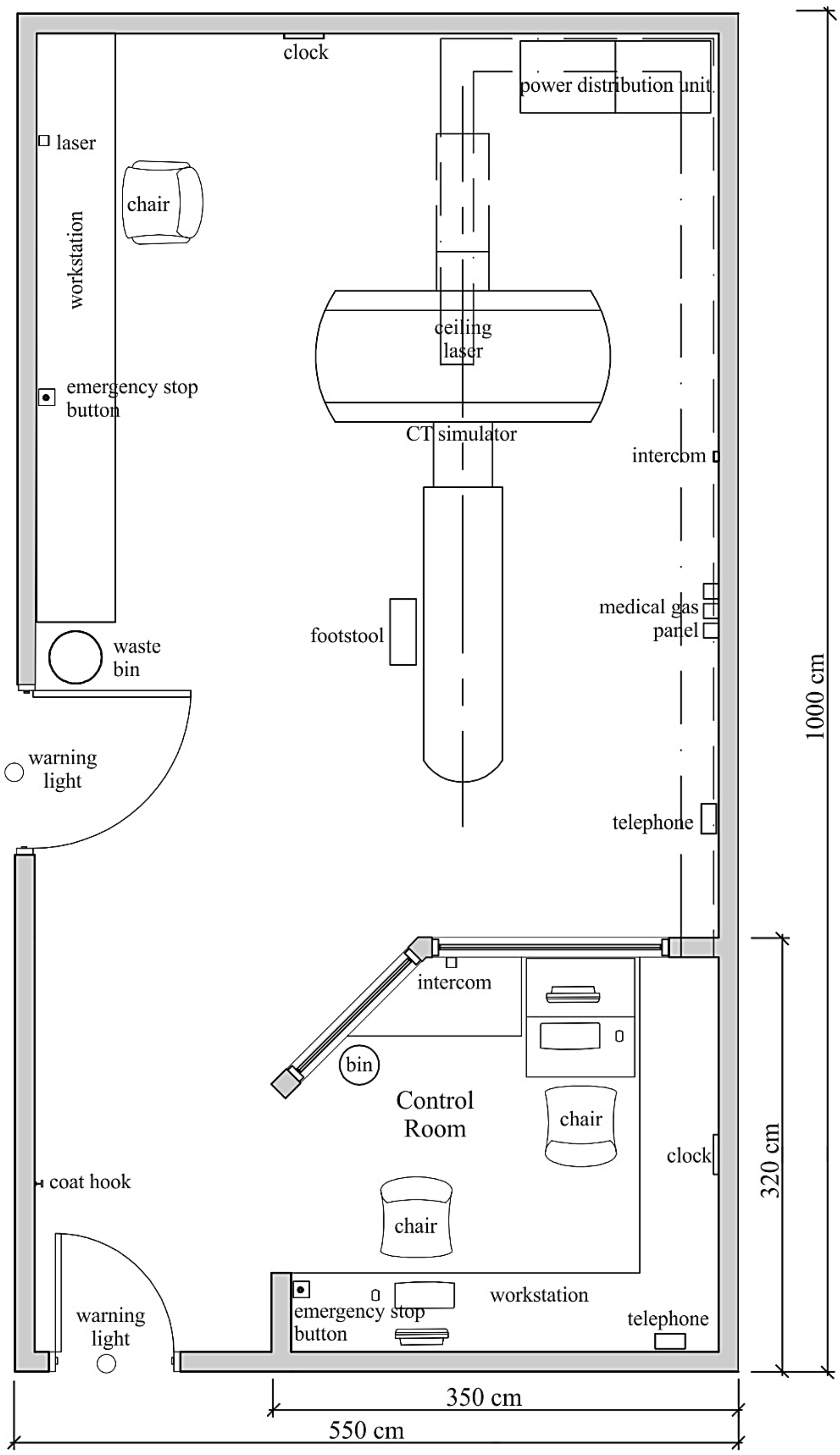


Figure B.11. Sample plan of a CT simulator room according to the DVA standard (2008)

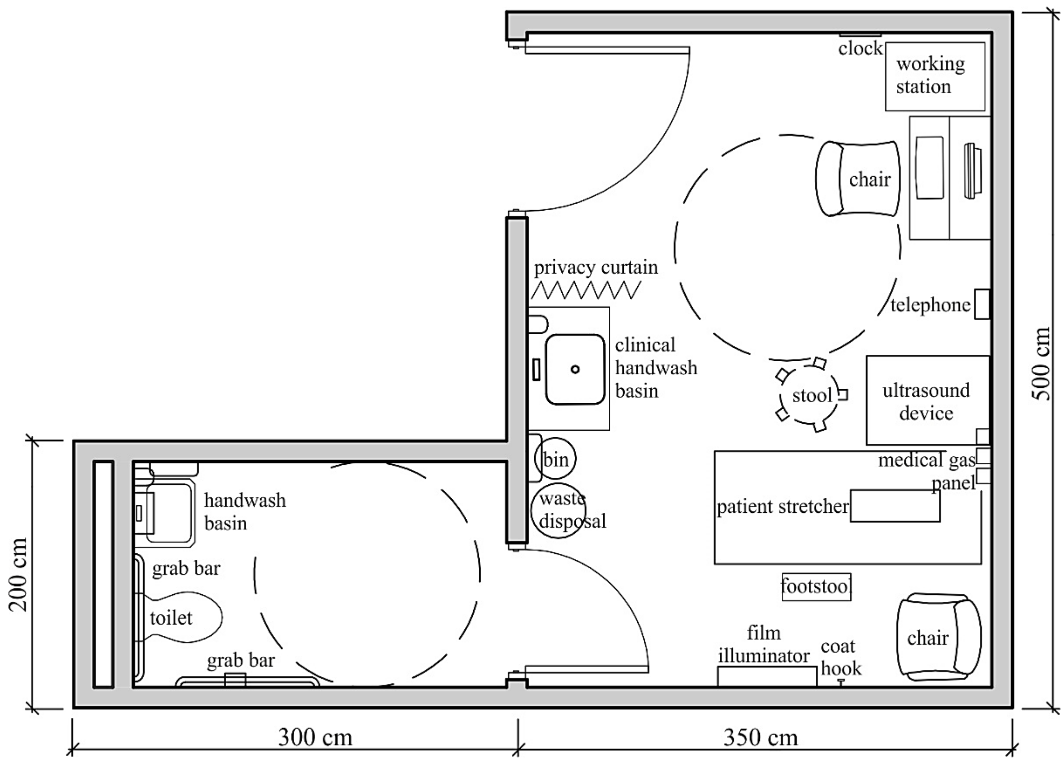


Figure B.12. Sample plan of an ultrasound room according to the DVA standard (2008)

unlike other standards, states that an additional ultrasound room should be included in the imaging module. A summary of this subject is presented in Table B.9.

B.4.3. Examination module

In the AHIA standard (2016c) of Australia, clinical areas where the pre-assessments of patients are performed are considered as modules, and the necessary rooms/spaces of these modules are presented in Table B.10. for radiation oncology departments with two bunkers and four bunkers. Sample room plans and models are illustrated in Figures B.13. and B.14.

Table B.9. *Comparison of imaging support areas in different standards*

Room/Space	AHIA	CSA	DH	FGI	DVA	MH
CT simulator room	45 m^2	59 m^2	33 m^2	no area information	37.2 m^2	-
CT simulator control room	14 m^2	no area information	25 m^2	no area information	11.2 m^2	-
Sub-waiting area	5 m^2	-	13.5 m^2	-	-	-
Image review room	10 m^2	-	8 m^2	-	11.2 m^2	-
Patient changing	5 m^2	-	2 + 4.5 m^2	-	-	-
Patient toilet	-	-	4.5 m^2	-	-	-
Ultrasound room	-	-	-	-	16.8 m^2	-

Table B.10. *Examination module areas according to the AHIA standard (2016c)*

Room/Space	2 Bunkers	4 Bunkers
Waiting	1 × 30 m^2	1 × 30 m^2
Beverage bay	1 × 3 m^2	1 × 3 m^2
Examination room	4 × 12 m^2	7 × 12 m^2
Examination room	2 × 14 m^2	3 × 14 m^2
Procedure room	1 × 16 m^2	1 × 16 m^2
Interview room	1 × 12 m^2	1 × 12 m^2
Office - clinical workroom	1 × 12 m^2	1 × 15 m^2
Patient toilet	1 × 4 m^2	1 × 4 m^2

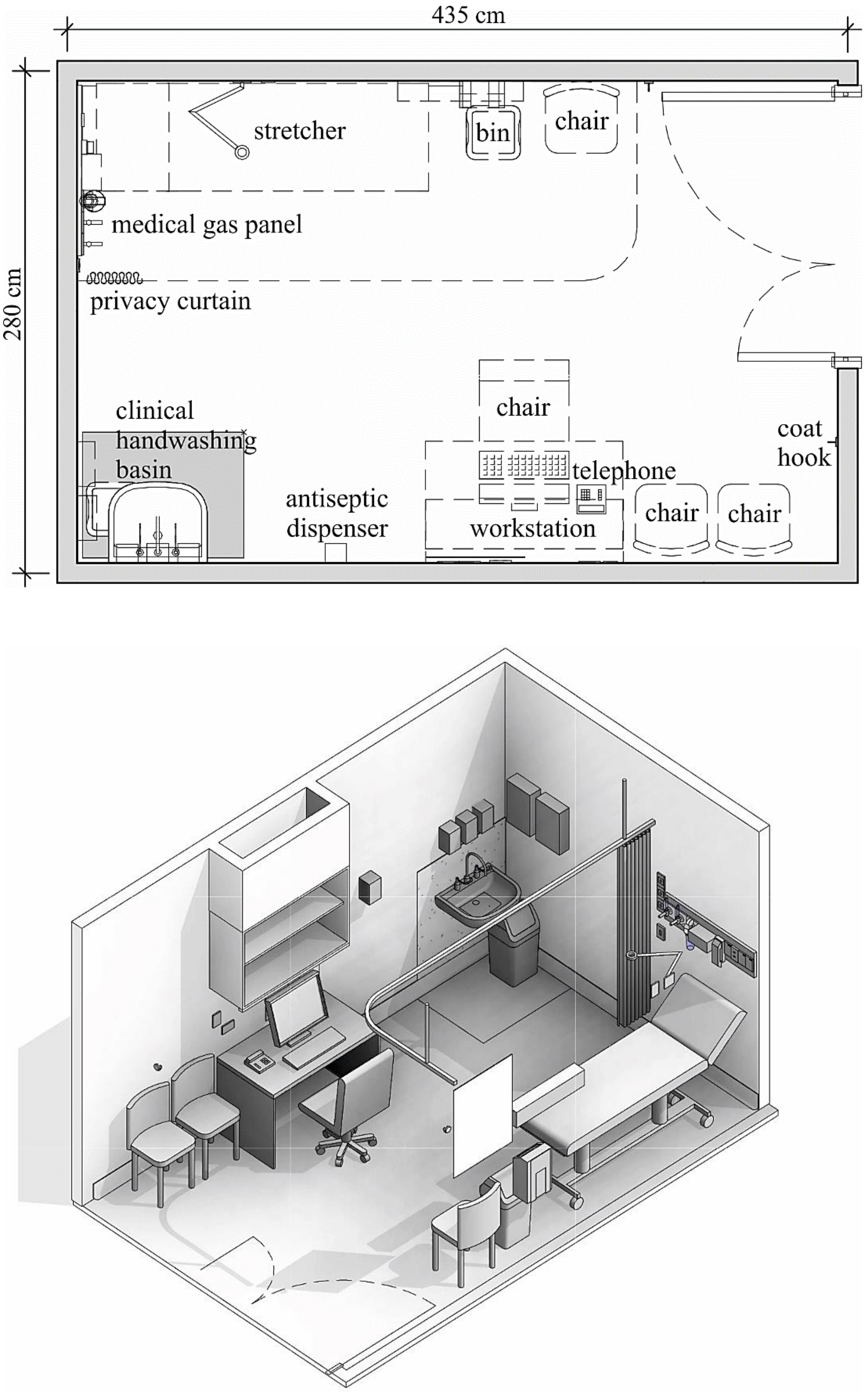


Figure B.13. Sample examination room plan and model according to the AHIA standard (2017c)

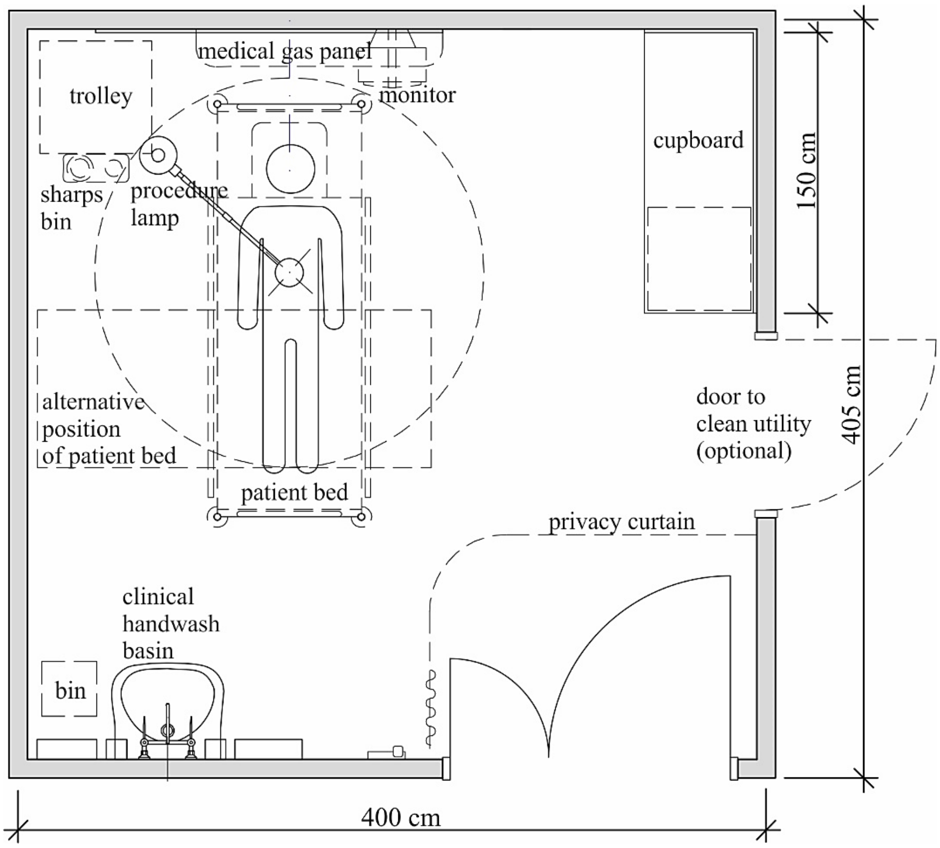


Figure B.14. Sample procedure room plan according to the AHIA standard (2017e)

According to the CSA standard (2016) of Canada, two examination rooms of 12 m^2 should be planned per radiotherapy bunker. The planning criteria are explained as follows (CSA, 2016):

- There should be a handwashing basin near the room door with a hand hygiene station mounted on the wall.
- A privacy curtain near the door of the room should be provided away from the door swing; in addition, there should be another curtain around the examination table.
- Blood pressure cuff, paper towel dispenser, sharps container, and hand hygiene station should be installed next to the examination table.

- Mirror and coat hooks must be installed adjacent to the door.
- Nurse call system should be provided.
- The minimum door width should be 1050 mm.
- There should be a minimum of 1800 mm circular clearance for wheelchair accessibility on one side of the room.
- The room should be arranged with 800 mm of clearance from one side of the patient’s stretcher and foot.
- Medical services (electrical connections, medical gases, vacuum) should be provided through a medical supply unit.
- An exam light should be located over the examination area.

In the DH standard (2013a) of the United Kingdom, as in the AHIA standard (2016c), clinical areas are considered as modules. An examination module consists of multi-purpose clinical rooms where patients undergoing radiotherapy are seen for examinations and consultations (DH, 2013a). This area can also be used for the evaluation of emergency patients (DH, 2013a). In addition, if pediatric patients are being treated in the department, an anesthesia room should be planned for pediatric patients in the module (DH, 2013a). According to the standard (DH, 2013a), the places required for the examination module of two-bunker and four-bunker radiation oncology departments are presented in Table B.11.

The FGI standard (2014) of the United States indicates that an examination room of a minimum of 100 ft^2 (9.29 m^2) with a handwashing basin should be planned for each radiotherapy bunker.

The DVA standard (2008, 2016a) of the United States notes that two examination rooms of approximately 120 ft^2 (11.2 m^2) are required for each radiotherapy bunker for evaluations of patients in initial consultations and for examinations during treatment and after completion of therapy. These rooms should be located close to bunkers and treatment planning areas for ease of function (DVA, 2016a).

Table B.11. *Examination module areas according to the DH standard (2013a)*

Room/Space	2 Bunkers	4 Bunkers
Waiting	6×2.25 m^2	12×2.25 m^2
Examination room	2×16 m^2	4×16 m^2
Procedure room	1×16 m^2	1×16 m^2
Interview room	1×12 m^2	1×12 m^2
Staff station	1×5.5 m^2	2×5.5 m^2
Clean utility	1×8 m^2	1×8 m^2
Dirty utility	1×8 m^2	1×8 m^2
Clean laundry storage	1×3 m^2	1×3 m^2
Equipment storage	1×8 m^2	1×8 m^2

In the standards examined within the scope of this thesis, while examination areas are considered as room-based spaces for evaluations of patients in initial consultations and examinations during treatment and after completion of therapy in the CSA (2016), FGI (2014), and DVA (2008, 2016a), in the AHIA (2016c) and DH (2013a) standards those are given as modules with support areas such as a waiting area, patient toilets, exam rooms, a procedure room, an interview room, clean-dirty utility rooms, and storage. The sizes of the examination rooms range from 9.3 m^2 to 16 m^2 in the standards; the lowest and highest values are observed in the FGI (2014) and DH (2013a) standards, respectively. In the standards, area and room number information is given per bunker or for two- or four-bunker units; however, Table B.12. summarizes this information with respect to a two-bunker radiation oncology department for ease of comparison.

B.4.4. Mold module

According to the AHIA standard (2016c) of Australia, the mold module consists of a clean workroom of 15 m^2, dirty workroom of 9 m^2, appliance fitting room of 10 m^2, and storage of 6 m^2. In the module, various positioning accessories and installation lasers used in treatment are produced and tested for patient suitability (AHIA, 2016c). The clean workroom is used in the manufacturing of treatment immobilization devices

Table B.12. *Comparison of examination module areas in different standards for two bunkers*

Room/Space	**AHIA**	**CSA**	**DH**	**FGI**	**DVA**	**MH**
Exam room	4 × 12 m^2 2 × 14 m^2	4 × 12 m^2	2 × 16 m^2	2 × 9.3 m^2	2 × 11.2 m^2	-
Procedure room	1 × 16 m^2	-	1 × 16 m^2	-	-	-
Interview room	1 × 12 m^2	-	1 × 12 m^2	-	-	-
Waiting	30 m^2	-	13.5 m^2	-	-	-
Staff station	5.5 m^2	-	-	-	-	-
Office - clinical workroom	-	-	12 m^2	-	-	-
Patient toilet	-	-	4 m^2	-	-	-
Beverage bay	-	-	3 m^2	-	-	-
Clean utility	8 m^2	-	-	-	-	-
Dirty utility	8 m^2	-	-	-	-	-
Storage	3 + 8 m^2	-	-	-	-	-

(AHIA, 2016c). In that room, storage space should be planned for the large amount of material used to shape the instruments (AHIA, 2016c). Due to the noise and fumes associated with the operations in the room, this area should be directly connected to the dirty working room and the appliance fitting room, but away from other patient areas (AHIA, 2016c). A separate dirty workroom is required to accommodate drills, etc. The equipment required in the clean workroom is as follows (AHIA, 2016c):

- plaster dust extraction system with plaster trap,
- fume extraction cabinet,
- large sink with plaster trap,
- full-sized thermoplastic water bath,
- heavy-duty stainless steel worktop,
- shelf and cupboard systems,
- drill, hot wire cutter, vacuum generator, block cutter,
- alloy pot,

- 3D printing technology infrastructure,
- bulky foam cutters for personalized stabilization products, and
- vacuum formers to manufacture custom masks.

The appliance fitting room is the area where instruments such as immobilization devices and masks produced for patients are tried and measured on the patient (AHIA, 2016c). The room should be located in direct connection with the corridor and clean working room considering patient privacy and ease of access for patients arriving on a bed or stretcher (AHIA, 2016c).

In the CSA standard (2016) of Canada, the mold module is known as a machine shop, and the required area varies according to the size of the facility and room furnishings. According to the standard (CSA, 2016), the following design features should be considered in the room:

- The machine shop should be equipped with general-purpose cabinets on stainless steel worktops.
- Lockable, adjustable, general-purpose storage areas should be provided.
- A paper towel dispenser and a whiteboard should be available.
- A natural gas connection should be provided to the welding hood.
- Vacuum should be planned for computer numerical control (CNC) devices.
- A fume hood must be provided.
- A hand hygiene washbasin, and an eyewash station should be planned.
- High-frequency fluorescent lighting fixtures should be used.
- Telephone and data connections must be available.

In the DH standard (2013a) of the United Kingdom, the mold module consists of an impression and fitting room (20 m^2), a patient changing room (4.5 m^2) suitable for disabled use, a patient shower (5 m^2), and a mold workshop (35 m^2). The preparation and manufacturing of immobilization equipment takes place in the impression and fitting room (DH, 2013a). Since the patient will usually have to be undressed during these procedures, a patient changing room should be adjacent to that room (DH, 2013a). Moreover, since the procedure can be long and uncomfortable for patients, the room should provide a light, airy environment and be as comfortable as possible (DH, 2013a). The room's ceiling may be equipped with a number of distractions to reduce the distress of patients and background music may be considered (DH, 2013a). In addition, seating should be provided in the room for relatives or staff accompanying patients (DH, 2013a). A sample room plan is presented in Figure B.15. and other planning criteria described in the standard (DH, 2013) are listed as follows:

- A dentist's chair and stretcher with adjustable height should be planned in the room. Patient privacy should be considered when deciding on the placement of the furniture in the room.
- There should be a handwashing basin, mirror, shelf, chair, and coat hook.
- For plasterwork in the room, a gypsum sink with splash back should be provided in addition to the patient handwashing basin.
- The use of thermoplastics requires a hot water bath with filling and discharging facilities.
- Locally adjustable heating and ventilation should be provided to control local heat gain and odors.
- The flooring must be non-slip linoleum or vinyl with coved skirting for ease of cleaning.
- Alignment lasers in the room should be installed at the same height as the radiotherapy bunkers.
- A workstation with a computer network point, sockets, telephone, and filing cabinet should be planned for technicians to view imaging data and perform office work.

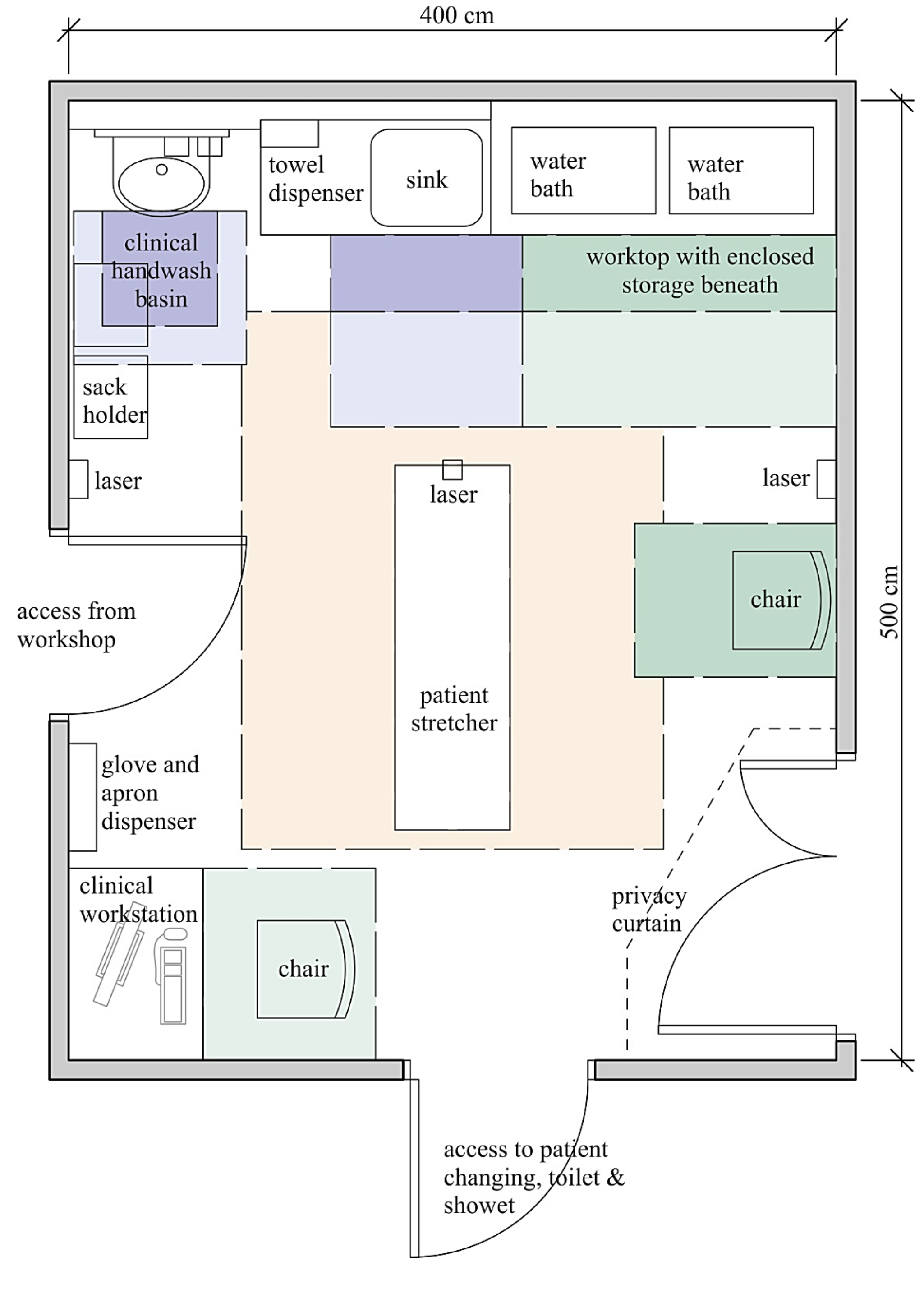


Figure B.15. Sample plan of an impression and fitting room according to the DH standard (2013a)

According to the DH standard (2013a), the workshop should be divided into clean and dirty areas. There should be sufficient bench space, and open shelving/storage systems should be kept to a minimum to minimize the dust level in the room (DH, 2013a). A laboratory gas supply should be provided as the heat source for the tools required for plastic work (DH, 2013a). Where plaster is applied, local dust absorption should be ensured (DH, 2013a). A handwashing basin should be planned and floors should be made of non-slip material (DH, 2013a). For the preparation of materials such as shells, wax boluses, and lead masks, a laser should be planned in the clean working area (DH, 2013a). The complete list of equipment required in the room should be determined based on the immobilization solutions applied in the facility (DH, 2013a). A sample room plan is presented in Figure B.16.

The FGI standard (2014) of the United States notes that a lead mold room with exhaust outlet and handwashing station, as well as a mask mold room with storage space, should be planned within radiation oncology departments.

In the DVA standard (2008, 2016a) of the United States, it is stated that a lead mold room of 220 ft^2 (20.5 m^2) should be planned in each radiation oncology department. The room is expected to be planned in close proximity to the CT simulator module because the produced equipment is tested there before the actual treatment (DVA, 2016a). There must be enough storage space for the equipment in this room, such as wedges, casting, tissue compensators, bolus devices, beam-limiting devices, light-duty machinery equipment, cutting devices, lathes, grinding machines, drill presses, melting pots, and materials such as lead, copper, plastic, and plaster (DVA, 2016a).

In the standards examined within the scope of this thesis, there is no information about the mold module areas of the radiation oncology departments in the Ministry of Health's regulations, and the FGI standard (2014) has not revealed detailed information. In the other standards examined, although the names of the rooms are different, similar explanations are made about the functional areas of mold production. A summary of the subject is presented in Table B.13.

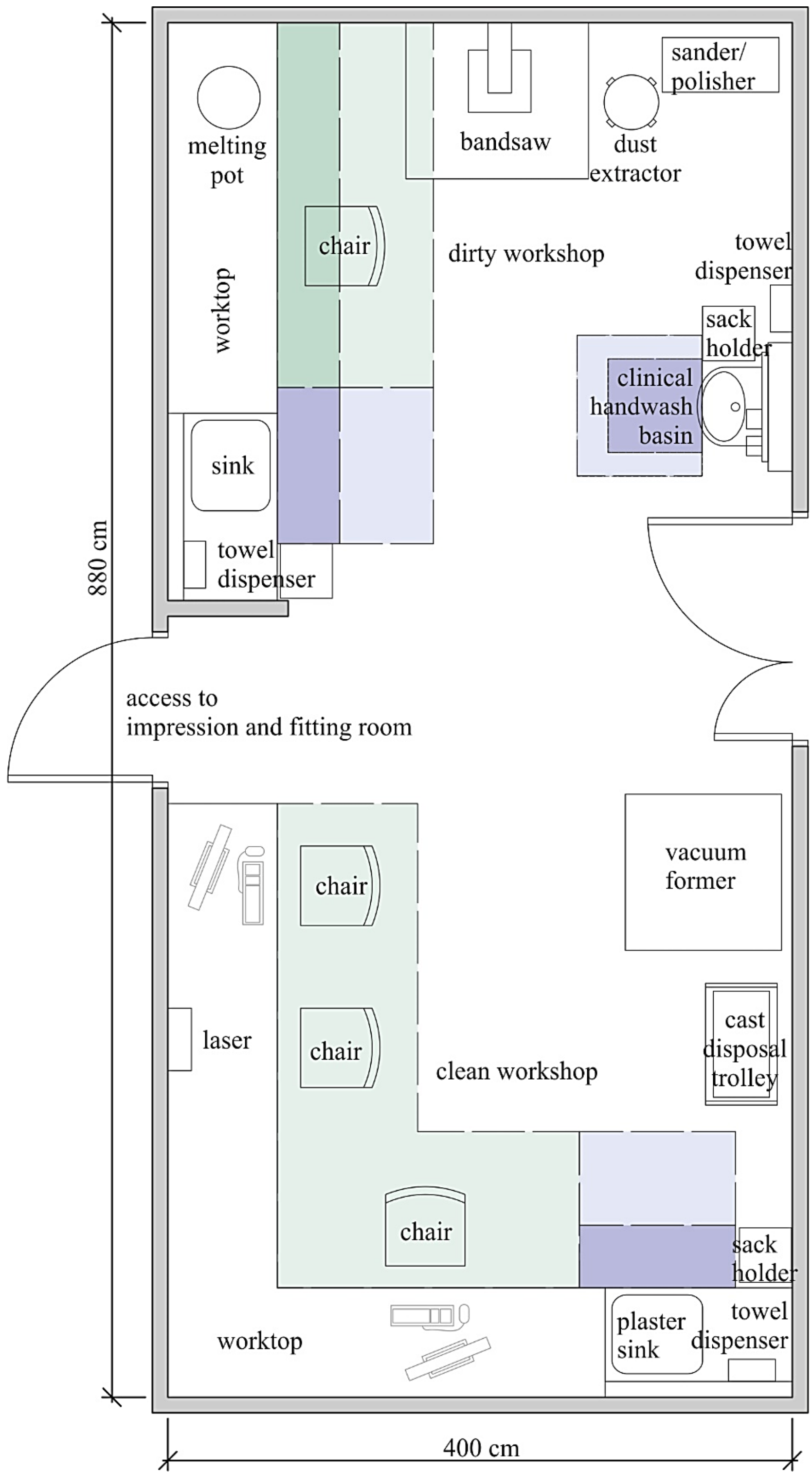


Figure B.16. Sample plan of a molding workshop according to the DH standard (2013a)

Table B.13. *Comparison of mold module areas in different standards*

Room/Space	AHIA	CSA	DH	FGI	DVA	MH
Mold room	15 m^2, clean 9 m^2, dirty	no area information	35 m^2	no area information	20.5 m^2	-
Appliance fitting room	10 m^2	no area information	20 m^2	no area information	-	-
Patient changing	-	-	4.5 m^2	-	-	-
Patient shower	-	-	5 m^2	-	-	-
Storage	6 m^2	-	-	-	-	-

B.4.5. Other

The AHIA standard (2016c) of Australia states that besides imaging, mold, and examination modules, there are other clinical support areas that should be provided within radiation oncology departments, such as physics laboratories, workshops, treatment planning areas, and patient holding spaces. Those spaces are listed in Table B.14 and sample preparation-recovery and medication room drawings are presented in Figure B.17. and Figure B.18.

The CSA standard (2016) of Canada notes that wheelchair/stretcher parks and clean supply rooms should be provided as centralized areas or as decentralized spaces with direct access through an internal corridor for ready access from the patient care areas based on functional program requirements.

According to the DH standard (2013a) of the United Kingdom, other clinical support areas include radiotherapy physics and technology modules, treatment planning rooms, physics rooms, offices, and storage areas. The radiotherapy physics and technology module, which undertakes maintenance and repair works of the equipment in the department and contributes to the quality assurance, consists of an electronics workshop, mechanical workshop, dosimeter laboratory, office spaces, and storage (DH, 2013a). The electronics workshop should be planned as a clean, dust-free space with task lighting on the workbenches and good general lighting (DH, 2013a).

Table B.14. *Other clinical support areas according to the AHIA (2016c) standard*

Room/Space	**2 Bunkers**	**4 Bunkers**
Physics laboratory	1×25 m^2	1×40 m^2
Physics store	1×15 m^2	2×15 m^2
Electrical workshop	1×30 m^2	1×45 m^2
Mechanical workshop	1×5.5 m^2	1×5.5 m^2
Cleaner's room	1×5 m^2	1×5 m^2
Disposal room	1×8 m^2	1×8 m^2
Treatment planning module		
Treatment planning room	1×50 m^2	1×90 m^2
Treatment planning office (single person)	1×9 m^2	1×9 m^2
Treatment planning office (two-person, shared)	1×12 m^2	1×12 m^2
Patient holding and recovery module		
Staff station	1×12 m^2	1×12 m^2
Patient holding bay	2×9 m^2	3×9 m^2
Patient preparation and recovery room	-	$1 \times (12+5)$ m^2
Handwashing bay	1×1 m^2	1×1 m^2
Patient toilet	1×4 m^2	1×4 m^2
Linen bay	1×2 m^2	1×2 m^2
Resuscitation bay	$1 \times 1,5$ m^2	$1 \times 1,5$ m^2
Medication room	1×12 m^2	1×14 m^2
Dirty utility	1×10 m^2	1×10 m^2
Beverage bay	-	1×4 m^2
Office (single person)	1×9 m^2	1×9 m^2

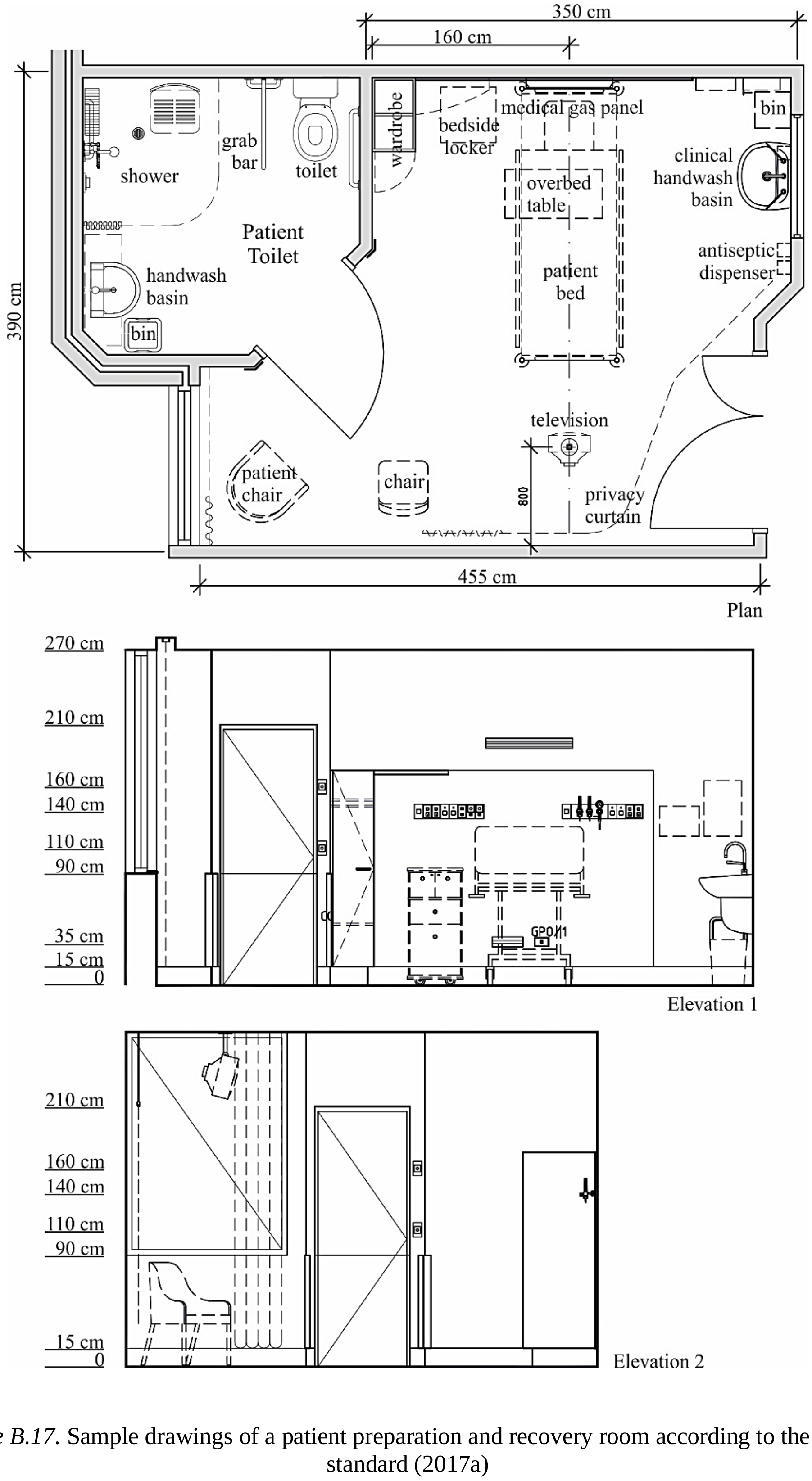


Figure B.17. Sample drawings of a patient preparation and recovery room according to the AHIA standard (2017a)

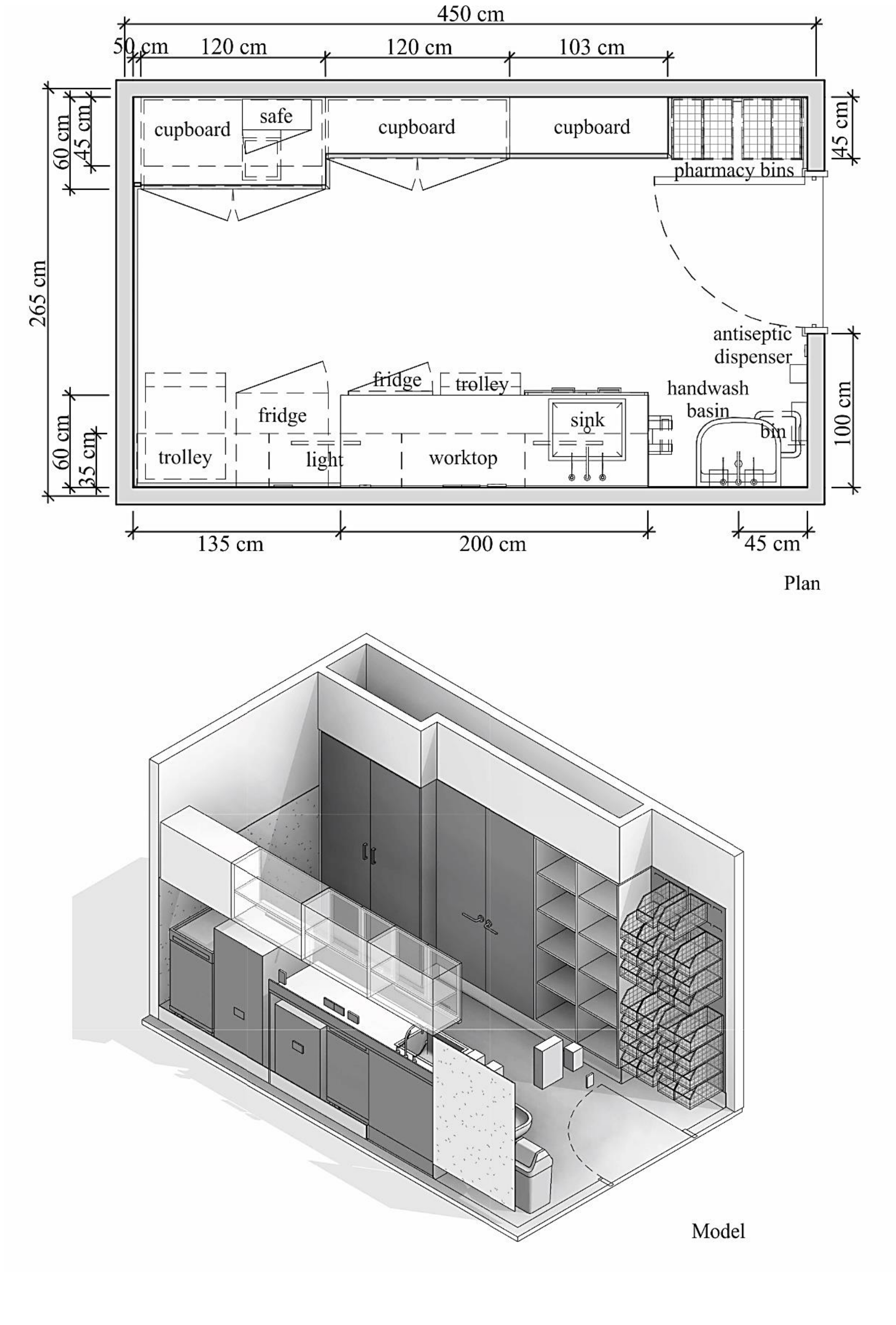


Figure B.18. Sample plan and model of a medication room according to the AHIA standard (2017b)

Although solar control and mechanical ventilation may be required to maintain proper operating temperatures, natural lighting and ventilation are preferred (DH, 2013a). Other requirements in the electronics workshop in accordance with the standard (DH, 2013a) are:

- large counter areas with cupboards and drawers underneath,
- desk space for record keeping,
- shelves and bookcase systems for manuals and records, and
- telephone and computer workstation.

In terms of mechanical workshop design, construction and layout of equipment and workplaces must meet the requirements of existing health and safety regulations (DH, 2013a). The lighting requirements of the mechanical workshop are similar to those of the electronics workshop (DH, 2013a). Moreover, the flooring must be non-slip and oil-resistant, and the wall coverings must be robust (DH, 2013a). Although the equipment required in the workshop varies according to local conditions, the list of possible equipment according to the standard (DH, 2013a) is as follows:

- vacuum-forming machine with compressor,
- contouring device,
- electric oven,
- saw,
- bench drill and grinder,
- bench sander and polisher,
- wax bath,
- workbenches and storage cabinets,
- compressed air outlet,
- wall-mounted viewing boxes,
- telephone and computer workstation,
- plaster trap sink, and
- crane systems for lifting heavy objects.

Although the equipment required in the dosimeter laboratory, which is another component of the radiotherapy physics and technology module, varies according to local conditions, according to the standard (DH, 2013a) the possibilities include a dosimetry system, a bench-mounted oven for dosimetry work, a safe, laboratory workbenches, storage cupboards, and telephone and computer workstations. The storage areas of the radiotherapy physics and technology module are required for the storage of a wide range of materials and instruments (e.g., plaster models, bandages, and transparencies) (DH, 2013a). These areas should be planned by considering security with locked doors, away from patients' sight (DH, 2013a).

The treatment planning room, another clinical support area, should be located in a quiet area (DH, 2013a). It should be linked to the treatment planning system, the PACS monitor, and the record-verification system and it should have access to data from imaging modalities and brachytherapy devices (DH, 2013a). Table B.15. provides information on the quantity and floor area of the above-mentioned clinical support areas as stated in the DH standard (2013a).

In the FGI standard (2014) of the United States, it is indicated that in addition to the mentioned clinical support areas, patient preparation-recovery areas, inpatient holding areas, consultation rooms, and quality control areas should be planned in radiation oncology departments. The inpatient holding area must be immediately accessible from staff areas considering the balance of patient privacy and direct observation (FGI, 2014). The quantity and floor area of patient preparation and recovery rooms should be determined according to the number of patients foreseen in the planning stage of the department (FGI, 2014). Those areas should be immediately accessible from radiotherapy treatment rooms (FGI, 2014). If the patient preparation and recovery areas are arranged as arenas, at least 60 ft^2 (5.58 m^2) should be provided for each patient (FGI, 2014). In the case of a cubic system, each patient care area should at least 80 ft^2 (7.43 m^2), including a visitor seat (FGI, 2014). In any case, at least 4 ft (1.22 m) of clearance between stretcher/patient beds and 3 ft (0.91 m) of clearance between partition walls and stretcher/patient beds should be provided (FGI, 2014).

Table B.15. *Other clinical support areas according to the DH standard (2013a)*

Room/Space	**2 Bunkers**	**4 Bunkers**
Treatment planning room	5 × 8 m^2	5 × 20 m^2
Physics room	1 × 12 m^2	-
Cleaner's room	2 × 8 m^2	2 × 8 m^2
Resuscitation trolley bay	1 × 2 m^2	1 × 2 m^2
Pantry/refreshment area	1 × 8 m^2	1 × 8 m^2
Disposal hold	1 × 12 m^2	1 × 12 m^2
General store	1 × 8 m^2	1 × 8 m^2
Equipment and consumables store	1 × 24 m^2	1 × 32 m^2
Linen store	1 × 3 m^2	1 × 3 m^2
Radiotherapy physics and technology module		
Electronics workshop	-	1 × 16 m^2
Physics office (single person)	-	2 × 8 m^2
Equipment and consumables store	-	1 × 8 m^2

According to the DVA standard (2008, 2016) of the United States, in addition to the previously described support areas, some other clinical support areas, which are listed in Table B.16, should be planned in radiation oncology departments. If a PACS is used in the imaging modules of the department, a digital quality control room and a digital archiving storage area are needed for the storage, access, distribution, and presentation of images; if not, dark/light film processing rooms, film sorting areas, film storage, film files storage, and chemical storage should be designed. An example treatment planning/dosimetry room plan is presented in Figure B.19.

In the standards examined within the scope of this thesis, in addition to the mentioned clinical support areas in the previous sections, treatment planning rooms, physics laboratory and offices, electrical and mechanical workshops, inpatient holding areas, patient preparation and recovery rooms, and storage are commonly referred to as clinical support areas of the radiation oncology department.

Table B.16. *Other clinical support areas according to the DVA standard (2008, 2016)*

Room/Space		**Floor area**	
Physics laboratory		300 ft^2 (27.9 m^2)	
Treatment planning room/dosimetry		300 ft^2 (27.9 m^2)	
3D work station		120 ft^2 (11.2 m^2)	
Computed radiology reader area		40 ft^2 (3.8 m^2)	
Consultation room		120 ft^2 (11.2 m^2)	
Teaching room		240 ft^2 (22.3 m^2)	
Clean utility room		100 ft^2 (9.3 m^2)	
Dirty utility room		80 ft^2 (7.5 m^2)	
Housekeeping aid closets		60 ft^2 (5.6 m^2)	
Linen alcove		20 ft^2 (1.9 m^2)	
Support equipment storage		200 ft^2 (18.6 m^2)	
Stretcher/wheelchair storage		40 ft^2 (3.8 m^2)	
If PACS is authorized		If PACS is not authorized	
Room/Space	Floor area	Room/Space	Floor area
Digital quality control	100 ft^2 (9.3 m^2)	Dark room film processing	100 ft^2 (9.3 m^2)
Digital archival storage	140 ft^2 (13.1 m^2)	Daylight processing	100 ft^2 (9.3 m^2)
		Film sorting area	80 ft^2 (7.5 m^2)
		Film files storage	250 ft^2 (23.3 m^2)
		Film storage	60 ft^2 (5.6 m^2)
		Chemical storage	40 ft^2 (3.4 m^2)

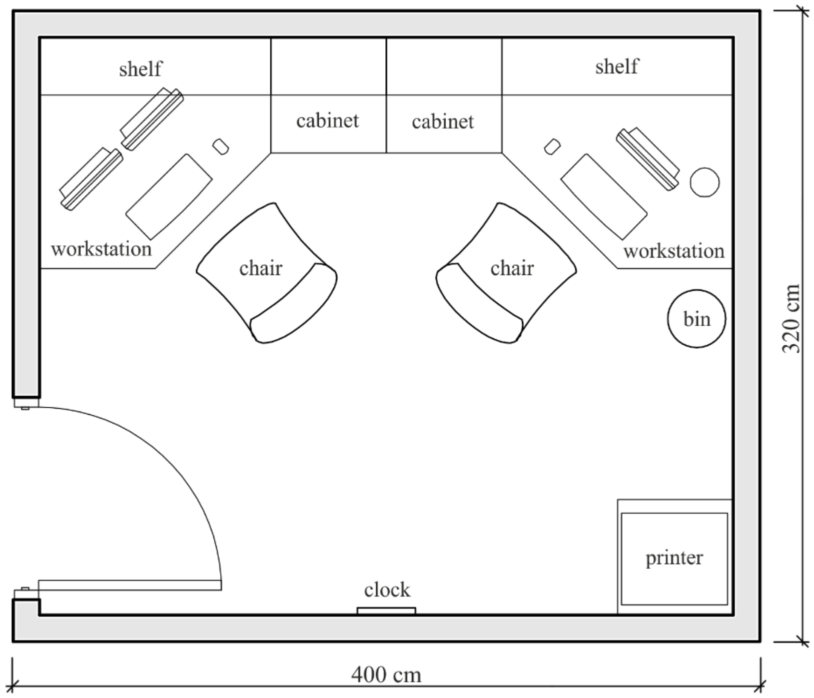


Figure B.19. Sample plan of a treatment planning/dosimetry room according to the DVA standard (2016)

B.5. Staff Areas

The AHIA standard (2016c) of Australia states that although a detailed establishment profile is needed to ensure that adequate quantity and floor area of working and resting rooms are provided, the staff breakdown of a radiation oncology department generally consists of:

- radiation oncologists,
- radiation therapists,
- medical physicists,
- technicians,
- nurses,
- administration staff,

- biomedical engineers,
- students/research staff, and
- a range of support staff including a quality assurance officer and information technology support (AHIA, 2016c).

Therefore, the quantity of staff rooms is to be planned based on the number of staff anticipated when the department is fully functional (AHIA, 2016c). However, required staff areas mainly comprise offices, workstations, meeting rooms, rest rooms, photocopy rooms, toilets, showers, and storage, as listed in Table B.17. (AHIA, 2016c). Depending on the department size, the mentioned staff areas could be distributed to various parts of the unit for easy access (AHIA, 2016c).

In the DH standard (2013a) of the United Kingdom, although there is no detailed information about staff areas of radiation oncology departments, is it stated that within the offices, access to the information technology network for treatment plan review and approval, access to imaging results through the PACS or radiotherapy archive, and access to the radiotherapy records and verification/scheduling system are required (DH, 2013a). The mentioned staff areas are listed in Table B.18.

In the FGI standard (2014) of the United States, while there is not any detailed explanation about the staff areas of radiation oncology departments, it is noted that office spaces should be provided for oncologists and physicists.

The DVA standard (2008, 2016a) of the United States indicates that staff areas need to be located away from patient areas and patient traffic due to security and confidentiality issues. Moreover, providing quiet resting rooms and offices increases productivity and decreases the risk of occupational accidents (DVA, 2008). The staff groups to which workstations should be provided are listed as secretaries, physicians, nurses, physicists, PACS administrators, quality assurance staff, clerical staff, data managers, and information technology staff (DVA, 2016a). Staff areas mentioned in the standard (DVA, 2008; DVA, 2016a) are listed in Table B.19.

Table B.17. *Staff areas according to the AHIA standard (2016c)*

Room/Space	2 Bunkers	4 Bunkers	Notes
Office, single person	1 × 12 m^2	1 × 12 m^2	To be allocated to clinical director
Office, single person	9 m^2	9 m^2	To be allocated to staff specialists and department heads Quantity will be dependent on organizational structure and staff establishment
Office, workstation	5.5 m^2	5.5 m^2	To be allocated to staff including clerical staff, data managers, IT staff, educators, clinical nurse consultants, etc. Quantity will be dependent on staff
Office, workstation	2 × 4.4 m^2	2 × 4.4 m^2	Hot desks for visiting staff and students
Meeting room	1 × 30 m^2	1 × 30 m^2	
Meeting room	-	1 × 20 m^2	
Meeting room	1 × 9 m^2	1 × 9 m^2	
Photocopy room	1 × 8 m^2	1 × 8 m^2	
Rest room	1 × 20 m^2	1 × 35 m^2	
Property bay	1 × 3 m^2	1 × 6 m^2	
Staff toilet	3 × 3 m^2	5 × 3 m^2	To be distributed throughout the department
Staff shower	1 × 3 m^2	1 × 3 m^2	

Table B.18. *Staff areas according to the DH standard (2013a)*

Room/Space	2 Bunkers	4 Bunkers	Notes
Office, single person	1 × 8 m^2	2 × 8 m^2	
Office, single person	-	2 × 8 m^2	Within the physics unit
Office, two person	2 × 12 m^2	2 × 12 m^2	
Office, workstation	4 × 6.6 m^2	6 × 6.6 m^2	
Seminar room	25 m^2	31 m^2	For 15 places
Rest room with mini kitchen	19 m^2	38 m^2	For 10 & 20 people, respectively
Staff toilet	2 × 2 m^2	4 × 2 m^2	

Table B.19. *Staff areas according to the DVA standard (2008, 2016a)*

Room/Space	**Floor area**	**Notes**
Office	100 ft^2 (9.3 m^2)	To be allocated to department chief
Staff waiting	80 ft^2 (7.5 m^2)	One standard chair, one bariatric chair, one accessible space
Workstation, secretary	56 ft^2 (5.3 m^2)	One for each secretary
Workstation, physician	56 ft^2 (5.3 m^2)	One for each physician
Workstation, nurse	56 ft^2 (5.3 m^2)	One for each nurse
Workstation, professional non-physician	56 ft^2 (5.3 m^2)	One for each professional non-physician
Workstation, physicist	56 ft^2 (5.3 m^2)	One for each physicist
Office	100 ft^2 (9.3 m^2)	One for each technologist supervisor
Workstation, PACS administrator	56 ft^2 (5.3 m^2)	One for each PACS administrator
Workstation, quality assurance	56 ft^2 (5.3 m^2)	One for each quality assurance staff
Workstation, clerical	56 ft^2 (5.3 m^2)	One for each clerical staff
Workstation, data processing staff	56 ft^2 (5.3 m^2)	One for each data processing staff
Workstation, scheduler	56 ft^2 (5.3 m^2)	One for each scheduler
Workstation, transcriptionist	56 ft^2 (5.3 m^2)	One for each transcriptionist
Patient records filing room	80 ft^2 (7.5 m^2)	One for each bunker
Workstation, tele-radiology	120 ft^2 (11.2 m^2)	If tele-radiology is authorized
Staff training room	300 ft^2 (27.9 m^2)	For six people
Photocopy room	100 ft^2 (9.3 m^2)	
Storage room	120 ft^2 (11.2 m^2)	
Staff lounge	80 ft^2 (7.5 m^2)	Minimum floor area 1.4 m^2 should be added for every five personnel on peak shift
Staff locker room	80 ft^2 (7.5 m^2)	Minimum floor area 0.6 m^2 should be added for every thirteen personnel
Staff toilet	60 ft^2 (5.6 m^2)	Minimum floor area One additional toilet should be added for every fifteen personnel

In the standards examined within the scope of this thesis, offices, workstations, meeting rooms, seminar rooms, photocopy rooms, rest rooms, toilets, showers, and storage are commonly referred to as staff areas of the radiation oncology department. Offices could be planned for one person, for two people, or in an open office arrangement as workstations according to the number of staff and layout of the department. Rest rooms, changing rooms, toilets, and showers are expected to be planned considering the number of staff.

B.6. Patient and Public Areas

According to the AHIA standard (2016c) of Australia, there should be a single public entrance that will direct patients to the radiation oncology department, the main reception desk, patient administration (e.g., appointments, billings), and the main waiting area. Additionally, a children's playground area or bay should be included within the room to accommodate visitor amenities (AHIA, 2016c). A vending machine and a telephone bay need to be provided alongside the waiting area (AHIA, 2016c). Public toilets (minimum of two cabins) should be directly accessible from the waiting area that they support (AHIA, 2016c). At least one cabin needs to be planned considering accessibility requirements (AHIA, 2016c). Moreover, there should be a dedicated area for patient education close to the main entrance (AHIA, 2016c). Furthermore, a stretcher/wheelchair park should be located near the reception area and used by staff to transport patients to the unit (AHIA, 2016c). The areas for patients and patients' relatives described in the standard (AHIA, 2016c) are listed in Table B.20.

In the DH standard (2013a) of the United Kingdom, it is stated that the waiting areas for patients and relatives could be planned as centralized single or bunker-related sub-areas, depending on the size and layout of the unit. Additionally, patient support services such as wig attachment and prosthetic services, information/education services, and complementary therapies are important for radiation oncology departments (DH, 2013a). Those areas are ideally within the unit; otherwise, they

Table B.20. *Patient and public areas according to the AHIA standard (2016c)*

Room/Space	2 Bunkers	4 Bunkers	Notes
Airlock entry	1×10 m^2	1×10 m^2	Assumes two sets of double automatic doors, double 900 mm leaf Not required if entry is provided through an integral entry
Waiting	1×20 m^2	1×20 m^2	In two-bunker scenario, waiting space is shared with clinics
Reception	1×20 m^2	1×20 m^2	Two staff
Office	1×12 m^2	1×15 m^2	Two or three staff
Public toilet	2×3 m^2	2×3 m^2	
Public toilet, accessible	1×6 m^2	1×6 m^2	
Public telephone bay	1×1 m^2	1×1 m^2	
Vending machines bay	1×3 m^2	1×3 m^2	
Resource room	1×12 m^2	1×15 m^2	For education and/or information
Wheelchair/stretcher bay	1×4 m^2	1×6 m^2	

should be located at the nearest possible point (DH, 2013a). Moreover, infant feeding and nappy changing rooms should be considered in close proximity to the waiting area (DH, 2013a).

The DVA standard (2008, 2016a) of the United States indicates that the reception desk welcomes patients and patients' relatives, controls access to the patient areas, and prevents unauthorized entries. The waiting area should be separated as inpatient and outpatient waiting (DVA, 2008). Inpatient waiting should have space for patients on wheelchairs, stretchers, or beds with or without drip stands/oxygen cylinders attached (DVA, 2016a). Moreover, these areas could be also split and arranged in front of bunker, mold, and imaging rooms to maintain privacy and dignity (DVA, 2008). Outpatient waiting should be designed and sized considering family members accompanying patients (DVA, 2008). Minimizing the institutional image of the department and providing a friendly environment should be among the prime design objectives for waiting areas (DVA, 2008). High-intensity services should be located near waiting areas to facilitate patient access (DVA, 2008). Areas for patients and patients' relatives mentioned in the standard (DVA, 2008; DVA, 2016a) are listed in Table B.21.

In the standards examined within the scope of this thesis, there is no information about patient and public areas in the CSA, FGI, and MH standards. In the other standards examined, reception, waiting areas, toilets, and education spaces are commonly referred to as patient and public areas of the radiation oncology department.

Table B.21. *Patient and public areas according to the DVA standard (2008, 2016a)*

Room/Space	Floor area	Notes
Waiting	100 ft^2 (9.3 m^2)	Minimum floor area for 1-2 bunkers 50 ft^2 (4.6 m^2) should be added for every additional bunker
Reception	260 ft^2 (24.2 m^2)	Minimum floor area for 1-4 bunkers Extra space should be added for every additional bunker
Patient education kiosk/alcove	30 ft^2 (2.8 m^2)	
Public toilet	2 × 60 ft^2 (5.6 m^2)	One for males and one for females
Sub-waiting	80 ft^2 (7.5 m^2)	Minimum floor area for 1-3 bunkers 26 ft^2 (2.4 m^2) should be added for every additional bunker
Patient toilet	1 × 60 ft^2 (5.6 m^2)	Minimum quantity One additional toilet should be added for every additional two bunkers

C. INPATIENT CARE SERVICES

This section covers the basic physical requirements of inpatient care services in a healthcare facility in terms of general settlement principles (1), functional relationships (2), treatment areas (3), clinical support areas (4), staff areas (5), and patient/public areas (6), respectively.

C.1. General Settlement Principles

In the AHIA standard (2018a, 2019a) of Australia, it is stated that inpatient care services, be it acute care or intensive care, are among the core functions of healthcare buildings and are to be supported by a wide range of both clinical and non-clinical services. The delivery of these sevices is enhanced by good functional relationships (AHIA, 2018a, 2019a). The unit should be planned closely with:

- a main entrance particularly for visitors,
- diagnostic facilities such as medical imaging, nuclear medicine, etc.,
- emergency services,
- surgical services,
- distribution services for food, linens, and supplies (AHIA, 2018a, 2019a).

In the CSA standard of Canada (2016), a detailed chart is given to explain the general settlement principles of inpatient care services (Table C.1.). According to the chart (CSA, 2016), the units that have important relationships with acute care inpatient services are listed as:

- intensive care inpatient service,
- mental health care,
- emergency service, and
- laboratory services.

Table C.1. *General settlement principles of inpatient care services according to the CSA standard (2016)*

Related service	**Component impacting the relationship**	**Objective**	**Alternatives to direct adjacency of services**
Acute care inpatient services			
Important relationships			
Intensive care inpatient service	Patient bedrooms	Rapid transfer of patients requiring higher level care	Provide step-up care in inpatient unit
Mental health care	Physicians	Rapid access to medical specialists for consultations	
Emergency services	Patient treatment cubicles	Rapid transfer of admitted patients	
Laboratory services	Accessioning	Rapid transfer of specimens for processing	Provide an automated conveyance system (e.g., pneumatic tube) to transport specimens directly
Intensive care inpatient services			
Essential relationships			
Emergency services	Trauma/resuscitation room	Direct transfer of critically acute patients from trauma	Provide dedicated elevator in emergency care to directly connect these services
Surgical services	Operating rooms and interventional imaging rooms	Direct post-surgery transfer of some patients	Provide access to an elevator to directly connect the services
Important relationships			
Acute care inpatient services	Patient bedrooms	Transfer of patients following discharge from intensive care	Create step-down (or step-up) beds in the inpatient units
Respiratory services	Respiratory therapy	Access to respiratory therapy equipment	Satellite RT service may be included in intensive care
Laboratory services	Specimen accessioning	Urgent access to patients and laboratory results	Provide point-of-care testing equipment within critical care

Moreover, in the standard (CSA, 2016), general settlement principles of intensive care inpatient services are explained on two different precedence levels, wherein the units that require essential relationships with intensive care inpatient services are itemized as:

- emergency service and
- surgical service,

while the units that require important relationships are listed as:

- acute care inpatient service,
- respiratory services, and
- laboratory services.

According to the DH standard (2013b) of the United Kingdom, generally, inpatient care services are located above or adjacent to the diagnostic and treatment units of a healthcare facility (DH, 2013b). In addition, intensive care services are prioritized to be closest to surgical service and emergency departments whereas long-stay acute beds could be located more distantly (DH, 2013b). Being a large component of healthcare facilities, the departmental relationships of inpatient care services depend on the distance from diagnostic and treatment units, and the location and quantity of access points (DH, 2013b). In addition, inpatient wards' locations need to ensure privacy, especially at night (DH, 2013b). Ground floor locations should only be considered when the surroundings are free of hospital traffic and publicly accessible areas (DH, 2013b). Moreover, oncology inpatient services, as discrete and specialist wards, require direct access to chemotherapy and radiotherapy departments as treatment units, and to nuclear medicine and radiology departments as diagnostic units (DH, 2013b).

The FGI standard (2014) of the United States indicates that intensive care inpatient services should be located in the same building with:

- emergency services,
- respiratory therapy,
- laboratory services,
- pharmacy,
- imaging department, and
- surgical services.

Moreover, the location of the service should ensure ready response to emergency calls with minimum travel time by medical emergency resuscitation teams (FGI, 2014). In addition, unrelated traffic of staff, the public, or other patients through the service should not be permitted (FGI, 214).

In the DVA standard (2011) of the United States, a table is given to explain functional relations of inpatient care services with other units, like in the CSA standard (2016) (Table C.2. and C.3.). The table is very comprehensive in terms of the number of related departments, and the prominent units regarding close relations with inpatient care services can be listed as follows:

- social work/case management,
- physical therapy/occupational therapy,
- ventilator storage,
- respiratory therapy, and
- staff on-call rooms.

In the MH regulation (2011b) of Turkey, it is stated that intensive care services should be structured to be separate from the general usage areas of patients, visitors, and staff, preferably close to the elevators, surgical services, emergency services, laboratories, and imaging departments. Necessary arrangements should be made to ensure that patients are transported quickly and easily between the intensive care inpatient service and the ambulance entrance (MH, 2011b).

Table C.2. *Functional relationship matrix of acute care inpatient service according to the DVA standard (2011)*

Relationship	Services	Reasons
3	Intensive care inpatient service	G, H
4	Patient preparation and recovery	G
4	Emergency department	C, G
4	Main entrance	H
3	Surgical service	C, G
3	Cardiovascular labs	C, G
3	Endoscopy	C, G
3	Radiology	C, G
3	Diagnostic testing	C, G
3	Pulmonary clinic/testing	C, G
3	Cardiology clinic/testing	C, G
3	Digestive disease clinic/testing	C, G
3	Neurology clinic/testing	C, G
3	Ventilator storage	B, G
3	Respiratory therapy	G
5	Pharmacy	B, C, G, I
5	Laboratory	B, C, G, I
1	Social work/case management	H
2, 3	Physical therapy/occupational therapy	H
5	Food service/kitchen	E
5	Sterile processing department	B
4, 5	Staff on-call rooms	G
5	Linen storage	B
5, X	Waste management	B, E, F
5	Loading dock	B, D

Relationship	Reasons	
1. Adjacent	A. Common use of resources	G. Sequence of work
2. Close/same floor	B. Accessibility of supplies	H. Patient convenience
3. Close/different floor acceptable	C. Urgency of contact	I. Frequent contact
4. Limited traffic	D. Noise and vibration	J. Need for security
5. Connection needed	E. Presence of odors and fumes	K. Closeness inappropriate
X. Separation desirable	F. Contamination hazard	

Table C.3. *Functional relationship matrix of intensive care inpatient service according to the DVA standard (2011)*

Relationship	Services	Reasons
3	Acute care inpatient service	G, H
3	Patient preparation and recovery	G, H
3	Emergency department	G, H
4	Main entrance	H
3	Surgical service	C, G
3	Cardiovascular labs	C, G
3	Endoscopy	C, G
3	Radiology	C, G
3	Diagnostic testing	C, G
3	Pulmonary clinic/testing	C, G
3	Cardiology clinic/testing	C, G
3	Digestive disease clinic/testing	C, G
3	Neurology clinic/testing	C, G
1	Ventilator storage	B, G, I
1	Respiratory therapy	G, I
5	Pharmacy	B, C, G, I
5	Laboratory	B, C, G, I
1	Social work/case management	H
3	PT/OT	H
5, X	Food service/kitchen	E
5	Sterile processing department	B
2	Staff on-call rooms	C
5	Linen storage	B
5, X	Waste management	B, E, F
5	Loading dock	B, D

Relationship	Reasons	
1. Adjacent	A. Common use of resources	G. Sequence of work
2. Close/same floor	B. Accessibility of supplies	H. Patient convenience
3. Close/different floor acceptable	C. Urgency of contact	I. Frequent contact
4. Limited traffic	D. Noise and vibration	J. Need for security
5. Connection needed	E. Presence of odors and fumes	K. Closeness inappropriate
X. Separation desirable	F. Contamination hazard	

In the standards examined within the scope of this thesis, the necessity of proximity to emergency services, surgical services, and diagnostic facilities such as imaging departments, laboratories, and nuclear medicine is emphasized in terms of general settlement principles of inpatient care services. In addition, the relationship of the inpatient care services with respiratory services and related treatment facilities such as chemotherapy and radiation oncology departments has been considered as significant. A summary of this subject is presented in Table C.4.

C.2. Internal Function Relations

According to the AHIA standard (2018a, 2019a) of Australia, inpatient care services consist of several functional zones as follows:

- entry and waiting areas,
- patient and family care areas such as bedrooms, ensuites, bathrooms, and lounges,

Table C.4. *Comparison of functional relationships of radiation oncology department with other units in different standard*

	AHIA	CSA	DH	FGI	DVA	MH
Emergency service	X	X	X	X		X
Surgical service	X	X	X	X		X
Diagnostic facilities (imaging, laboratory, nuclear medicine, etc.)	X	X	X	X		X
Respiratory service		X		X	X	
Treatment facilities (chemotherapy, radiation oncology, etc.)		X	X		X	
Main entrance	X					
Distribution services (medicine, food, equipment, etc.)	X			X	X	
Staff on-call rooms					X	

- clinical support areas,
- staff areas, and
- public/visitor areas.

It is emphasized that optimal internal relationship configuration could be achieved by considering the following:

- patient and family care areas form the core of the service,
- staff stations and associated areas need direct access to and observation of patient areas,
- utility and storage areas need to be readily accessible from both patient and clinical support areas,
- public areas should be located on the perimeter of the service, and
- shared areas should be easily accessible from the units served (AHIA, 2018a, 2019a).

The functional relationship diagram of an inpatient care service in terms of the AHIA standard (2019a) is provided in Figure C.1.

The CSA standard (2016) of Canada states that all inpatient care services should be designed to maintain direct observation from staff station to patient room. The nurse station, which constitutes the primary staff work zone, should be in close proximity to the entry to monitor individuals entering and leaving the service (CSA, 2016). Moreover, the location of the entry should be adjacent to the visitor waiting area, but outside the patient care zone (CSA, 2016). Isolation patient rooms should be close to the entry and away from other patient areas and main corridors to limit the travel distance of immunosuppressed/infectious patients in the service (CSA, 2016). Additionally, staff areas need to be separate from patient-related areas due to security, privacy, and confidentiality issues (CSA, 2016).

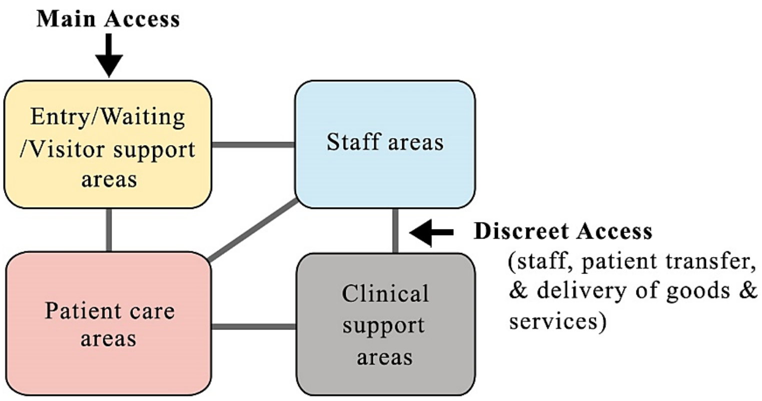


Figure C.1. The functional relationship diagram of an inpatient care service according to the AHIA standard (2019a)

The DH standard (2013b) of the United Kingdom states that patients admitted to inpatient care services are often acutely ill and need to be observed. Therefore, diminishing the distance between patient rooms and staff workstations should be one of the primary design goals (DH, 2013b). According to the standard (DH, 2013b), although ward layouts and total number of beds depend on local conditions, beds can either be arranged horizontally on large floor areas or located in towers. Together with a waiting area and facilities for visitors, a reception desk should be located at the entrance of the service. Moreover, if wards of the service can be grouped into clusters, each cluster should ideally have local access to supplies and disposal facilities (DH, 2013b). A sample functional relationship diagram of an inpatient care service is presented in Figure C.2.

In the DVA standard (2011) of the United States, inpatient care services are grouped into five functional areas, which are:

- reception area,
- patient area,
- support area,
- staff and administrative area, and
- education area.

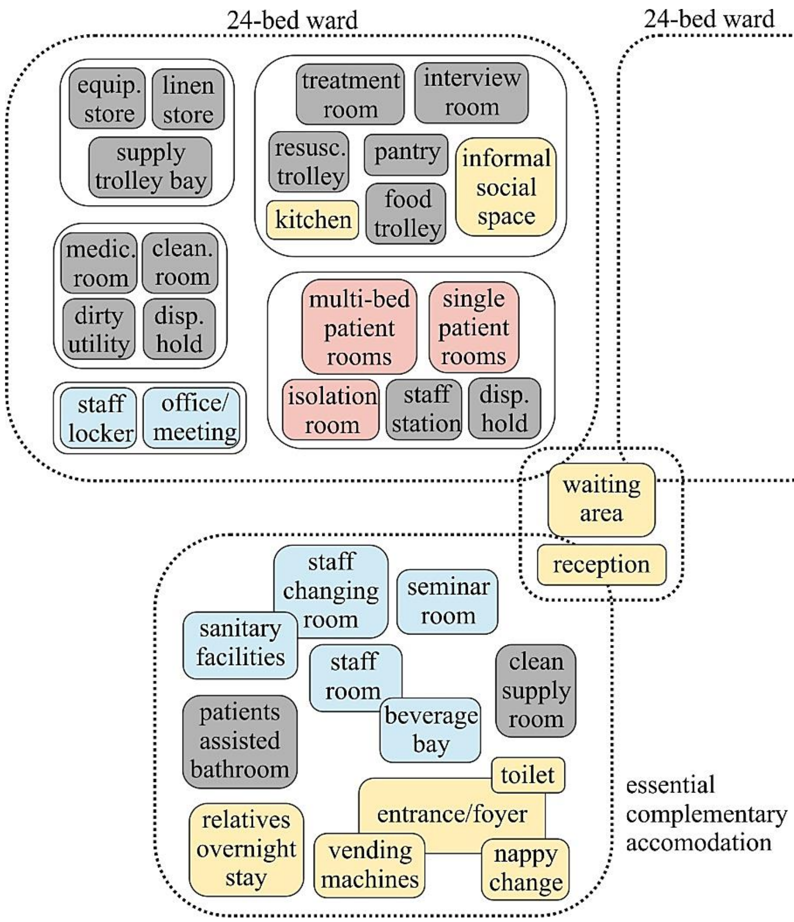


Figure C.2. The functional relationship diagram of an inpatient care service according to the DH standard (2013b)

According to the standard (DVA, 2011), public entry points should be separated from patient and service access, and nurse stations should be located adjacent to the public entrance of the service (DVA, 2011). Within wards, support functions should be decentralized to minimize staff circulation (DVA, 2011). Moreover, a decentralized nurse station can increase patient observation (DVA, 2011). Windows at the end of ward corridors are preferred to enable way-finding and bring natural light into the core (DVA, 2011). In addition, staff and administrative areas should be located in close proximity to the service but away from patient rooms to reduce noise in the ward and for staff respite (DVA, 2011). Sample schematic plans of acute and intensive care inpatient services are presented in Figures C.3. and C.4., respectively.

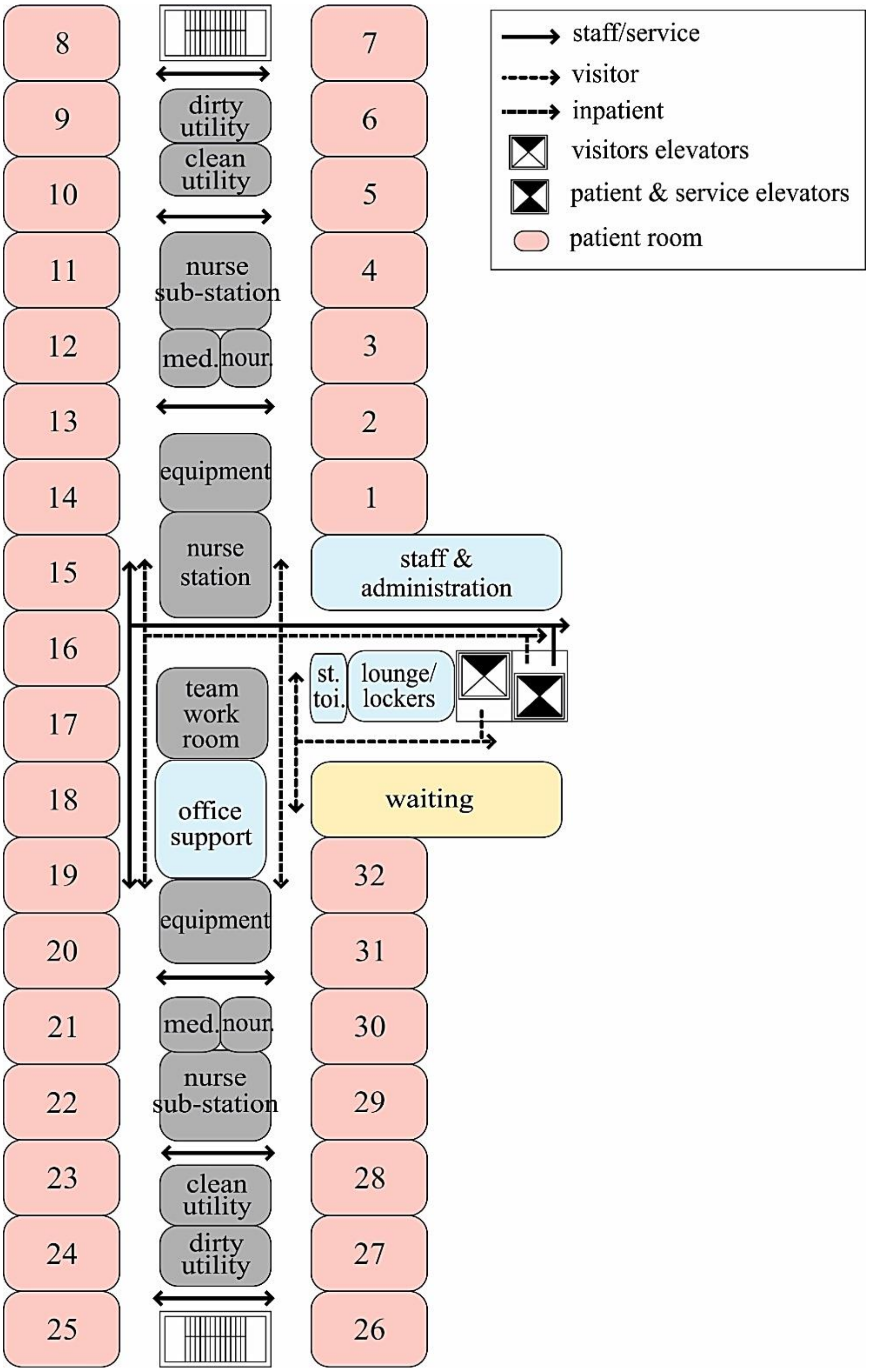


Figure C.3. Schematic plan of an acute care inpatient service according to the DVA standard (2011)

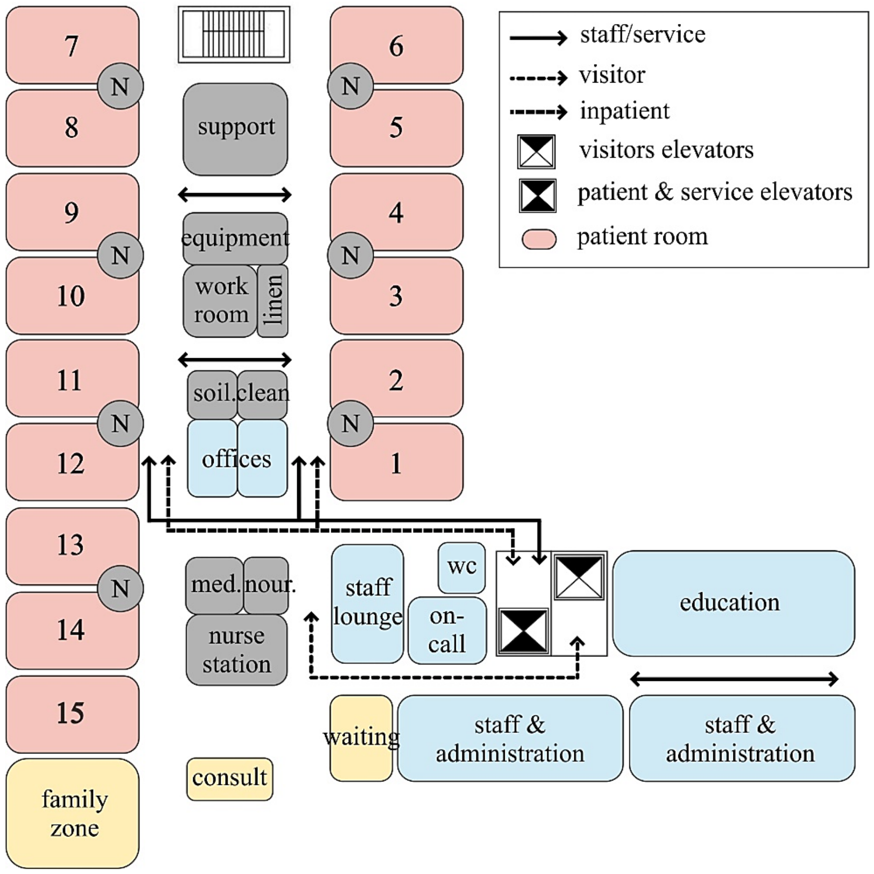


Figure C.4. Schematic plan of an intensive care inpatient service according to the DVA standard (2011)

In the MH regulations (2011b), it is stated that an appropriately sized space for reception, interviews, and waiting should be arranged for relatives of patients in the vicinity of inpatient care services. According to the regulation (MH, 2011b), intensive care inpatient services with a bed number of ten or less can be arranged as a single service. However, services with more than ten beds should be divided into multiple units of up to six beds (MH, 2011b). Moreover, appropriate and adequate staff support areas should be provided for healthy functional relationships (MH, 2011b).

In the standards examined within the scope of this thesis, it can be concluded that depending on the number of beds, inpatient care service wards can be grouped into clusters, and each cluster should have its own clinical support areas. Moreover, clinical support areas should be directly accessible from patient rooms regarding ease of service. Public areas such as waiting areas, family lounges, and counseling rooms should be located alongside the department entrance and away from the patient care zone. Furthermore, staff offices and education rooms need to be removed from patient-related areas due to security, privacy, and confidentiality issues.

C.3. Treatment Areas

According to the AHIA standard (2018a, 2019a) of Australia, inpatient care services could be designed as a mix of single-bed, double-bed, or four-bed rooms. In the standard (AHIA, 2018a), it is stated that both single-bed and multi-bed patient rooms have their own advantages. The advantages of single-bed patient rooms are listed in the standard (AHIA, 2018a) as follows:

- greater patient privacy generally and particularly in use of bathrooms,
- individual control over noise, light levels, and temperature, all of which facilitate better quality rest and sleep and reduce patient stress,
- reduced risk of cross-contamination between patients,
- facilitates family/caregiver engagement with care,
- improved communication between staff and families,
- ability to provide treatment at the bedside, reducing the need to transfer patients to other clinical spaces, e.g., treatment rooms,
- increased flexibility and space to care for higher acuity patients and accommodate the additional equipment required,
- greater flexibility in bed management,
- reduced patient transfers and room moves,
- reduced treatment and medication errors,
- improved staff hand hygiene compliance, and
- no possibility of gender mixing.

On the other hand, the benefits of multi-bed patient rooms are explained in the standard (AHIA, 2018a) as follows:

- greater staff supervision of higher dependency/high acuity patients,
- patient socialization with each other and families, particularly for longer stay patients,
- greater feeling of security and interaction with staff,
- reduced construction, cleaning, and maintenance costs associated with reduced floor space and bathrooms, and
- possible reduced travel distances in some unit layouts.

According to the AHIA standard (2018a, 2019a), in the planning and briefing phases, the combination of bedroom styles (single versus multi-bed) should be determined by considering issues such as patient safety, infection control, patient privacy and dignity, and staff comfort. It is stated that although multi-bed patient rooms are not recommended for surgical patients because of issues related to the movement of beds and potential onus of care, maximum bedroom capacity should comprise four-bed patient rooms (AHIA, 2018a). Additionally, oncology services undertaking allogenic bone marrow transplants require positive pressure isolation rooms and radioactive isotope isolation rooms (AHIA, 2018a).

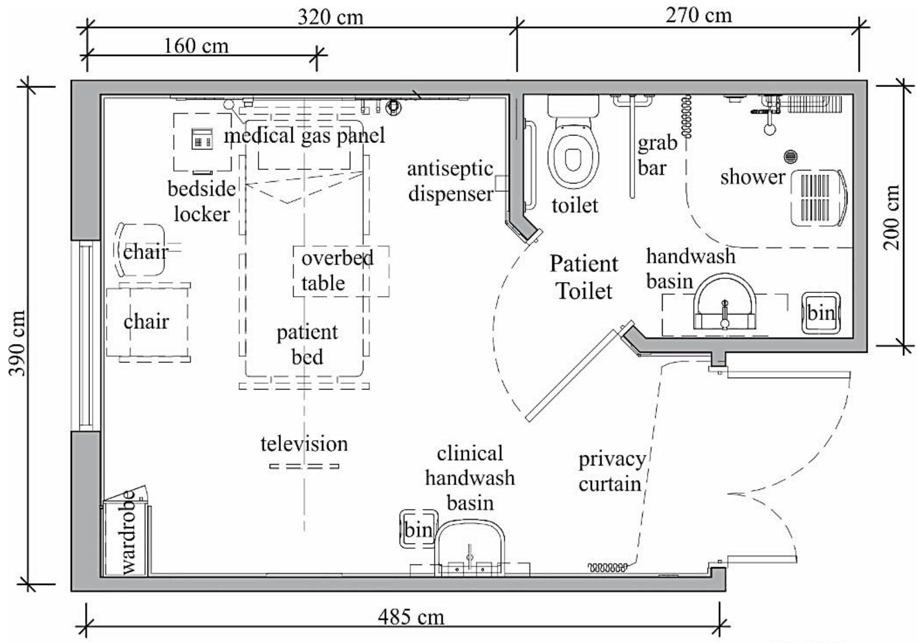
The AHIA standard (2018a, 2019a) emphasizes that the total number of beds in an inpatient care service depends on the service type (acute or intensive care) and the service needs of the individual healthcare facility. According to the standard (AHIA, 2018a, 2019a), while operationally efficient acute care inpatient services may range from 24 to 36 beds, an optimal intensive care inpatient service size is considered as approximately 14 beds (including isolation rooms). According to the planning, services could be divided into modules or clusters/pods of beds (AHIA, 2018a, 2019a). Each module or pod requires access to clinical support areas to minimize staff travel and reduce the potential of cross-infection (AHIA, 2019a).

Bed spacing and clearances are critical considerations in determining final room sizes. According to the AHIA standard (2018a, 2019a), in acute care inpatient services, clearance of 1200 mm should be required in double bedrooms at the foot of every bed so that appliances and beds can be moved easily (AHIA, 2018a). Moreover, the minimum distance between the lines of the bed center should be 2400 mm in multi-bed rooms (AHIA, 2018a). In intensive care inpatient services, the beds should be arranged in such a way that there is a minimum clearance of 1500 mm on the staff side of the bed, 1200 mm on the visitor side, and 900 mm at the head or foot (AHIA, 2019a).

Additionally, adequate clear distance between the bed and any fixed obstruction, including bed screens or walls, must be provided to facilitate resuscitation without limiting the movement of staff, beds, and equipment (AHIA, 2019a). Sample room plans and models are presented in Figures C.5., C.6., C.7., C.8. and C.9.

According to the AHIA standard (2018a), in order to encourage family involvement in care, bedrooms should provide seating for family members to facilitate family interaction with treatment without interfering with the clinical work within the room and should also provide secure storage for personal belongings of the family and patient. Additionally, each bed needs direct access to a bathroom with shower/toilet or separate shower and toilet compartments (AHIA, 2018a). Access to the bathroom should minimize the number of directional turns a patient has to make to reach the bathroom and should be visible from the bed (AHIA, 2018a). There may be a bathroom compartment shared among services, but the access should be discreet, not through a public corridor (AHIA, 2018a).

The CSA (2016) standard of Canada states that the design of an inpatient care bedroom should be considered to comprise three separate functional zones: (1) patient, (2) family, and (3) staff. Minimizing overlaps and conflicts between the activities in each zone should be the primary design goal. Moreover, intensive care patient bedrooms should provide sufficient space and facilities to allow additional family support (CSA,



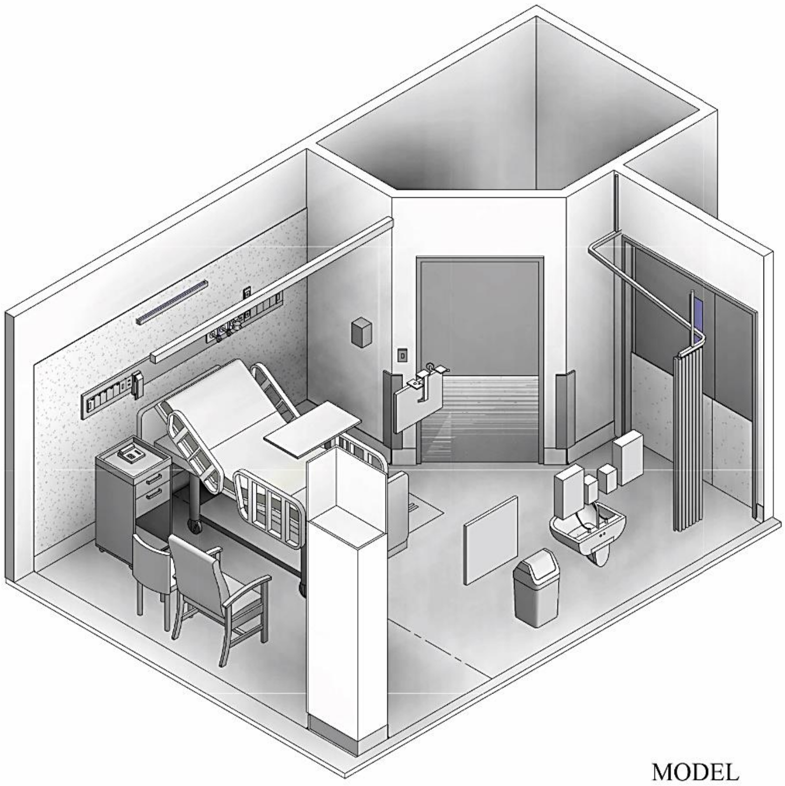


Figure C.5. Sample plan and model of a single-bed acute care inpatient room according to the AHIA standard (2018b)

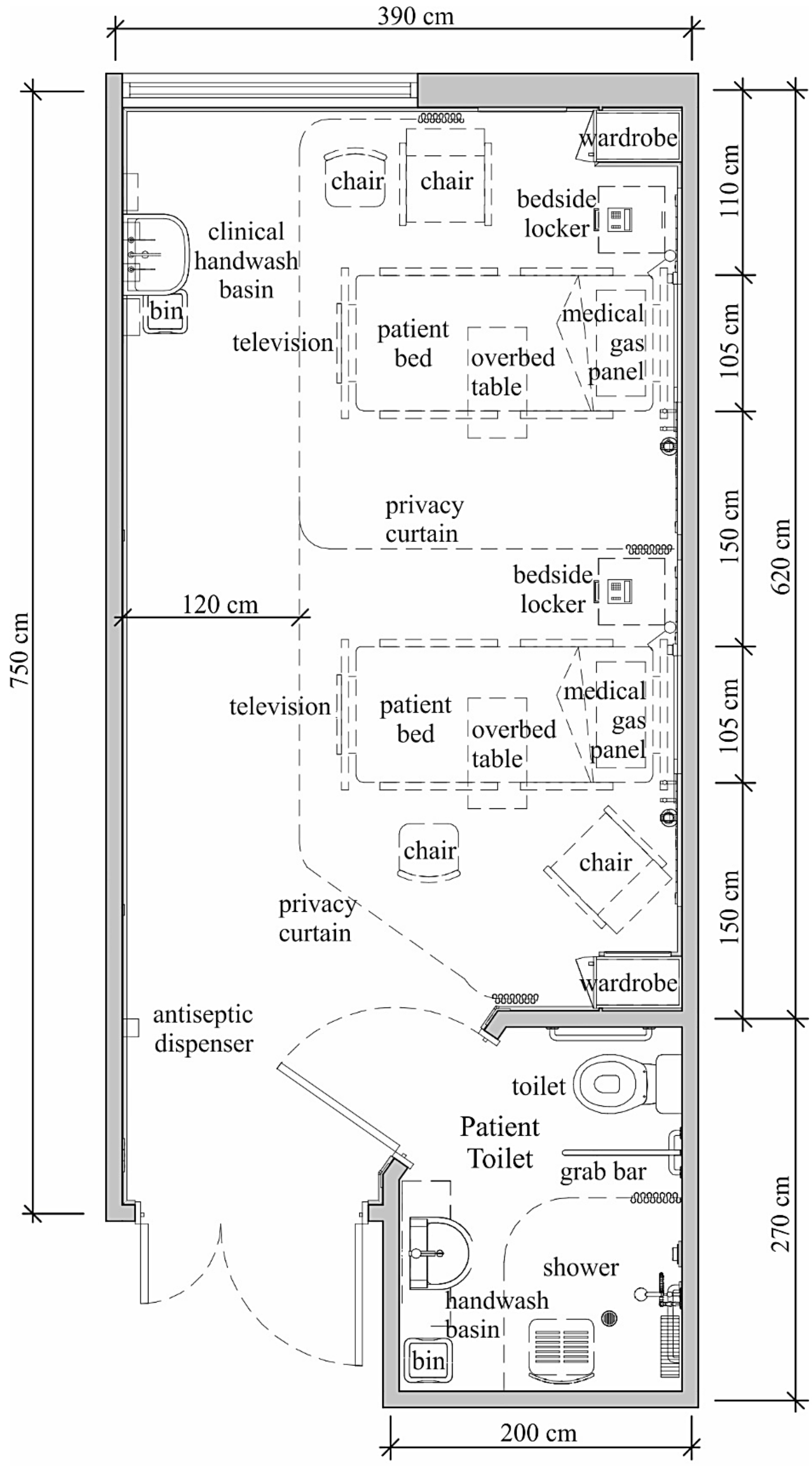


Figure C.6. Sample plan of a two-bed acute care inpatient room according to the AHIA standard (2018c)

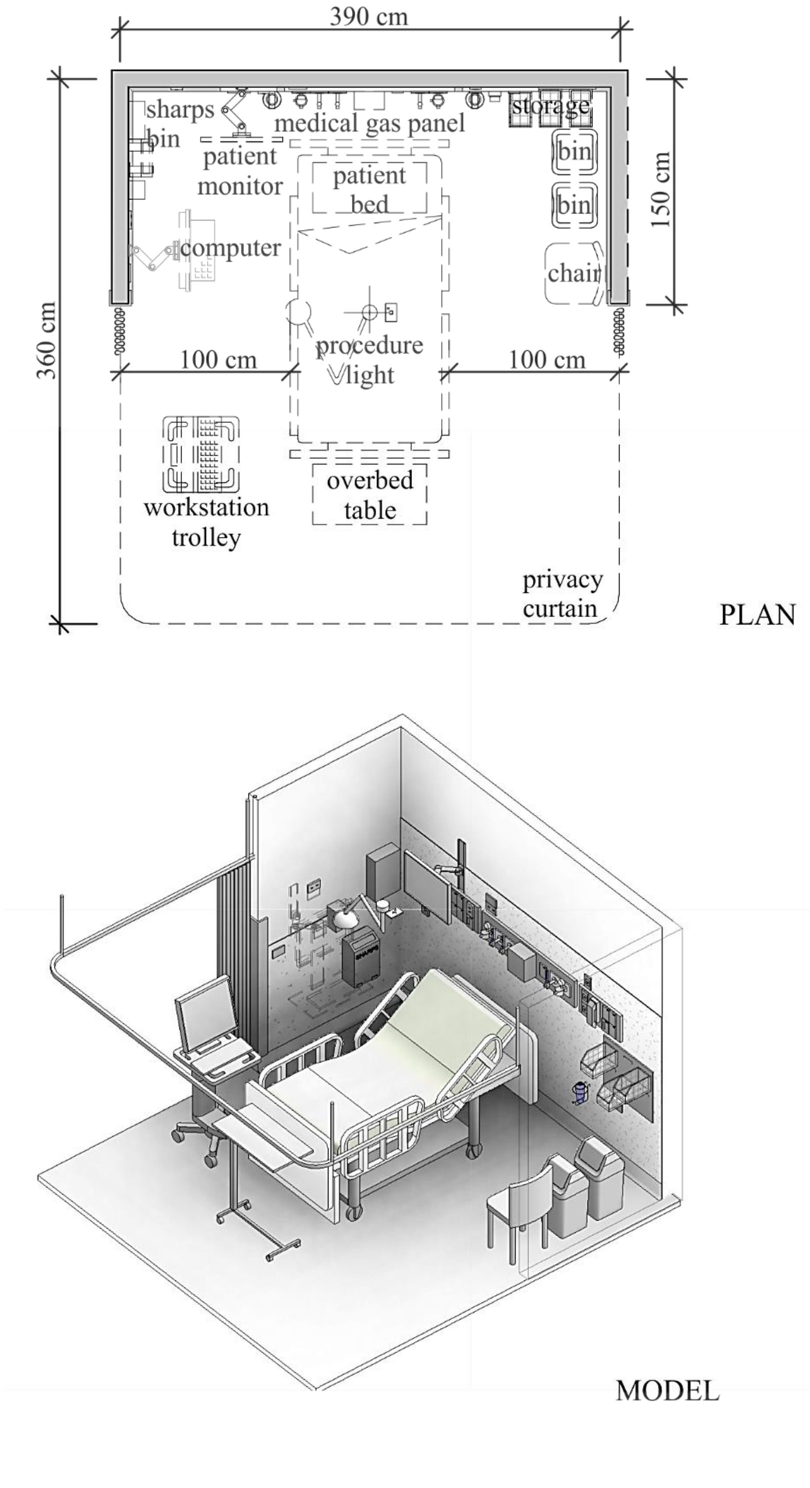
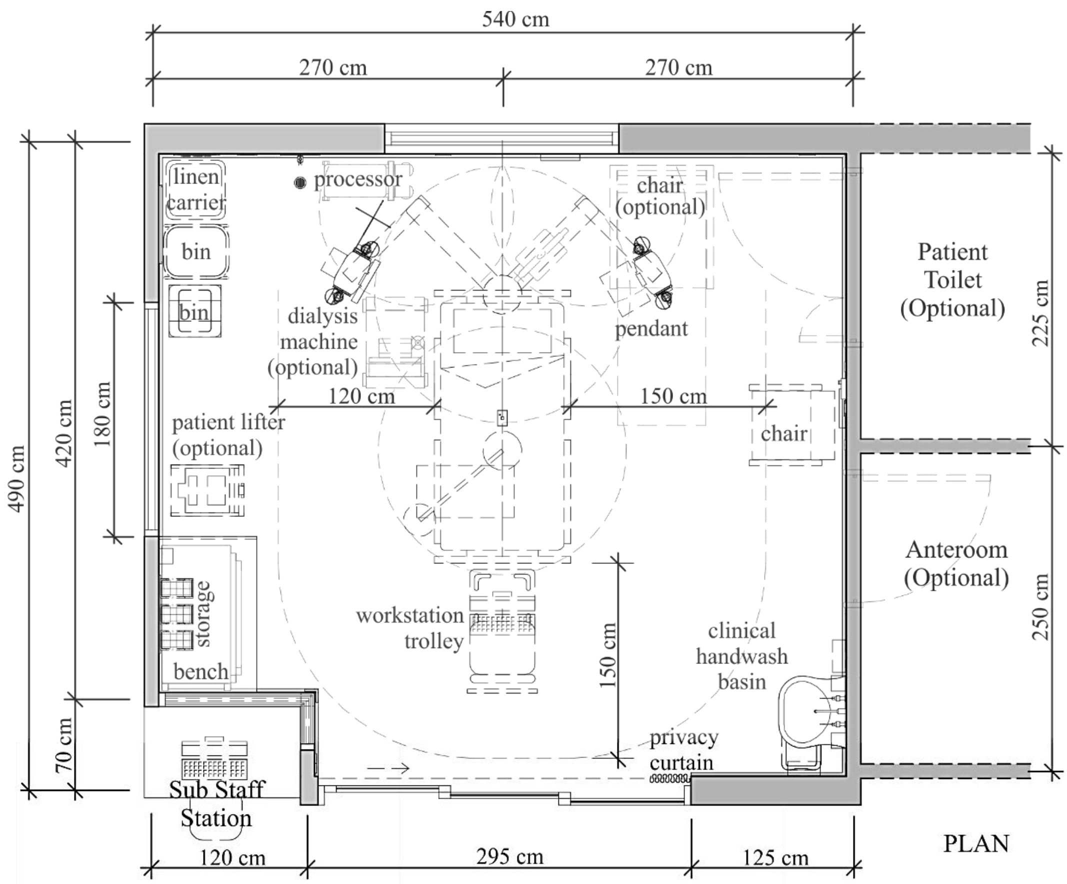


Figure C.7. Sample plan and model of an acute care inpatient bay according to the AHIA standard (2019b)



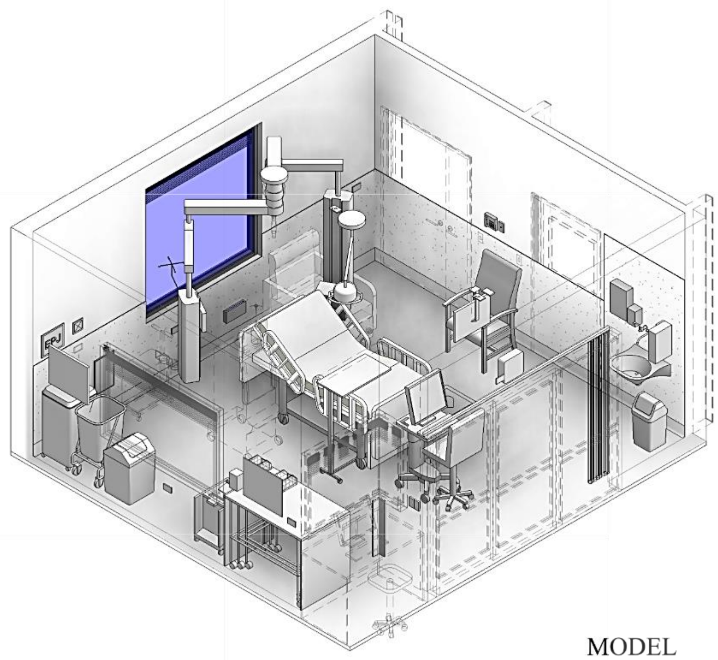


Figure C.8. Sample plan and model of an intensive care inpatient room according to the AHIA standard (2019d)

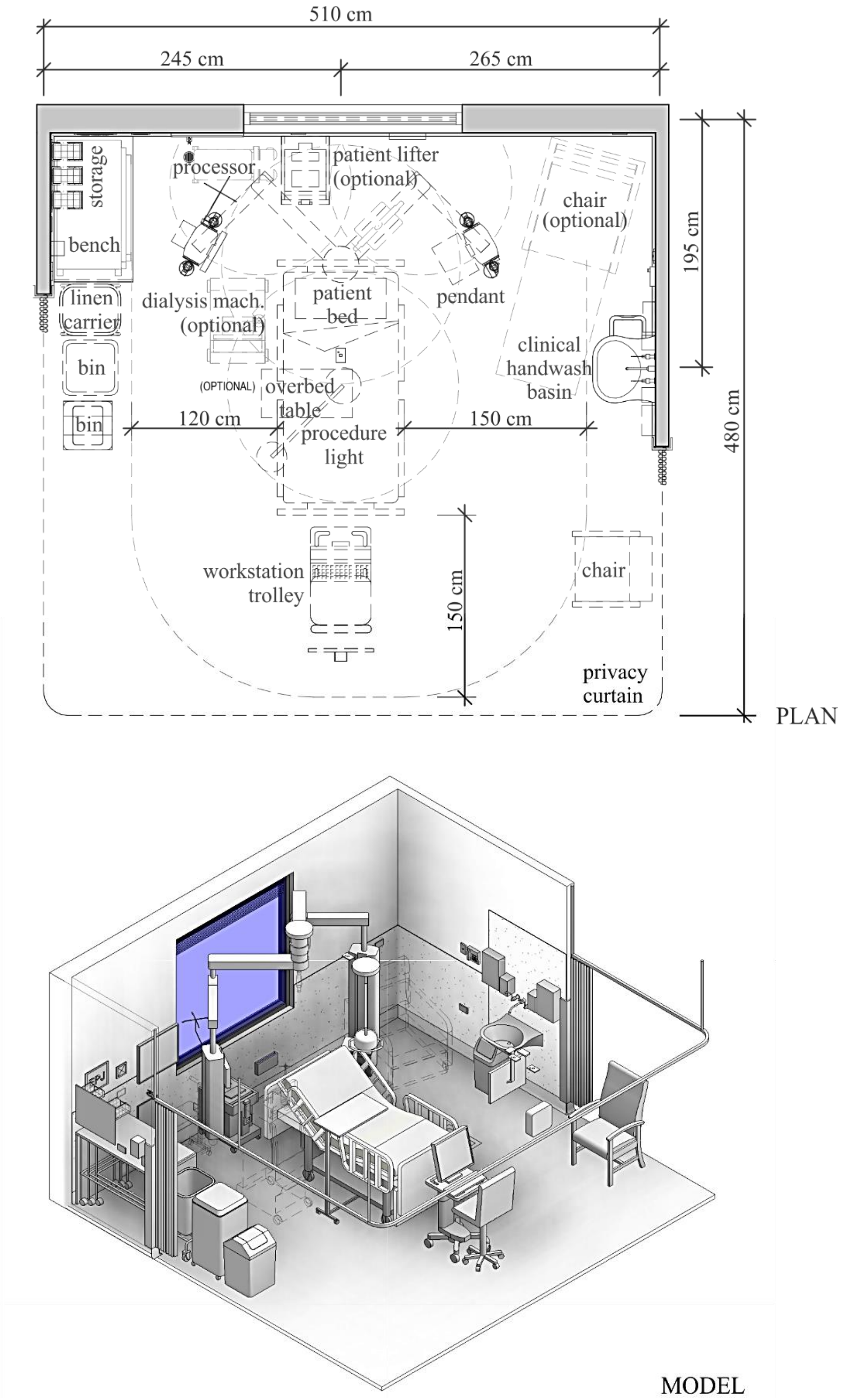


Figure C.9. Sample plan and model of an intensive care inpatient bay according to the AHIA standard (2019c)

2016). According to the standard (CSA, 2016), inpatient care bedrooms could be single-bed, double-bed, or single-bed isolation rooms. Single-bed inpatient care bedrooms should have a minimum bed area of 15 m^2 (family and staff zone included), 5.6 m^2 bathroom, 5 m^2 vestibule, and 1.4 m^2 supply alcove (CSA, 2016). Other design consideration for single-bed rooms can be listed as follows:

- Single-bed rooms should have a minimum of 16.0 m^2 of clear floor area, exclusive of toilet rooms, closets, lockers, wardrobes, alcoves, or vestibules.
- There should be sufficient space for the bed, equipment including monitors, ventilator, supply trolley, furnishings, staff and visitors, and mobile charting station.
- The bed area should have a minimum clear dimension of 4000 mm × 4000 mm including a minimum clear dimension of 1800 mm for wheelchair turning and stretcher access between the bed and the inside wall (staff side).
- The minimum distances around beds should be as follows:

  Minimum distances for acute care inpatient beds:

  - 1000 mm on the non-transfer side (wall) and to the fixed surface from the side of the bed,
  - 1200 mm at the foot of the bed.

  Minimum distances for intensive care inpatient beds:

  - 1200 mm on the non-transfer side (wall) and to the fixed surface from the side of the bed,
  - 1500 mm at the foot of the bed.
- Staff should be able to access all sides of the patient's bed.
- The family side of the bed should contain a wardrobe unit with minimum dimensions of 450 mm × 600 mm and space for a recliner/pull-out bed or a window seat.
- A hand hygiene station should be located in the corridor outside each bedroom and at the point of care in each bed area.
- There should be a private bathroom accessible from the patient's cubicle.

- Each bed should have access to daylight. The amount of daylight should be controllable.
- Within the room, a soiled linen hamper, storage for the patient's personal belongings, a medical gas panel, a wall- or ceiling-mounted clock, and a telephone should be provided.

According to the standard (CSA, 2016), double-bed inpatient care bedrooms have a minimum bed area of 23 m^2 (13 m^2 per bed), 11.2 m^2 bathroom (5.6 m^2 per bed), 7 m^2 vestibule, 3 m^2 family zone, 3 m^2 staff zone, and 1.4 m^2 supply alcove (CSA, 2016). Other design considerations for double-bed rooms can be listed as follows:

- General design considerations are similar to single-bed patient rooms.
- The need to pass through another patient's bed space to access the bathroom room or window should be avoided.
- A privacy curtain should be incorporated in all shared bedrooms.
- There should be side-to-side visual privacy between patients.
- The minimum distances around beds should be as follows:

  Minimum distances for acute care inpatient beds:
  - 1000 mm on the non-transfer side (wall) and to the fixed surface from the side of the bed,
  - 1200 mm at the foot of the bed,
  - 1200 mm between beds,
  - 1800 mm from centerline to centerline of beds.

  Minimum distances for intensive care inpatient beds:
  - 1200 mm on the non-transfer side (wall) and to the fixed surface from the side of the bed,
  - 1500 mm at the foot of the bed,
  - 1800 mm between beds,
  - 2400 mm from centerline to centerline of beds.
- The height of the windowsill should be as low as permissible by code in order to provide the maximum view from the patient's bed.

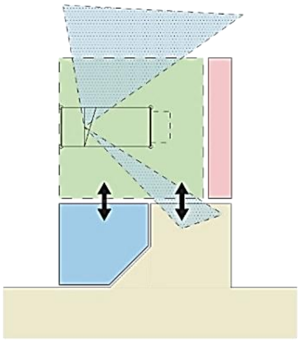
- It should be possible to view the patient's head from the entrance door.

In the DH standard (2013b) of the United Kingdom, treatment areas of inpatient care services consist of:

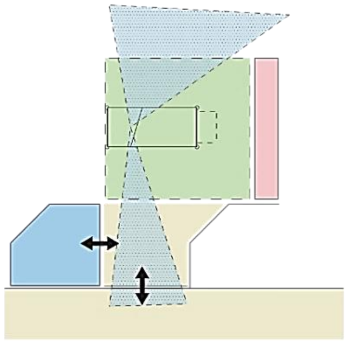
- single-bed patient rooms (19 m^2),
- bathroom in single-bed patient rooms (4.5 m^2),
- multi-bed patient rooms - 4 beds (64 m^2),
- patient toilet for multi-bed patient rooms (2 m^2),
- shower for multi-bed patient rooms (6.5 m^2),
- isolation patient rooms (24 m^2), and
- assisted bathroom (15 m^2).

The standard (DH, 2013b) states that bathrooms can have a significant impact on the bedroom regarding floor area, views to and from the bed, and support facilities such as the nurses' "touchdown" bases (Figure C.10.). Sanitary bathroom facilities should be located close to multi-bed patient rooms, which patients can reach without the need to travel long corridors (DH, 2013b). Isolation patient rooms comprise a single-bed room, bathroom, and ventilated lobby (DH, 2013b).

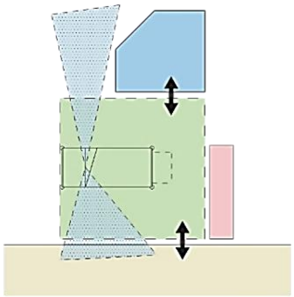
Treatment rooms for unsealed-source brachytherapy require different planning (DH, 2013a) (Figure C.11.). The enclosing structure of those rooms needs to be shielded to prevent radiation from passing through the room into the surrounding areas (DH, 2013a). The protection comprises thick concrete walls, lead coating (if necessary), and shielding doors (DH, 2013a). Moreover, shielded windows need to be provided for access to natural light and views (DH, 2013a). On the other hand, observation of and communication with the patient are ensured by monitoring systems due to radiation protection concerns (DH, 2013a). Furthermore, the bathroom areas of these rooms must also feature a specially designed drainage system to cope with radioactive wastes (DH, 2013a).



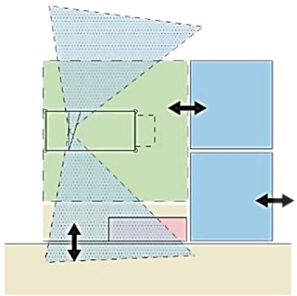
Internal bathroom
- Access to bathroom and to the room are on the same side and this determines the minimum width of the room.
- Views of the bed from the corridor are restricted.
- External views are maximised.
- Privacy for the patient is maximised especially for views into the bathroom.
- There are two options for support services: external wall or partition wall.
- Bed turning can be accommodated adjacent to the bedroom, which increases the circulation space but minimises corridor width.
- The door position can be optimised to increase or decrease space within the room.
- A nurse "touchdown" base can be accommodated adjacent to the bedroom door.



Internal adjacent bathroom
- Access to bathroom and to the room are on the same side and this determines the minimum width of the room.
- Views of the bed from the corridor are improved in comparison to the inboard option.
- External views are maximised.
- Privacy for the patient is reduced. Entry to the en-suite can be seen from the corridor.
- There are two options for support services: external wall or partition wall.
- To accommodate bed turning, either the corridor or the bedroom doors will need to be wider.
- The bedroom door position is fixed.
- Accommodating the nurse "touchdown" base is difficult without adding additional width to the corridor.



External bathroom
- Access to room and en-suite are on opposite sides, which is less restrictive on room width.
- View of the bed from the corridor is maximised.
- External views are minimised.
- Privacy for the patient is minimised and entry into the bathroom can be observed from the corridor.
- There are three options for support services: part external wall, part corridor partitions and room partitions.
- To accommodate bed turning, either the corridor or the bedroom doors will need to be wider.
- The bedroom doors can be located flexibly on the corridor wall.
- A nurse "touchdown base" can be accommodated adjacent to the bedroom door.



In-between bathroom
- Interlocking bathroom increases overall width and depth of the room.
- Views of the bed from the corridor are maximised.
- External views are maximised.
- Privacy for the patient is minimised and entry into the bathroom can be observed from the corridor.
- There are two options for clinical support services: external wall or corridor partitions. This will be influenced by whether the bathroom is "nested" on the external or internal wall.
- To accommodate bed turning, either the corridor or the bedroom doors will need to be wider.
- The bedroom doors can be located flexibly on the corridor wall.
- A nurse "touchdown" base can be accommodated adjacent to the bedroom door.

views from bed | bathroom | bed space | clinical support | circulation | ↔ access points

Figure C.10. Four sample locations for bathroom according to the DH standard (2013b)

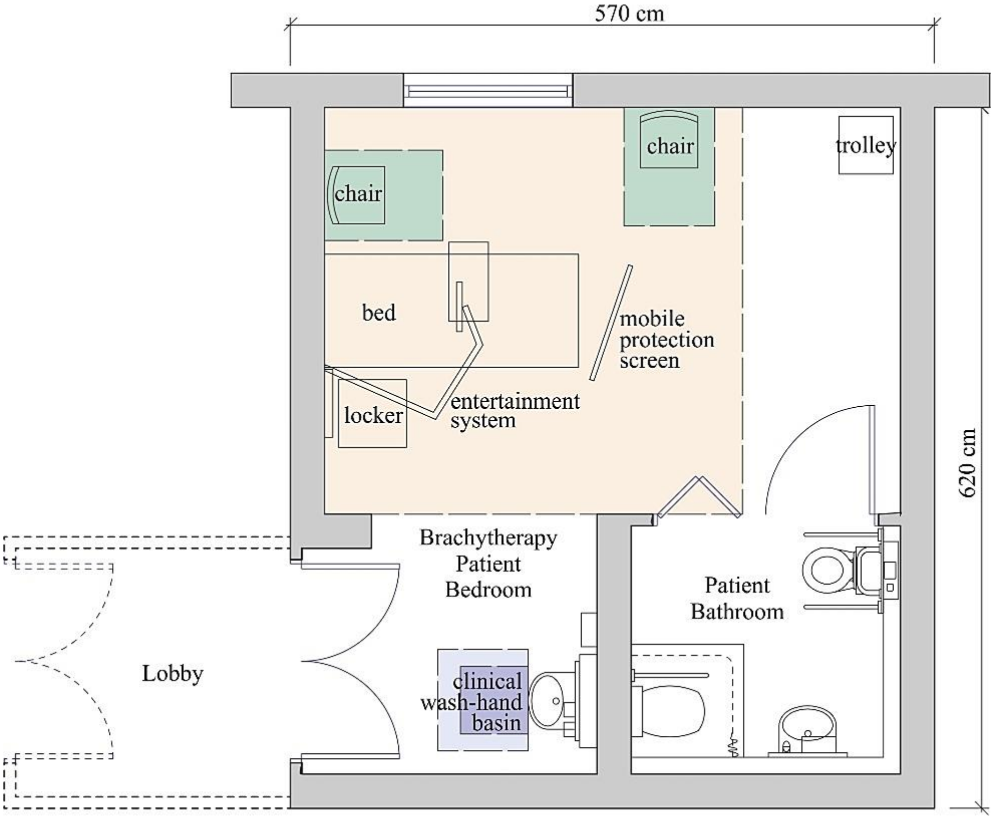


Figure C.11. Sample plan of an unsealed-source brachytherapy room according to the DH standard (2013a)

The FGI standard (2014) indicates that each patient room should have at most one bed in either acute or intensive care inpatient services. However, if there is renovation work and it is not possible to maintain patient capacity conditions, each patient room should be designed for a maximum of four patients for acute care inpatient services (FGI, 2014). In the standard (FGI, 2014), room floor area and clearance considerations are different for acute and intensive care patient rooms. Acute care patient rooms should have a minimum clear floor area of 120 ft^2 (11.15 m^2) in single-bed rooms and 100 ft^2 (9.29 m^2) per bed in multiple-bed rooms (FGI, 2014). Moreover, while minimum clearance should be 3 ft (91.44 cm) between the sides and foot of the bed and any wall or any other fixed obstruction in single-bed rooms, in multiple-bed rooms a minimum clearance of 4 ft (122 cm) should be available at the foot of each bed to permit the passage of equipment and beds (FGI, 2014).

On the other hand, intensive care patient areas (whether a separate room or a bay or a cubicle in a multiple-bed, open-plan area) should have a minimum clear floor area of 200 ft^2 (18.58 m^2) with a minimum headwall width of 13 ft (3.96 m) per bed (FGI, 2014). Furthermore, according to the standard (FGI, 2014), all adult and pediatric intensive care patient areas should have minimum clearances as follows:

- 1 ft (30.48 cm) from the head of the bed to the wall,
- 5 ft (152 cm) from the foot of the bed to the wall,
- 5 ft (152 cm) on the transfer side,
- 4 ft (122 cm) on the non-transfer side, and
- 8 ft (244 cm) between beds.

In the FGI standard (2014), it is noted that natural light is to be provided for each patient room by means of a window to the outside, which is a minimum of 8 percent of the floor area of the room served, and with a maximum opening of 4 inches (102 mm). Moreover, one handwashing station should be provided in each patient room and for every four-patient care area in open-plan patient rooms (FGI, 2014). In addition, a separate wardrobe and a bathroom with toilet and handwashing basin should be designed for each patient room (FGI, 2014). According to the standard (FGI, 2014), pediatric inpatient care rooms should be separated from units serving adult populations and include provisions for family support (hygiene, sleeping, and personal belongings), which should not limit or encroach upon the minimum clearance requirements around the patient's bed station.

According to the DVA standard (2011) of the United States, inpatient care rooms should be organized to provide handwashing facilities close to the entry, a workspace near the patient's bed, a patient care zone, and a family zone on the far side of the room from the clinician's workspace. Doors to all rooms should be glazed to ensure maximum visibility of patients from the corridor and the nurse stations of the service

(FGI, 2014). Moreover, all rooms should have a curtain that crosses the entrance area of the room when necessary to ensure patient privacy (FGI, 2014). The standard (FGI, 2014) states that isolation patient rooms are to be provided within inpatient care services. Those should include an anteroom, in which a handwashing basin, clean storage for personal protective equipment, and a soiled holding room are provided (FGI, 2014). Additionally, to be able to view patients from the hallway, glazed panels are to be installed in the corridor wall and in the wall between the anteroom and the patient's room (FGI, 2014). Sample plans of acute care, intensive care, and isolation inpatient rooms are presented in Figures C.12., C.13., and C.14.

There are three MH regulations that give information about treatment areas of inpatient care services (MH, 2010, 2011b, 2012). Although general information on the issue is parallel among these regulations, there are some numerical differences. The MH regulations (2010, 2011b, 2012) state that while the maximum capacity of a room is two patients in acute care inpatient services, intensive care patient areas should be designed for one patient in either room or arena type. However, single rooms are recommended for both cases for the sake of infection control, patient privacy, patient safety, and long-term economics (MH, 2010, 2012).

According to the 2010 MH regulation, single-bed acute care patient rooms should be at least 15 m^2 and should have clearance of 110 cm around the bed, at the foot, and on both sides. In acute care patient rooms with more than one bed, there should be at least 9 m^2 of clear floor space per bed, clearance of 110 cm in front of the foot of each bed, and 120 cm between the two beds so that access to the equipment and beds is possible (MH, 2010). The MH (2012) further states that there should be a gap of 120 cm around the patient's bed to allow for intervention in three directions, and bedrooms should be a minimum of 4.00 × 8.00 m.

According to both of the regulations (MH, 2010, 2012), each acute care patient should have access to a toilet without leaving the patient's room in the general corridor. A toilet should not serve for more than four beds and two patient rooms (MH, 2010).

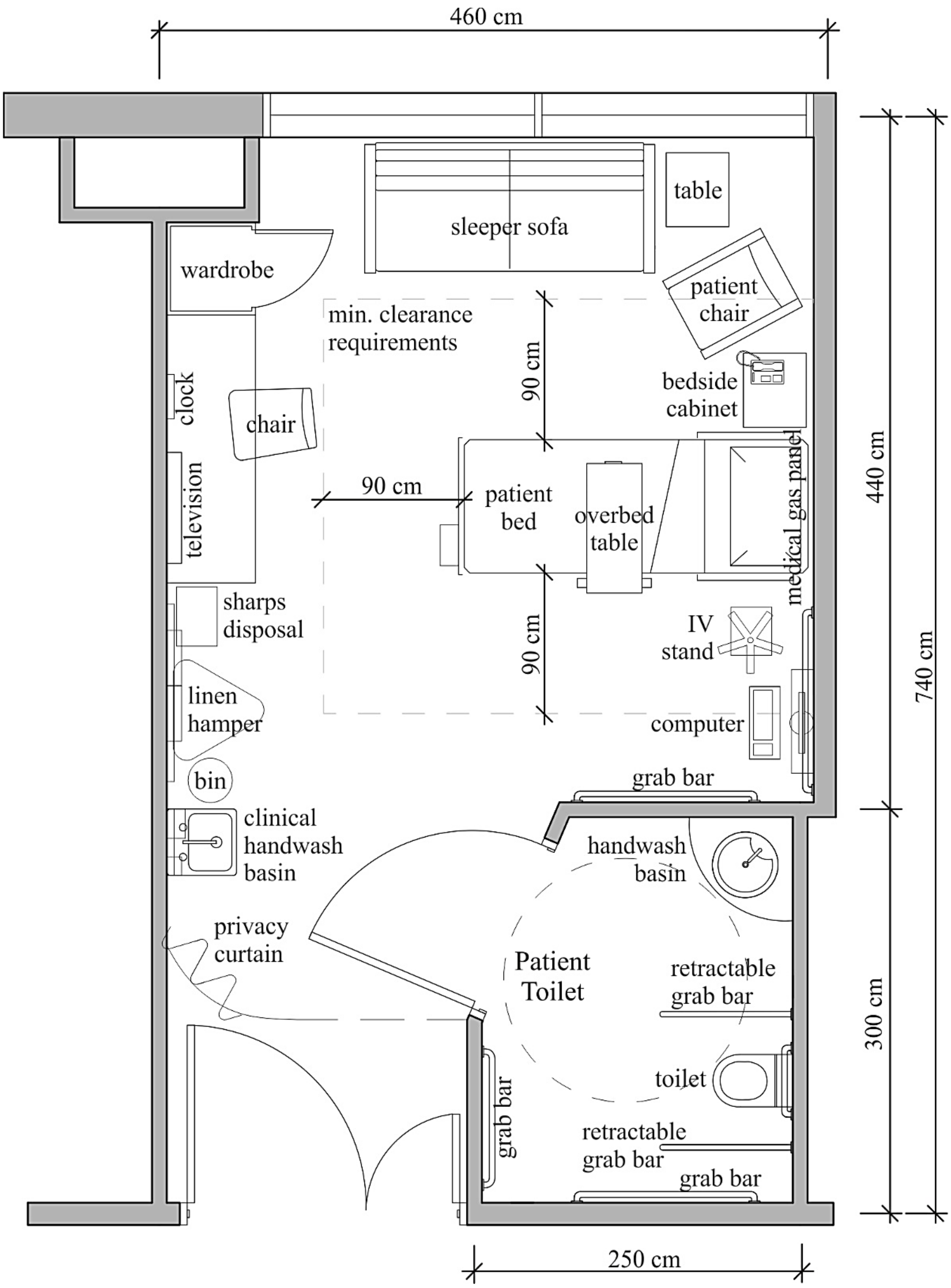


Figure C.12. Sample plan of an acute care inpatient room according to the DVA standard (2011)

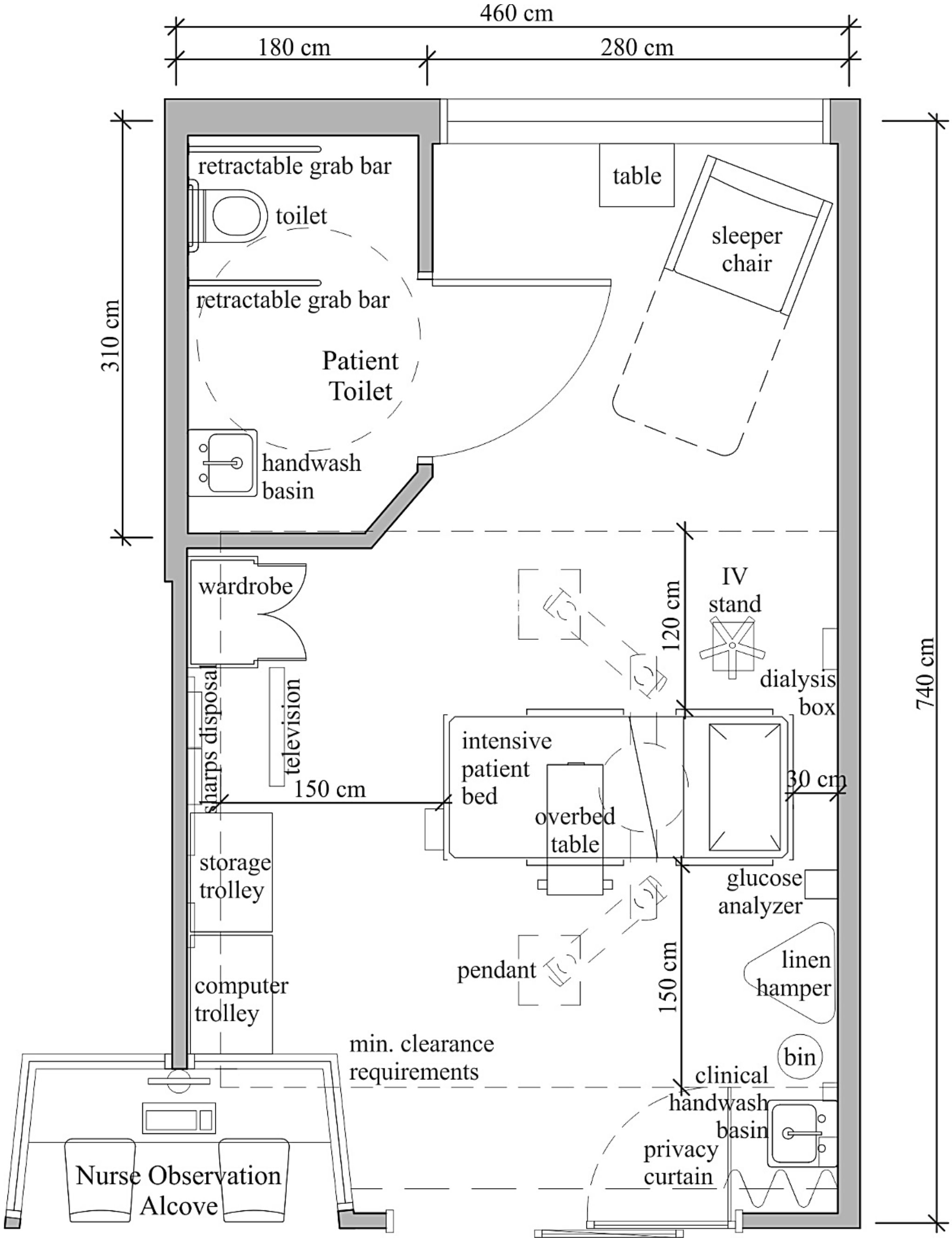


Figure C.13. Sample plan of an intensive care inpatient room according to the DVA standard (2011)

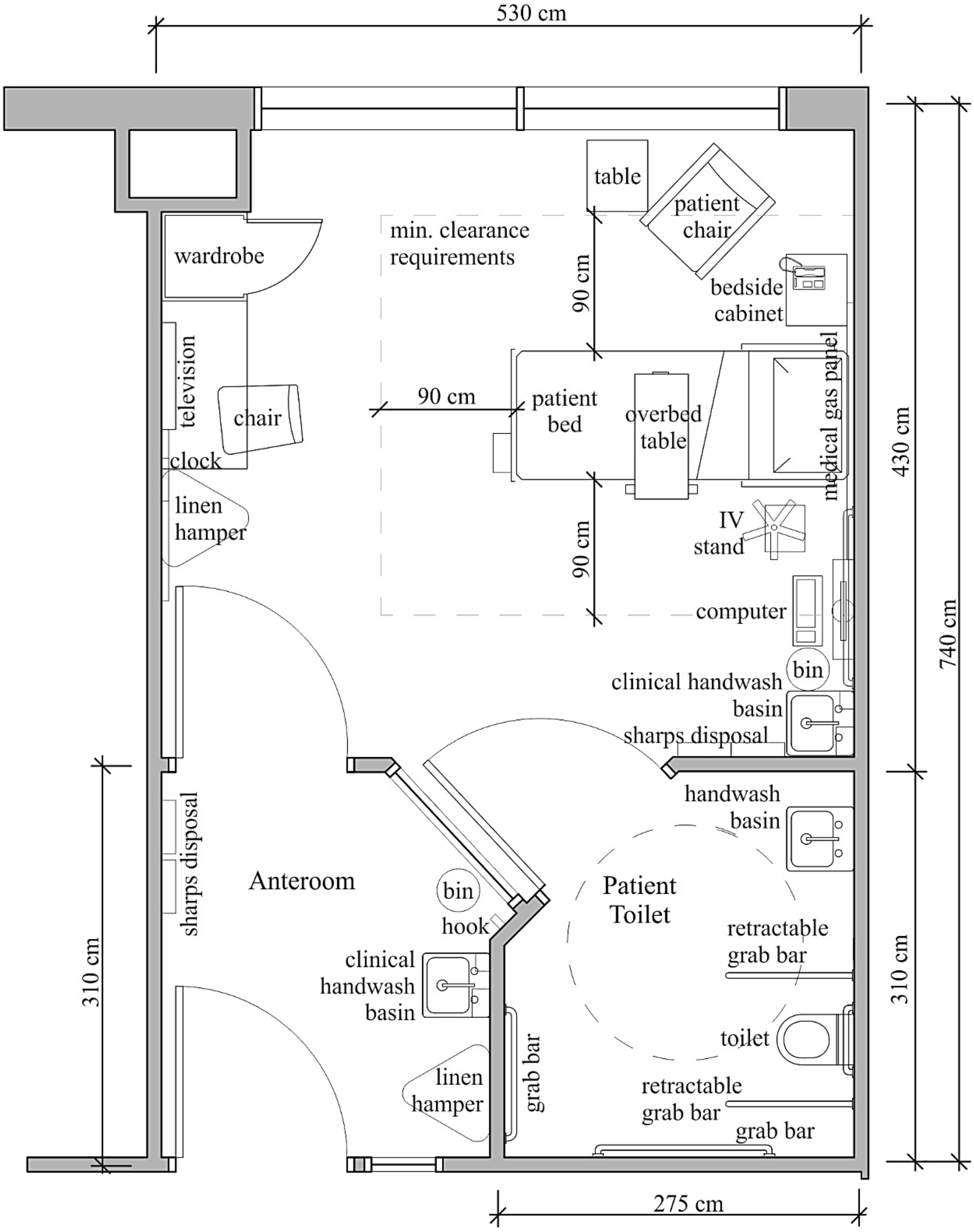


Figure C.14. Sample plan of an isolation inpatient room according to the DVA standard (2011)

While the 2010 MH regulation notes that bathrooms with showers in patient rooms cannot be smaller than 3.35 m^2 including handwashing equipment, the minimum required dimensions for patient bedroom bathrooms are given as 2.50 × 2.00 m in the 2012 MH regulation. The MH regulations (2010, 2012) indicate that there should be separate lockers and desks for the patients, support bars to allow the patient to go to the toilet alone if necessary, and a window for natural light should be provided. Sample acute care patient room plans as given in both regulations (MH, 2010, 2012) are presented in Figures C.15., C.16., and C.17.

The 2010 MH regulation notes that single-bed intensive care patient rooms should have a minimum clear floor area of 13 m^2 and should have clearance of 120 cm around the bed, at the foot, and on both sides. In intensive care patient rooms with more than one bed, there should be at least 13 m^2 of clear floor area per bed and a clearance of 240 cm between two beds so that access to the equipment and beds is possible (MH, 2010). However, the 2011 MH regulation states that at least 12 m^2 of clear floor space should be reserved for each bed and that the clearance between the beds should be at least 1.5 m and 2 m for adult and pediatric intensive care rooms, respectively.

According the 2010 MH regulation, the bathroom in single-bed intensive care inpatient rooms has requirements similar to that in acute care patient rooms. On the other hand, there is no bathroom in intensive care patient rooms according to the 2011 and 2012 MH regulations. The MH regulations (2010, 2011) indicate that there should be a space on both sides of the patient’s bed where visitors can stand while visual privacy is ensured, preventing random viewing by other patients or visitors. Moreover, each intensive care patient room should have a view through the windows, and the distance between each bed and the windows should not exceed 12 m (MH, 2010). Sample intensive care patient room plans as given in the regulations (MH, 2010, 2012) are presented in Figures C.18., C.19., and C.20.

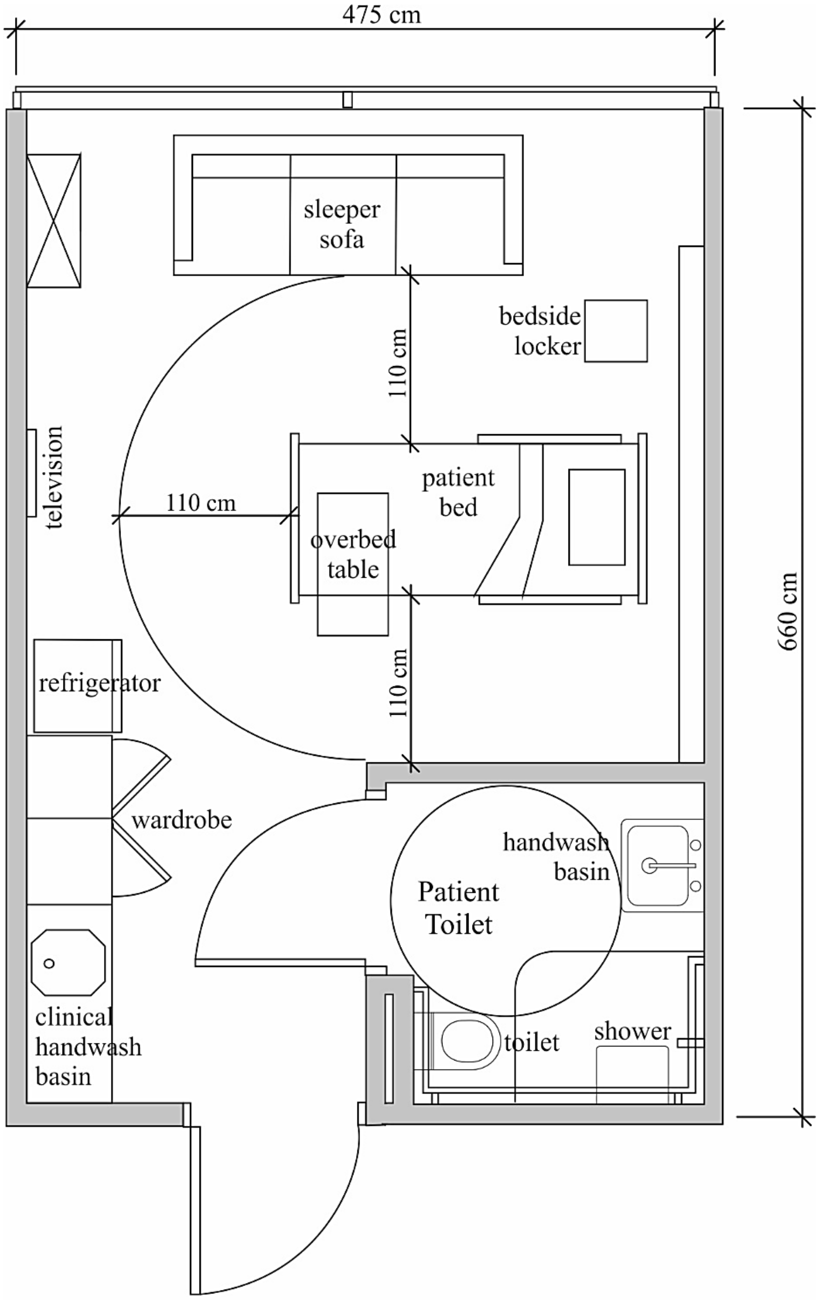


Figure C.15. Sample plan of a single-bed acute inpatient room according to the MH standard (2010)

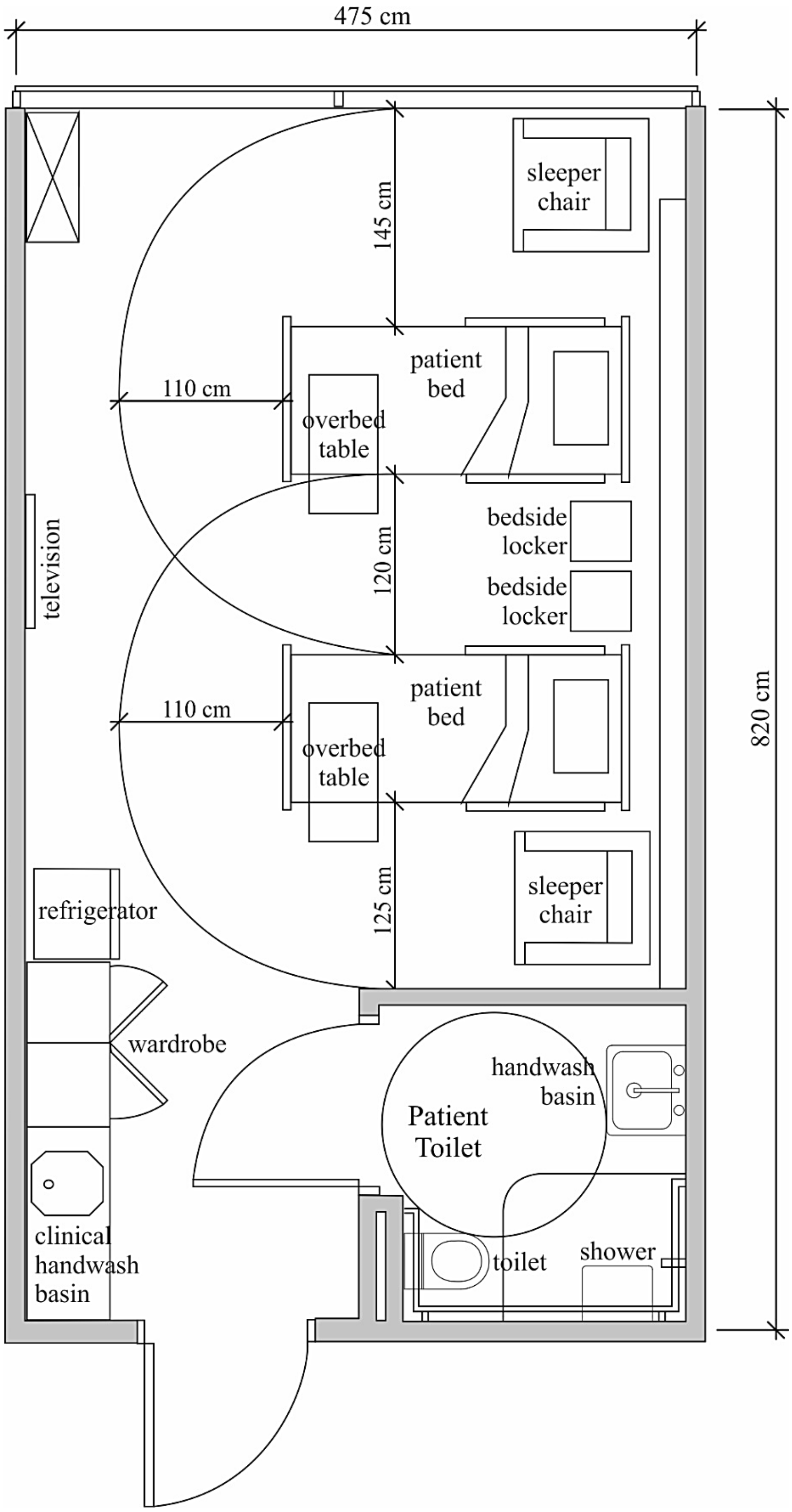


Figure C.16. Sample plan of a double-bed acute inpatient room according to the MH standard (2010)

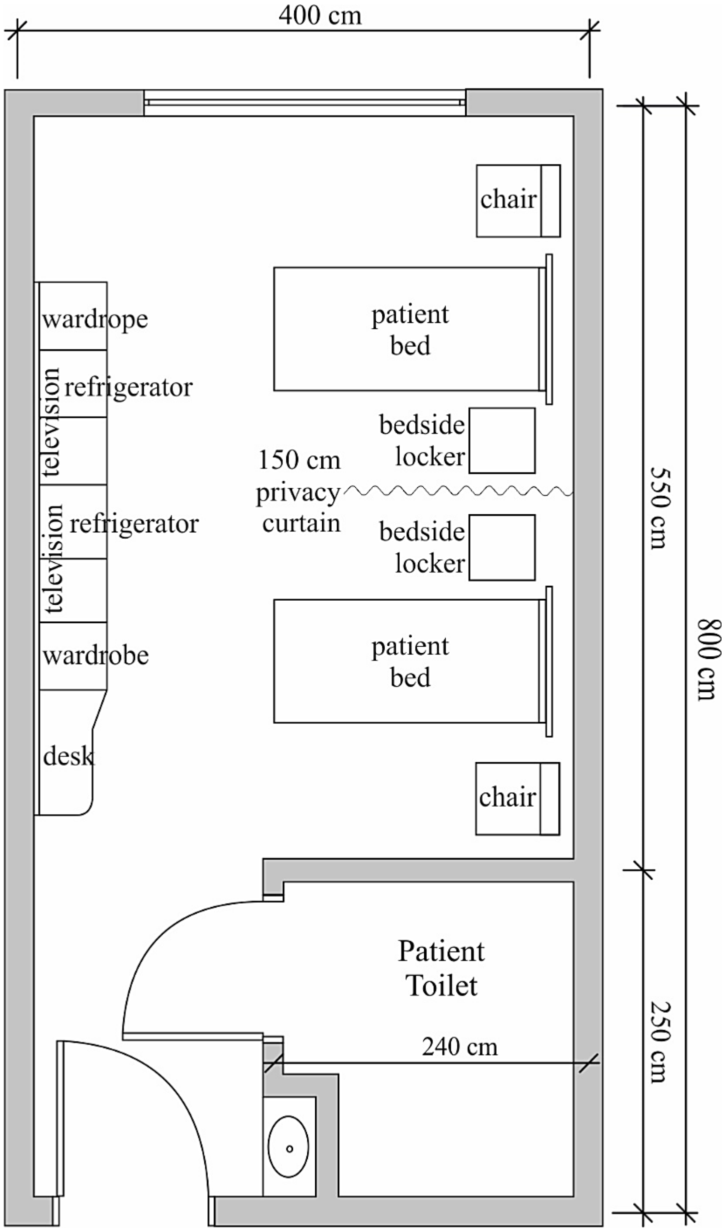


Figure C.17. Sample plan of a double-bed acute inpatient room according to the MH standard (2012)

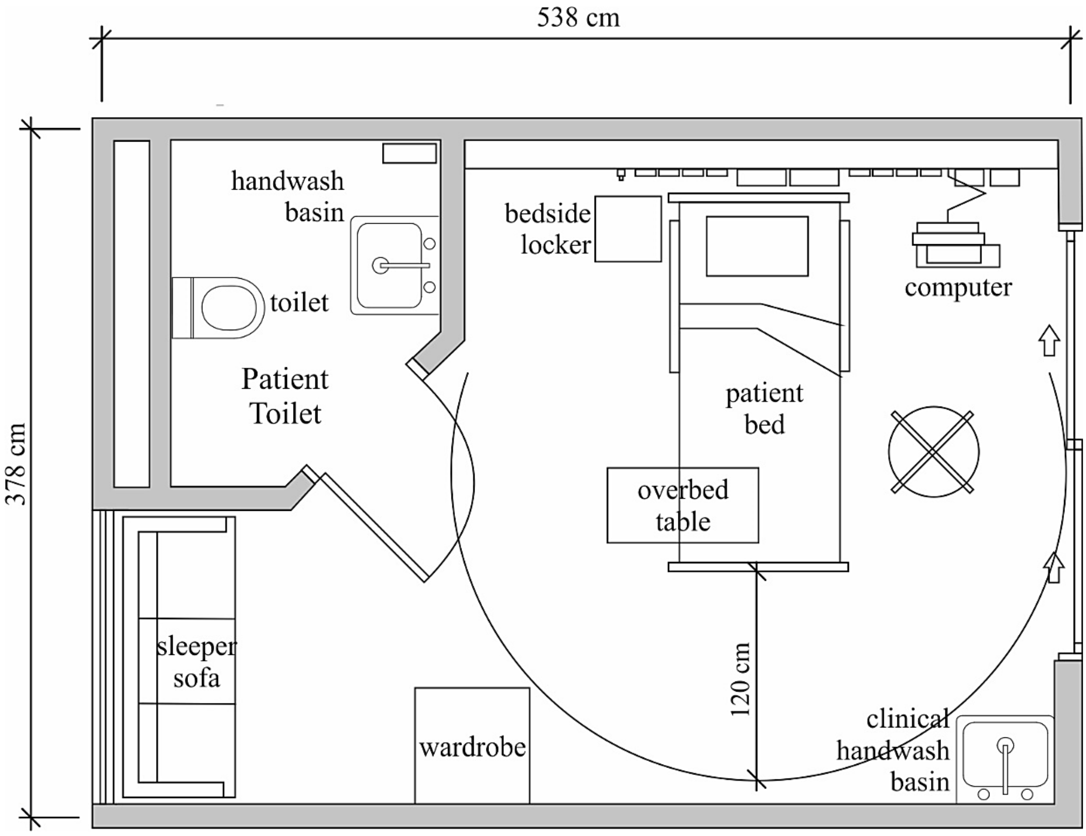


Figure C.18. Sample plan of a single-bed intensive care inpatient room according to the MH standard (2010)

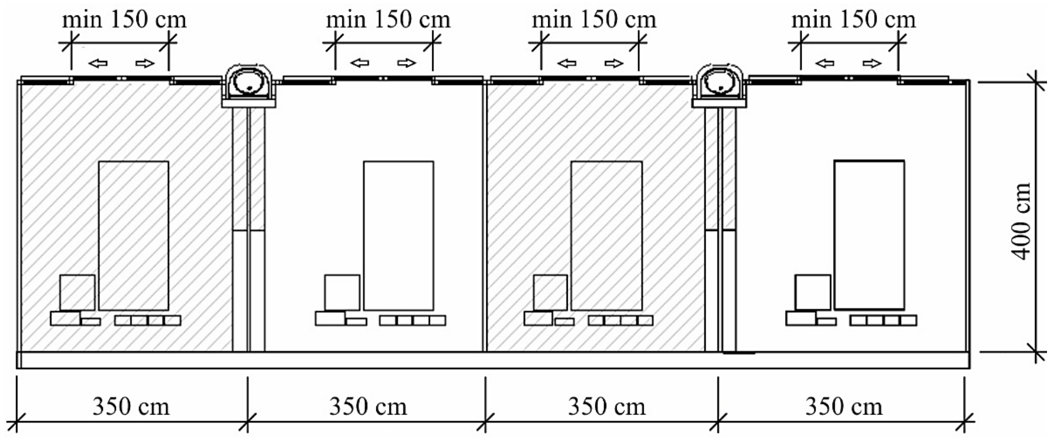


Figure C.19. Sample plan of arena-type intensive care inpatient area according to the MH standard (2012)

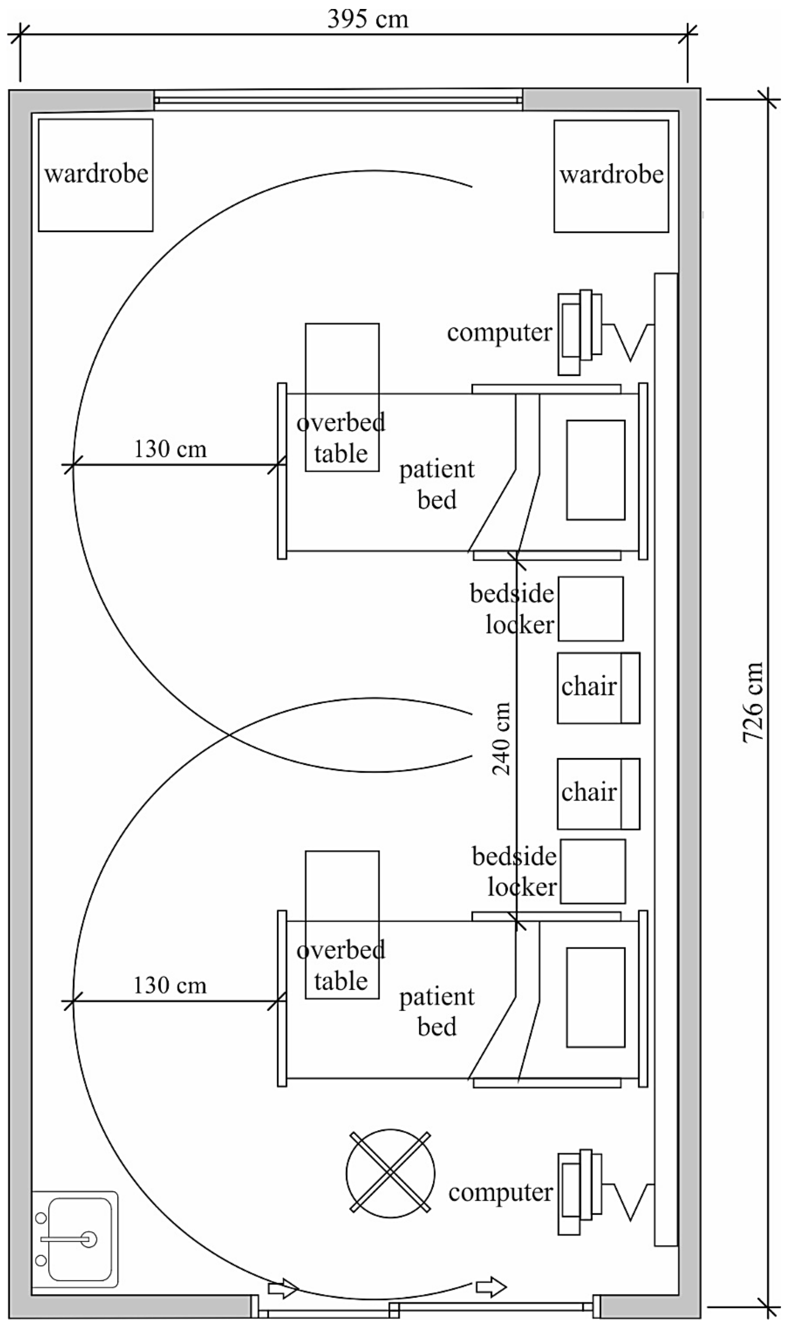


Figure C.20. Sample plan of a double-bed intensive care inpatient room according to the MH standard (2010)

According to the MH regulation (2010), at least one isolation patient room should be provided. Each room should have only one bed, with a minimum of 15 m^2 of floor area (MH, 2010). Each of the isolation rooms should have an anteroom of a minimum of 4 m^2 for handwashing, dressing, and holding clean/dirty materials (MH, 2010). Separate bathrooms of at least 6 m^2 including toilets, showers, and handwashing sections are required for each isolation room.

In the standards examined within the scope of this thesis, there are differences in the treatment areas of inpatient care services in terms of number of patients per room, minimum floor areas, and clearances. Together with these differences between the standards, the MH legislation contains contradictions within itself. This comparison is presented in Table C.5. On the other hand, the examined standards are parallel in advocating that each patient room should include a patient care zone, a staff-working zone, and a family zone. Although treatment areas of the inpatient care service could be arranged in arena, cubicle, or room layouts, room type planning with single-patient accommodations is highly recommended due to infection control and privacy issues. Furthermore, an adequate number of airborne isolation rooms with anterooms within the service are required.

C.4. Clinical Support Areas

In the AHIA standard (2018a, 2019a) of Australia, clinical support areas of inpatient care services consist of staff stations, procedure rooms (especially for acute care inpatient services), medication rooms, interview rooms, clean/dirty utility rooms, storage areas, bays for various purposes, disposal rooms, and offices (Table C.6.). According to the standard (AHIA, 2019a), a central staff station is recommended per pod to support high-level monitoring and staff support across the service. Decentralized staff stations collocated with patient rooms can be provided to improve visibility and access to the patient (AHIA, 2019a). The central staff station should provide space for clinical handwashing, resuscitation equipment, charting, central cardiac monitoring, PACS viewing facilities, and diagnostic monitors (AHIA, 2019a).

Table C.5. *Comparison of inpatient care room requirements in different standards (cfa: clear floor area)*

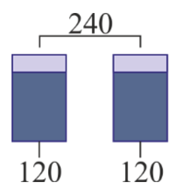
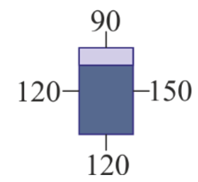
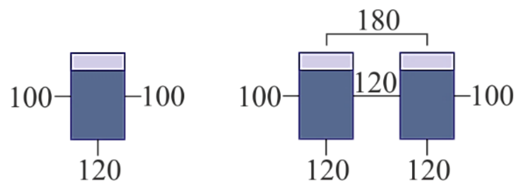
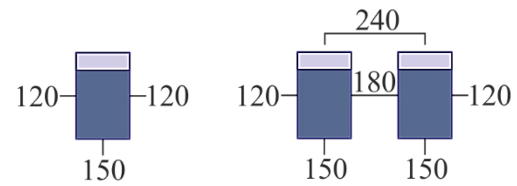
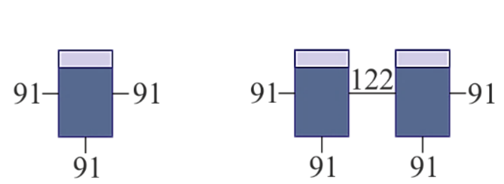
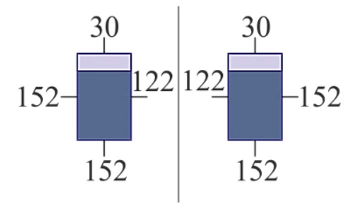
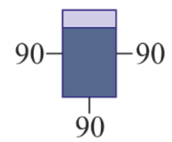
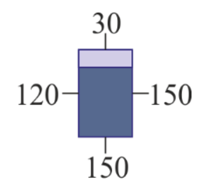
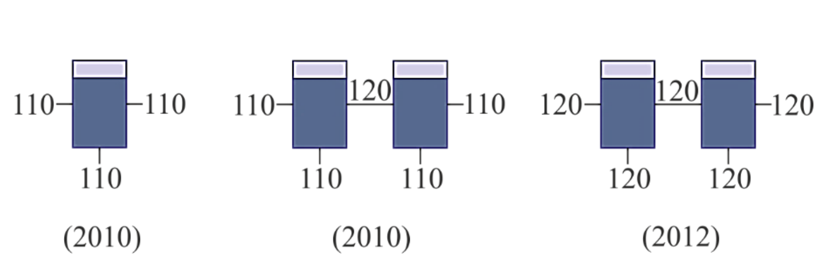
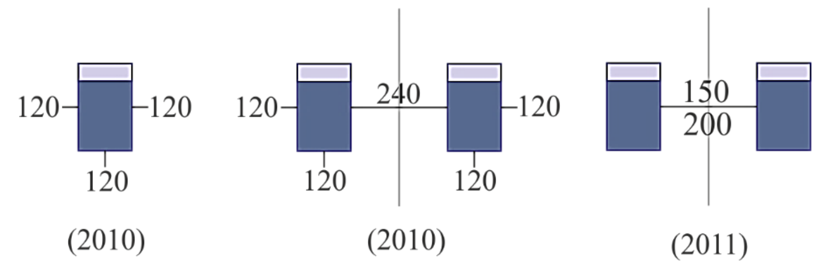
Standard	Room type	No. of patients per room	Minimum floor areas	Clearances: Acute care	Clearances: Intensive care
AHIA	Acute	1, 2, 4	1-bed room - 16 m^2 2-bed room - 27 m^2 1-bed bay - 12 m^2		
	Intensive	1	1-bed room - 14 m^2		
CSA	Acute	1, 2	1-bed room - 21.4 m^2 2-bed room - 37.4 m^2		
	Intensive	1, 2	1-bed room - 21.4 m^2 2-bed room - 37.4 m^2		
DH	Acute	1, 4	1-bed room - 19 m^2 4-bed room - 64 m^2		
	Intensive	1, 4	1-bed room - 19 m^2 4-bed room - 64 m^2		
FGI	Acute	1, multi	1-bed room - 11.15 m^2 cfa multi-bed room - 9.29 m^2 cfa per bed		
	Intensive	1	1-bed room - 18.58 m^2 cfa		
DVA	Acute	1	1-bed room - 26.01 m^2		
	Intensive	1	1-bed room - 27.87 m^2		
MH	Acute	1, 2	1-bed room - 15 m^2 (2010) 2-bed room - 18 m^2 (2010) 2-bed room - 32 m^2 (2012)		
	Intensive	1	1-bed room - 13 m^2 cfa (2010) 1-bed room - 12 m^2 cfa (2011) 1-bed room - 14 m^2 (2012)		

Table C.6. *Clinical support areas according to the AHIA standard (2018a, 2019a)*

	Acute care	**Intensive care, 14 beds**	**Intensive care, 56 beds (4 pods)**
Room/Space	**Qty × Net area**	**Qty × Net area**	**Qty × Net area**
Staff station	1 × 14 m^2 1 × 5 m^2	1 × 25m^2	4 × 25 m^2
Procedure room	1 × 14 m^2	-	-
Medication room	1 × 10 m^2	1 × 12 m^2	2 × 20 m^2
Interview room	1 × 9 m^2	-	-
Clean utility	1 × 14 m^2	1 × 30 m^2	2 × 60 m^2
Dirty utility	1 × 12 m^2	1 × 12 m^2	4 × 12 m^2
Cleaner's room	1 × 5 m^2	1 × 5 m^2	4 × 5 m^2
Storage - general	1 × 9 m^2	1 × 14 m^2	2 × 28 m^2
Storage - equipment	1 × 20 m^2	1 × 28 m^2	1 × 112 m^2
Storage - photocopy/stationary	1 × 8 m^2	1 × 5 m^2	2 × 8 m^2
Bay - beverage	1 × 4 m^2	1 × 4 m^2	2 × 4 m^2
Bay - meal trolley	1 × 4 m^2	1 × 4 m^2	2 × 4 m^2
Bay - flowers	1 × 2 m^2	-	-
Bay - handwashing	1 × 1 m^2	2 × 1 m^2	8 × 1 m^2
Bay - linen	1 × 2 m^2	1 × 2 m^2	4 × 2 m^2
Bay - mobile equipment	1 × 4 m^2	3 × 4 m^2	12 × 4 m^2
Bay - resuscitation	1 × 1.5 m^2	1 × 1.5 m^2	4 × 1.5 m^2
Bay - pneumatic tube	-	1 × 1 m^2	1 × 1 m^2
Bay - pathology	-	1 × 3 m^2	4 × 3 m^2
Bay - blanket/fluid warming	-	1 × 1 m^2	2 × 1 m^2
Disposal room	1 × 10 m^2	1 × 8 m^2	1 × 20 m^2
Office - clinical workroom	1 × 15 m^2	1 × 12 m^2	1 × 20 m^2

If a pneumatic tube system to distribute pharmaceutical and/or pathological drugs is planned, early planning would ensure that it is situated in the central staff station zone (AHIA, 2019a).

According to the standard (AHIA, 2018a), clinical and associated waste management is a major issue for inpatient care services. Early in the project, project staff should evaluate the waste requirements, define the needs for waste-keeping, and ensure proper allocation of space for dirty utility and disposal rooms (AHIA, 2018a). Dirty utility and disposal rooms need to be located to ensure that staff do not have to cross public and administrative areas while transporting goods to and from these rooms (AHIA, 2018a). Moreover, the standard (AHIA, 2018a) states that the number of procedure rooms may depend on the number of single bedrooms. However, there is usually no need for a dedicated procedure room in intensive care inpatient services to minimize patient movement (AHIA, 2019a). In order to reduce errors, the location and configuration of the medication room must minimize travel distances, noise, and disturbances of medication-related activities by staff (AHIA, 2018a). A medication room includes:

- lockable medication trolleys and bedside lockers,
- webster-pak or other similar proprietary system, and
- automated dispensing systems (AHIA, 2018a).

According to the CSA standard (2016) of Canada, clinical support areas of inpatient care services are composed of:

- reception/control desk,
- staff workstation,
- staff workroom,
- medication room,
- clean and dirty utility rooms,
- tub room,
- assisted bathroom,

- outdoor space, and
- storage.

The standard (CSA, 2016) states that the reception desk is to be located at the entrance of the service to enable staff to monitor access and provide information to visitors and staff. Staff workrooms offer workspace for nurses, allied health professionals, clinicians, and clerical staff and should be equipped with a tack board, a white board, and a TV and multi-media player (CSA, 2016). Medication rooms should be secured with access restricted to clinical and pharmacy staff and should have a scientific refrigerator/freezer, a safe for narcotics, and a hand hygiene sink (CSA, 2016). Clean and dirty utility rooms should be separated and may be centralized or decentralized based on service design and in consideration of staff travel distances (CSA, 2016). The design should provide direct access from the service corridor to the patient areas served (CSA, 2016).

According to the standard (CSA, 2016), unless each patient room is provided with a bathroom, at least one standard tub room for every twelve beds should be provided for general use. Each bathtub or shower should be in an individual room or enclosure that provides privacy for bathing, drying, and dressing and should include a shelf and hook for patient supplies (CSA, 2016). Assisted bathrooms should have a minimum width of 3500 mm and a minimum of 1800 mm and 1200 clearance at the two sides for staff movement around a stretcher (CSA, 2016). In storage planning, the provision of regularly spaced storage for clean and soiled equipment and for ease of access and improved operating efficiency should be considered (CSA, 2016). If an outdoor space is planned, a safe enclosure should be provided to prevent wandering away from the service (CSA, 2016). Moreover, to enhance its use, consideration should be given to locating the outdoor space adjacent to the indoor common activity/therapy space (CSA, 2016).

In the DH standard (2013b) of the United Kingdom, clinical support areas of inpatient care services are explained in detail and given as a table (Table C.7.). The reception

Table C.7. *Clinical support areas according to the DH standard (2013b)*

	24-bed ward, 50% single-bed rooms	24-bed ward, 83% single-bed rooms	24-bed ward, 100% single-bed rooms
Room/Space	**Qty × Net area**	**Qty × Net area**	**Qty × Net area**
Reception	1 × 11 m^2	1 × 11 m^2	1 × 11 m^2
Interview room	1 × 8 m^2	1 × 8 m^2	1 × 8 m^2
Touchdown base	2 × 6 m^2	2 × 6 m^2	2 × 6 m^2
Treatment room	1 × 16 m^2	1 × 16 m^2	-
Ward pantry	1 × 12 m^2	1 × 12 m^2	1 × 12 m^2
Parking bay for resuscitation equipment	1 × 2 m^2	1 × 2 m^2	1 × 2 m^2
Parking bay for food trolley	1 × 2 m^2	1 × 2 m^2	1 × 2 m^2
Parking bay for mobile hoist	1 × 2 m^2	1 × 2 m^2	1 × 2 m^2
Medicine store/preparation room	1 × 8 m^2	1 × 8 m^2	1 × 8 m^2
Dirty utility room for bedpan processing	2 × 12 m^2	2 × 12 m^2	2 × 12 m^2
Cleaners' room	1 × 8 m^2	1 × 8 m^2	1 × 8 m^2
Bathroom: assisted	1 × 15 m^2	1 × 15 m^2	1 × 15 m^2
Clean supply room	1 × 8 m^2	1 × 8 m^2	1 × 8 m^2
Disposal hold	1 × 6 m^2	1 × 6 m^2	1 × 6 m^2
General storage	1 × 18 m^2	1 × 18 m^2	1 × 18 m^2

desk should be at the entrance to the ward in a prominent position (DH, 2013b). The desk needs to provide a workspace for a receptionist and another one to welcome visitors, relatives, and staff, and to carry out local clerical and administrative tasks (DH, 2013b). In addition to the workstations in the bedrooms, medical administration needs “touchdown” bases for additional working space close to patients (DH, 2013b). In inpatient services with multi-bed bays, a treatment room should be provided where clinical procedures can be carried out in private (DH, 2013b). However, in services composed of 100% single-bed patient rooms, the provision of a treatment room is optional (DH, 2013b). A medicine storage and preparation room is required for the storage and preparation of all medicines to be used in the service including controlled drugs, medicines requiring refrigeration, and consumables such as syringes and needles (DH, 2013b). A disposal hold room is needed for the temporary storage of all materials and equipment items that need to be collected for washing, reprocessing, or destruction, such as medical and non-clinical waste products and departmental sterile services items (DH, 2013b).

According to the FGI standard (2014) of the United States, clinical support areas of inpatient care services include the following:

- administrative center or nurse station,
- documentation area,
- examination room,
- nurse or supervisor office,
- multi-purpose room,
- handwashing stations,
- medication room,
- nourishment area or room,
- clean workroom and supply room,
- dirty workroom and supply room,
- equipment and supply storage, and
- environmental services room.

The administrative center or nurse station should include space for counters and handwashing stations and should provide a view of the patient while the patient is in bed (FGI, 2014). For medical meetings, education, training sessions, and consultation, at least one multi-purpose room for each service should be provided for staff, patients, and families (FGI, 2014). An examination room equipped with an examination light, storage for supplies, accommodations documentation, and space for a visitor's chair should be planned for each inpatient care service, but this room may be omitted if all patient rooms in the service are single-bedded (FGI, 2014). Each examination room should have a minimum clear floor area of 120 ft^2 (11.15 m^2) with a minimum clear dimension of 10 ft (3.05 m) (FGI, 2014). Additionally, there should be a minimum clearance of 3 ft (91.44 cm) on each side and at the foot of the examination table present in the room (FGI, 2014).

According to the standard (FGI, 2014), for each of four patient care areas, at least one handwashing station should be provided. Based on the arrangement of the services, handwashing stations should be evenly distributed and provide uniform distance from the two patient care areas farthest from a handwashing station (FGI, 2014). A medication room should be provided for preparing, dispensing, storing, and administering medications and it should be located outside of circulation paths, but under the visual control of the nursing staff, to reduce the potential for distraction and interruption (FGI, 2014). The room should contain a work counter, handwashing station, lockable refrigerator, lockable storage for controlled drugs, and sharps containers (FGI, 2014). Storage areas should have separate spaces for clean linen, general equipment, stretchers/wheelchairs, and emergency equipment (FGI, 2014).

According to the DVA standard (2011) of the United States, the following constitute the clinical support areas of inpatient care services:

- nurse station and nurse substation,
- nurse observation alcoves,
- telemetry alcove,

- medication rooms,
- nourishment stations,
- nurse and team workrooms,
- clean and dirty utility rooms,
- clean linen room,
- equipment and medical gas storage rooms,
- multi-purpose specialty storage rooms, and
- environmental management storage.

The standard (DVA, 2011) states that a central nurse station should be located next to the service's public entrance, optimally at the center of the service. This position serves three key functions: providing access control of the unit, providing surveillance of patient rooms for the surrounding rooms, and acting as a central location for all staff information and interaction (DVA, 2011). If telemetry monitoring and a pneumatic tube system are authorized in the service, those systems should be located at or adjacent to the central nurse station for ease of control (DVA, 2011) (Figure C.21.). As an alternative to the centrally located nurse station, especially for larger units of more than 24 beds, nurse sub-stations may be provided depending on unit size and configuration at locations that provide close visualization of patients (DVA, 2011). Nurse observation alcoves are required to observe patients directly by means of a glazed panel between the alcove and the patient bed for intensive care inpatient services and should be positioned outside the clear width of the circulation corridor (DVA, 2011).

According to the standard (CSA, 2011), in order to maximize convenience and minimize travel distance, regularly used clinical support areas such as medication and nourishment rooms should be located near the nurse station and/or sub-stations. A nurse workroom and a team workroom should be located centrally within the service (DVA, 2011). While the nurse workroom is ideal for nursing examination of the medical needs and charting of patients, the team workroom accommodates a multi-

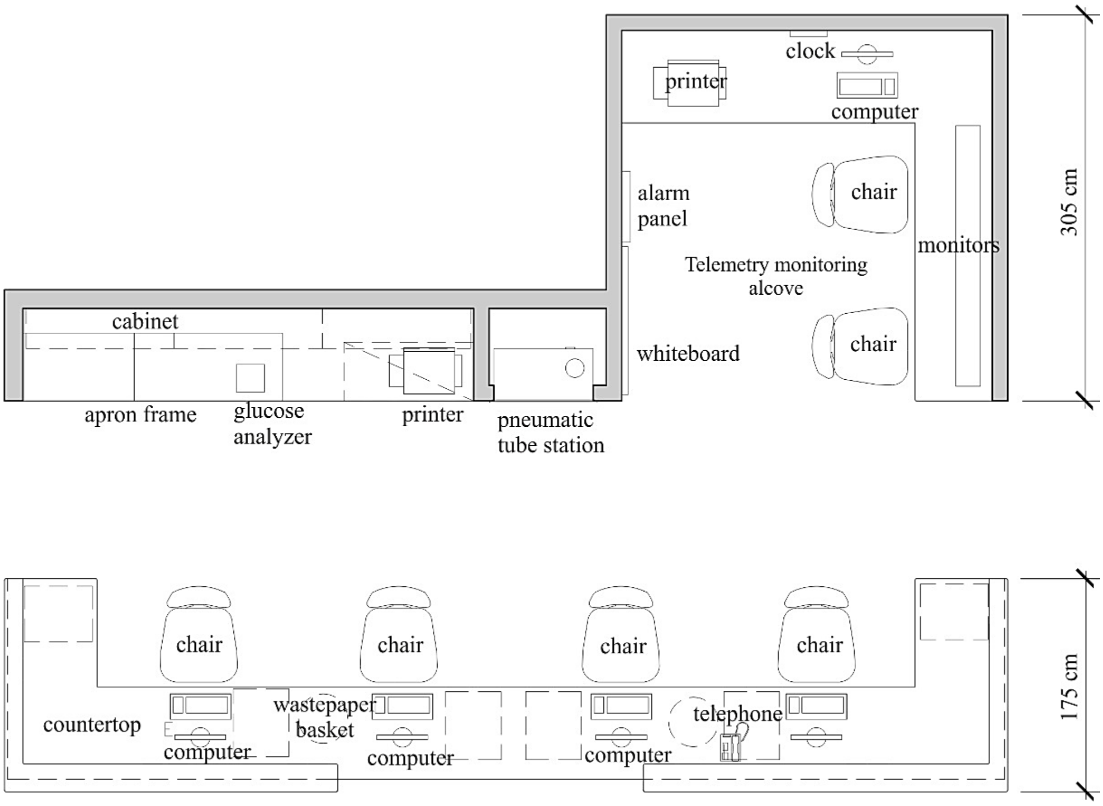


Figure C.21. Sample plan of a nurse station according to the DVA standard (2011)

disciplinary work area that can support a collaborative setting of doctors, pharmacists, residents, dietitians, and researchers (DVA, 2011). Other support areas such as clean utility room, dirty utility room, and clean linen room may be decentralized in larger inpatient services to provide staff with shorter travel distances (DVA, 2011). In order to keep the main circulation corridor of the service free of objects such as carts, wheelchairs, stretchers, and portable electronic or medical devices, storage spaces should be planned (DVA, 2011).

The MH standard (2011b) of Turkey indicates that appropriate and adequate clinical support areas should be ensured for healthy functional relationships within inpatient care services. There should be a material room, which is equipped with a counter, washbasin, foot-controlled trash can, and waste disposal, to remove wastes, temporarily store dirty materials and devices, and clean them if necessary (MH, 2011b). A sun-protected storage area should be provided away from patient zones for the materials and the necessary medicines used frequently for patient care (MH, 2011b). A separate medication preparation area should be planned for drugs and infusions that are not readily available from the pharmacy and must be prepared within the services (MH, 2011b). Additionally, there should be at least one antiseptic hand hygiene station at the entrance of the service, and one for every six beds in the patient zone (MH, 2011b).

In the standards examined within the scope of this thesis, clinical support areas of inpatient care services mainly comprise the nurse station and sub-stations (observation alcoves), medication and nourishment rooms, workrooms, examination rooms, and utility and storage rooms. There needs to be a main nurse station within each cluster, which is located centrally and ideally, in close proximity to the public entrance. Moreover, especially for intensive care services, nurse sub-stations or observation alcoves should be provided in terms of close visualization of patients. Medication and nourishment rooms, as highly used support areas, need to be located adjacent to nurse stations or sub-stations for ease of access and control. Additionally, an examination room is required to carry out clinical procedures in private. Other support spaces such as utility rooms including clean utility, dirty utility, clean linen, and disposal hold rooms could be decentralized to provide ready access to utility rooms and storages. Storage spaces are essential to keep service corridors clear of trolleys, wheelchairs, stretchers, and mobile electronic or clinical equipment.

C.5. Staff Areas

The AHIA standard (2018a, 2019a) of Australia states that the required staff areas mainly include offices, workstations, lounges, meeting rooms, toilets, changing rooms, and bedrooms for overnight stays, as listed in Table C.8. (AHIA, 2018a, 2019a). According to the standard (AHIA, 2019a), staff areas should be located in close proximity to patient care areas, while ensuring privacy from patient and public areas.

Table C.8. *Staff areas according to the AHIA standard (2018a, 2019a)*

	Acute care	**Intensive care, 14 beds**	**Intensive care, 56 beds (4 pods)**
Room/Space	**Qty × Net area**	**Qty × Net area**	**Qty × Net area**
Office - single person	1 × 9 m^2	1 × 9 m^2 1 × 12 m^2	1 × 9 m^2 1 × 12 m^2
Office - two persons, shared	1 × 12 m^2	-	-
Office - three persons, shared	1 × 15 m^2	-	-
Office - workstation (per person)	-	4.4 m^2 5.5 m^2	4.4 m^2 5.5 m^2
Staff lounge	1 × 15 m^2	1 × 18 m^2	1 × 60 m^2
Property bay	1 × 3 m^2	-	-
Staff toilet	2 × 3 m^2	2 × 3 m^2	6 × 3 m^2
Meeting room	1 × 18 m^2	1 × 15 m^2	1 × 15 m^2 1 × 20 m^2
Staff changing (female)	-	1 × 10 m^2	1 × 40 m^2
Staff changing (male)	-	1 × 8 m^2	1 × 32 m^2
Overnight stay - bedroom	-	1 × 10 m^2	1 × 10 m^2

A property bay with handbag-sized lockers must be available within acute care inpatient services for casual, part-time, and agency staff (AHIA, 2018a). Moreover, easy access to a shower or eyewash facility should be provided for emergency spills near the service (AHIA, 2018a). Although staff changing rooms are a necessity for intensive care inpatient services, those areas may be provided somewhere else in the healthcare facility for acute care inpatient services (AHIA, 2018a, 2019a).

According to the AHIA standard (2018a), a readily accessible staff lounge may be provided to be shared among all staff and students in the inpatient services; however, a small lounge with small beverage-making facilities should preferably be available for staff to have short breaks and private debriefings with their peers within each service. Additionally, meeting rooms should be designed to be used flexibly to undertake education and ongoing skills maintenance, and to accommodate the maximum number of staff and students using the space on a regular basis (AHIA, 2018a).

According to the CSA standard (2016) of Canada, there should be a conference or teaching room for multi-disciplinary staff education in inpatient care services. Moreover, a staff respite room, offices, and team room should be provided within the service (CSA, 2016).

In the DH standard (2013b) of the United Kingdom, staff areas of inpatient care services consist of:

- office/meeting room (1 × 16 m^2),
- staff locker bays (2 × 1.5 m^2),
- staff toilet (1 × 2 m^2),
- changing room (1 × 25.2 m^2),
- staff lounge (1 × 5.4 m^2), and
- seminar room (1 × 12 m^2).

According to the standard (DH, 2013b), the staff office or meeting room is a multi-purpose office used by clinical staff to take notes on patients, hold patient handover meetings, make telephone calls, and hold staff discussions, in which two computer workstations, a table, seats for eight to ten people, and a cupboard or shelves are provided. Locker bays are needed to hold small personal belongings of staff while on duty (DH, 2013b). Staff changing rooms and staff lounges may be shared among several wards by providing adequate space for full-time and part-time staff, including trainees and students (DH, 2013b).

In the FGI standard (2014) of the United States, the staff lounge, toilet, and staff storage and accommodation constitute the staff areas of inpatient care services. The staff lounge should have a minimum floor area of 100 ft^2 (9.29 m^2), should be located either in or adjacent to the service, and should have telephone or intercom and emergency code alarm connections (FGI, 2014). Staff toilets should be easily accessible to the staff lounge and each nursing unit (FGI, 2014). Staff storage consisting of securable closets or cabinet compartments for personal articles should be located in or near the nurse stations (FGI, 2014). Staff accommodations are used for sleeping and rest during 24-hour on-call work schedules. The rooms should have a bed, a chair, individually secured storage for personal items, a communication system, and a bathroom (FGI, 2014).

According to the DVA standard (2011) of the United States, staff areas of inpatient care services include:

- offices for physicians and assistants, nurse leaders, social workers, dieticians, clinical pharmacists, clinical researchers, and consultants,
- cubicles for unit administrators, interns, residents, and fellows,
- recycling room,
- staff lounge,
- staff locker rooms,
- staff toilet,
- on-call rooms (for intensive care inpatient services),
- conference/classroom, and
- library.

The standard (DVA, 2011) states that while offices for the nurse manager and supervisor should be located at the center of the service, other office areas should be in close proximity but outside of the service to minimize unrelated traffic within the ward and to allow those administrative spaces to be shared with other inpatient services. Staff locker rooms and lounges should be separate, and lounges should be located outside of wards to reduce noise levels and ensure staff respite from activity in the service (DVA, 2011). On-call rooms and education areas are to be shared with adjacent inpatient services with similar clinical programs (DVA, 2011).

In the MH regulations (2011b), it is stated that appropriate and adequate numbers of staff lounges and changing areas should be provided within inpatient care services. However, if there is a general changing room for all personnel within the healthcare facility, it is not obligatory to arrange a separate room within the service (MH, 2011b).

In the standards examined within the scope of this thesis, offices, staff amenities (lounge, changing room, toilets, etc.), and educational rooms are commonly referred to as the staff support areas of inpatient care services. Offices, lounges, and educational rooms could be nearby but outside of the patient wards to lower the circulation and noise within the service and to provide healthy resting areas. Moreover, especially for intensive care inpatient services, on-call rooms, in which a resting area and a bathroom are provided, should be considered.

C.6. Patient and Public Areas

According to the AHIA standard (2018a, 2019a) of Australia, there should be a reception area in every inpatient care service to control the movements of patients, visitors, and staff entering or leaving the service. The standard (AHIA, 2019a) states that intensive care inpatient services particularly require waiting rooms in relation to a reception area where visitors have access to toilets, beverage bays, a children's play area, and interview rooms. In addition to the waiting room in the entrance area, there should be a patient and family lounge located closer to the interior of the service (AHIA, 2018a, 2019a). Patient and family lounges should have facilities for family members to rest and shower, as well as access to healthy food options and drinks at all hours of the day. The patient and public areas described in the standard (AHIA, 2018a, 2019a) are listed in Table C.9.

The CSA standard (2016) of Canada states that security measures of healthcare facilities should be designed to prevent the public from having free access to the building. However, at the same time, patients' families should feel welcome and could be accommodated by family lounges if necessary (CSA, 2016). Areas for family, friends, and visitors should provide a relaxing atmosphere while offering

Table C.9. *Patient and public areas according to the AHIA standard (2018a, 2019a)*

	Acute care	**Intensive care, 14 beds**	**Intensive care, 56 beds (4 pods)**
Room/Space	**Qty × Net area**	**Qty × Net area**	**Qty × Net area**
Reception	no area information	1 × 10 m^2	1 × 12 m^2
Waiting	-	1 × 15 m^2	1 × 40 m^2
Play area - pediatric	-	1 × 10 m^2	1 × 10 m^2
Patient/family lounge	1 × 20 m^2	2 × 14 m^2	3 × 14 m^2
Public toilet	1 × 3 m^2	1 × 3 m^2	1 × 3 m^2
Public toilet - accessible	1 × 6 m^2	1 × 6 m^2	1 × 6 m^2
Water dispenser bay	no area information	1 × 1 m^2	1 × 1 m^2
Beverage bay	no area information	-	1 × 4 m^2

additional rooms and facilities to meet the needs of residents staying in the area for extended periods of time (CSA, 2016).

The DH standard (2013b) of the United Kingdom notes that there should be a waiting area near the reception desk within inpatient care services, which may also serve as day room space for patients. Additionally, public toilets, a nappy changing room, and a vending machine should be provided adjacent to and accessible from the waiting area (DH, 2013b). In terms of unsealed-source brachytherapy inpatient services, for radiation control, visitors of patients cannot be accepted for face-to-face meetings (DH, 2013a). Thus, those visitors could communicate with patients via CCTV connections (DH, 2013a). Therefore, a private room for that purpose should be provided adjacent to the waiting area (DH, 2013a).

In the FGI standard (2014) of the United States, the patient and public areas of inpatient care services consist of (1) a family and visitor lounge, (2) a toilet room, (3) a place for meditation and prayer, and (4) patient play areas for pediatric units. Family and visitor lounges should be sized according to the number of beds served and should have seating capacity for a minimum of 1.5 persons per patient bed (FGI, 2014). The lounge may be shared with more than one inpatient care service, but it should be located on the same floor as the services, and it should be readily accessible from each of them (FGI, 2014). The toilet room and room for meditation and prayer should be readily accessible from the family and visitor lounge (FGI, 2014).

According to the DVA standard (2011) of the United States, the patient and public areas of inpatient care services include the following:

- waiting,
- family lounge/pantry,
- public toilets, and
- patient education/resource kiosk.

The standard (DVA, 2011) states that patient and public areas should be located near the main public entry but outside the main patient care zone. Nursing staff should have clear visualization of those spaces to control access to the service (DVA, 2011). The family lounge and pantry should be planned as a set of functionally connected spaces including food storage, food preparation, and dishwashing; access to media and Internet sites, TV, and telephones; and areas for family and visitor education about service-related issues (DVA, 2011). The patient education and resource kiosk should provide access to information about the specific illnesses of patients and should accommodate patients and family members in a visually and acoustically private setting (DVA, 2011).

The regulation of the MH (2011b) states that a suitable space for debriefing, interviewing, and waiting should be arranged in the vicinity of inpatient care services.

In the standards examined within the scope of this thesis, waiting rooms, family lounges, public toilets, and educational areas are commonly considered as patient and public areas of inpatient care services. There should be a public entry for inpatient care services, which will direct patients to a main reception desk and a waiting area. The reception desk meets visitors and controls access to patient rooms. The waiting area needs to be designed with beverage opportunities and toilet facilities. Consulting and patient education rooms should be provided and located in relation to the waiting area while ensuring visual and acoustic privacy. Moreover, it is recommended that amenities such as opportunities for food storage, food preparation, dishwashing, and TV and internet connections be provided within family lounges.

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name	: Cankurtaran, İlkay
Nationality	: Turkish (TC)
Date and Place of Birth	: 3 December 1987, Şanlıurfa
Phone	: +90 535 505 18 09
E-mail	: ilkaycankurtaran@gmail.com.tr

EDUCATION

Degree	**Institution**	**Year of Graduation**
MS	METU Building Science, Ankara	2012
BArch	METU Architecture, Ankara (3rd rank in Department of Architecture)	2010
High School	Güzelbahçe 60.Yıl Anadolu Lisesi, İzmir	2006

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2014-Present	Ministry of Health, Ankara	Health Specialist
2013-2014	Ministry of Environment and Urbanization, Ankara	Architect

FOREIGN LANGUAGES

Advanced English

PUBLICATIONS

1. Cankurtaran, İ. (2018). *Kanser Tedavi Birimlerinin Mimari Tasarımına İlişkin Dünya Standartlarının İncelenmesi ve Analizi* (Unpublished report). Ministry of Health, Ankara.

2. Güryay, İ. (2014). New York Times Tower. A book section in *Tall Buildings: Structural Systems and Aerodynamic Form* (pp. 125-129). New York: Taylor & Francis Group.

3. Güryay, İ. (2012) *Sustainability of High-Rise Buildings: Energy Consumption by Service Core Configuration* (Master's thesis). Middle East Technical University, Ankara.

HOBBIES

Travelling, Running, Violin, Books, Movies