

EVIDENCE-BASED PRACTICES: THE CASE OF UCC IN SKOPJE

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ABSTRACT

The challenges inherent in designing healthcare facilities stem from the dynamic and complex nature of healthcare itself, coupled with the increasing responsibility to enhance the patient experience, improve population health, reduce costs, and create better working conditions for staff. National healthcare systems, global planning, and design practices are increasingly inclined towards evidence-based practice (EBP) (Peavey and Vander, 2017; Halawa et al., 2020), particularly characterized by evidence-based design (EBD). Evidence-based practice involves systematically gathering scientific evidence to inform decision-making (Robinson et al., 2020), where evidence-based research methods are emerging as a unifying paradigm across various healthcare disciplines, shifting decision-making away from anecdotal evidence towards more reliable sources derived from controlled trials (Peavey and Vander, 2017). This research explores the evidence-based processes and their methods that improve healthcare operations within clinical facilities.

The study will identify deficiencies in the methodological research approaches used in healthcare facility complexes, such as the University Clinical Center of Skopje (UCCS). It will address the Center's essential needs for enhancing accessibility, efficiency, and patient experience. Furthermore, the main issues at the University Clinical Center in Skopje can be approached through EBP, providing a systematic and valid method of addressing key questions in an efficient and accessible manner.

KEYWORDS _ *EBP, EBD, research methods, health care, UCCS*

INTRODUCTION

This research addresses the lack of a methodological approach while planning the development of the University Clinical Center in Skopje (UCCS). It provides an exploratory study on Evidence-Based Practice (EBP) and Evidence-Based Design (EBD), as well as their implementation in healthcare systems, planning, and design practices. While there is a governmental strategic framework for managing health services and the economic development of the University Clinical Center in Macedonia, the architectural approach lacks thorough research. Such research is crucial for promoting social inclusiveness, enhancing patient well-being, and improving design practices.

In Yugoslavia, healthcare planning was shaped by demographic characteristics, types of health conditions, geographical locations, infrastructure, and the overall health status of the population. During the 1960s, concerns arose regarding the state of the hospital fund, which included hospital beds, medical facilities, technical equipment, and services (Kliska, 1965). As investments increased, new buildings were added to the Clinical Center in Skopje to support healthcare plans and strategies. Many of these new facilities involved adapting, extending, and upgrading existing clinical hospitals.

Following Yugoslavia break, and the establishment of independence of Macedonia, several healthcare strategies were developed. These strategies focused on improving accessibility, quality, and effectiveness of healthcare, particularly through a renovation plan for the UCCS. A financial reconstruction program was also planned and partially implemented within the clinical hospitals of the UCCS (Ministry of Health, 2021-2030).

These strategies highlight multiple factors influencing the construction of new hospital buildings. Clinical hospitals are expected to meet spatial requirements and patient needs while adhering to economic constraints. However, achieving these goals is challenging due to the limitations of existing facilities and funding options. Issues arise from the activities and spatial organization of clinical hospitals, as well as systemic and temporal transformations, impacting the internal dynamic processes that, in turn, affect healthcare delivery. Therefore, a methodological approach is needed in dealing with the influential factors, and a systematic approach while considering new architectural designs.

The design of clinical hospitals significantly impacts the processes that ultimately highlight shortcomings in health system management. Evidence-Based Practices (EBP) employs various methods to assess how architectural planning affects functionality and numerous performance metrics, including walking paths and distances, spatial flow, length of stay, safety, duration of clinical services, and quality of care. Evidence-Based Design (EBD) offers guidelines for the design of healthcare facilities (Halawa et al., 2020).

This study is organized into three chapters, each focusing on the case study and Evidence-Based Practices (EBP). The first chapter provides a literature review of theories related to EBP and EBD. The second chapter discusses the methodology, detailing the approaches and methods used in this research. It includes an overview of the case studies conducted at two clinics in the UCCS. The third chapter presents the results, summarizing the analysed data on patient and spatial relationships using Space Syntax Theory. This graph method facilitates a comparative analysis of architectural layouts and the permeability of circulation processes, emphasizing key values such as connectivity, depth, and integration. The concluding sections consist of the conclusion and final observations.

LITERATURE REVIEW

Evidence-Based Practice (EBP) is a systematic approach to inform decision-making using scientific evidence (Robinson et al., 2020). EBP is emerging as a unifying paradigm across many health care disciplines, moving away from anecdotal decision-making and toward more reliable evidence from controlled trials (Peavey and Vander, 2017).

The term “evidence-based” first emerged in the early 1990s, specifically in the context of Evidence-Based Medicine (EBM). EBM is defined as “the most conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. (Sackett et al., 1996, p.71).

Evidence-Based Design (EBD) is part of the Evidence-Based Practice and encompasses many disciplines, including architecture. EBD draws on disciplines that have been established over the past 60 years, such as environmental psychology, which studies the impact of the environment and physical context on the way people think, feel, and behave. EBD has become increasingly popular with the study of Ulrich (1984), which showed the impact of a patient’s view out of a window on their recovery after surgery. The first definition of EBD was recognized by Hamilton in his paper “The four levels of evidence-based practice” in 2003. Hamilton (2003) will emphasize for EBD: “the deliberate attempt to base design decisions on the best available research evidence” and that “an evidence-based designer, together with an informed client, makes decisions based on the best available information from research and project evaluations.”(Peavey and Vander, 2017, p.4).

Wagenaar (2006) explores the concept of Evidence-Based Design (EBD), which refers to the process of designing a building or environment based on scientific research to achieve optimal outcomes. He examines architecture as a historical discipline that is culturally rich and interprets hospital buildings as structures serving specific sociological functions. Wagenaar (2018) emphasizes the potential of EBD, questioning whether it can inspire new perspectives on creating buildings that better accommodate our needs than previously thought possible. While EBD certainly aids in the design of more comfortable environments, it does not reduce inhabitants to passive recipients of their surroundings. On the contrary, Evidence-Based Design aims to empower the patient, rather than merely focusing on the building itself (Wagenaar, 2018, p. 37).

Rosalyn Cama (2009) will point out that EBD is not a new approach; in fact, it is quite a common practice in academia, but very rarely applied in professional practice. The issue lies in the fact that design considerations related to the built environment are rarely integrated into healthcare organizational structures. Gaining knowledge in design through evidence requires specific skills, techniques, and measurable outcomes. This approach not only supports the education of future architects but also embodies rigor, integrity, and critical thinking. Cama (2009) notes that EBD “does not provide a solution, but rather a platform from which to add to the existing knowledge base or initiate innovation” (Cama, 2009, p. 7).

The studies that involve EBP and EBD are categorized based on methodology, area of focus, typology, and the measurability of the results obtained. Evidence-Based Design (EBD) research predominantly involves observations, surveys, in-use research, analyses based on space-syntax theory, or retrospective studies. There is a noticeable lack of studies focusing on architectural design optimization frameworks, healthcare design modelling, artificial intelligence applications, and the conditions and quality of architectural design. These aspects of research and operations management are crucial as they inform the design process of healthcare facilities from the earliest stages and facilitate the measurement of facility performance in quantitative terms. Unfortunately, these methodologies are currently underutilized in architectural practice (Halawa et al., 2020).

METHODOLOGY

Literature review on methodology

Research related to Evidence-Based Design (EBD) practices mainly utilizes methods such as surveys, observations, and literature reviews. In contrast, the application of simulation modelling, machine learning, and optimization techniques is relatively limited. However, analyses using the theory of Space Syntax are employed more widely (Halawa et al., 2020).

EBD, through the theory of Space Syntax, has been applied in several studies to interpret findings

obtained from research. Some studies focus on empirical research to quantify the environment as a set of predictive variables that influence the behaviours of medical staff, patients, and visitors (Haq, 2012).

Furthermore, Morgareidge and colleagues (2014) employed Space Syntax to determine the optimal location and reorganization of the existing emergency department within the hospital complex at Yuma Regional Medical Center, aiming to enhance its operational efficiency. The application of Space Syntax is centred on calculating visibility or coordinating care through improved accessibility. This research highlights visibility and connectivity as crucial factors influencing user movement, communication, and the overall performance of the facility (Morgareidge et al., 2014).

Overall, Space Syntax is increasingly being used to study healthcare facilities, making it an important method for researchers and architects in the design process (Haq, 2012).

Case study – University Clinical Center Skopje

The University Clinical Center in Skopje (UCCS) is a complex hospital network that is continuously developing. It serves as both a consultative and inpatient facility, integrating education and scientific research into its operations. The clinical hospitals within the center are its fundamental units and provide health services across various domains. Each clinic is equipped with diagnostic capabilities and patient treatment services, which help establish the clinical pathways for patient care (Health Care Law, 2016).

UCCS is characterized as a dispersed model of clinical hospitals. Over the past 40 years, the University Clinical Center has undergone constant upgrades to meet healthcare demands, with significant construction projects occurring since the late 1960s through the 1970s and 1980s. Any expansion of the clinics is driven by the need for educational institutions, and additional spaces for learning and practice. This growth increases construction density in the area and directly impacts the internal infrastructure of the center.

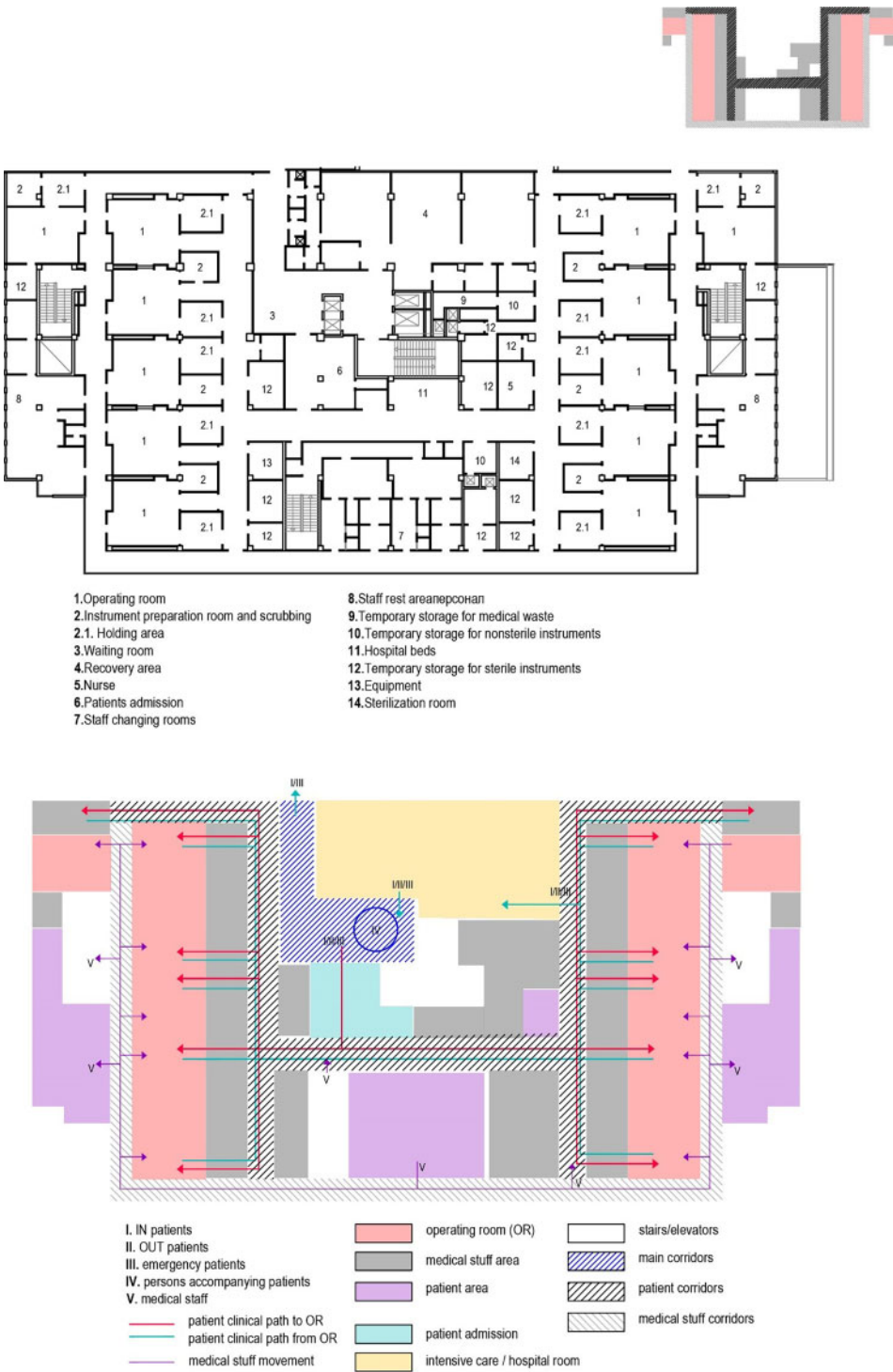
This case study focuses on two clinics at UCCS: the expanded Surgical Clinic (SC) built in 1980 (Figure 1) and the new Cardiovascular Surgery Clinic (CSC) built in 2015 (Figure 2).



Figure 1: Surgical Clinics (SC) – UCCS, Source: author; **Figure 2:** Cardiology Surgical Clinic (CSC) – UCCS, Source: author

Surgical blocks – SC and CSC

In clinics, the surgical block functions as a medical work area dedicated to performing surgeries. Its primary purpose is to facilitate interventional treatments under aseptic conditions, while remaining isolated from other hospital activities. Communication and waiting areas, along with patient preparation and anaesthesia zones, should be designed to help reduce patient anxiety. Efforts to



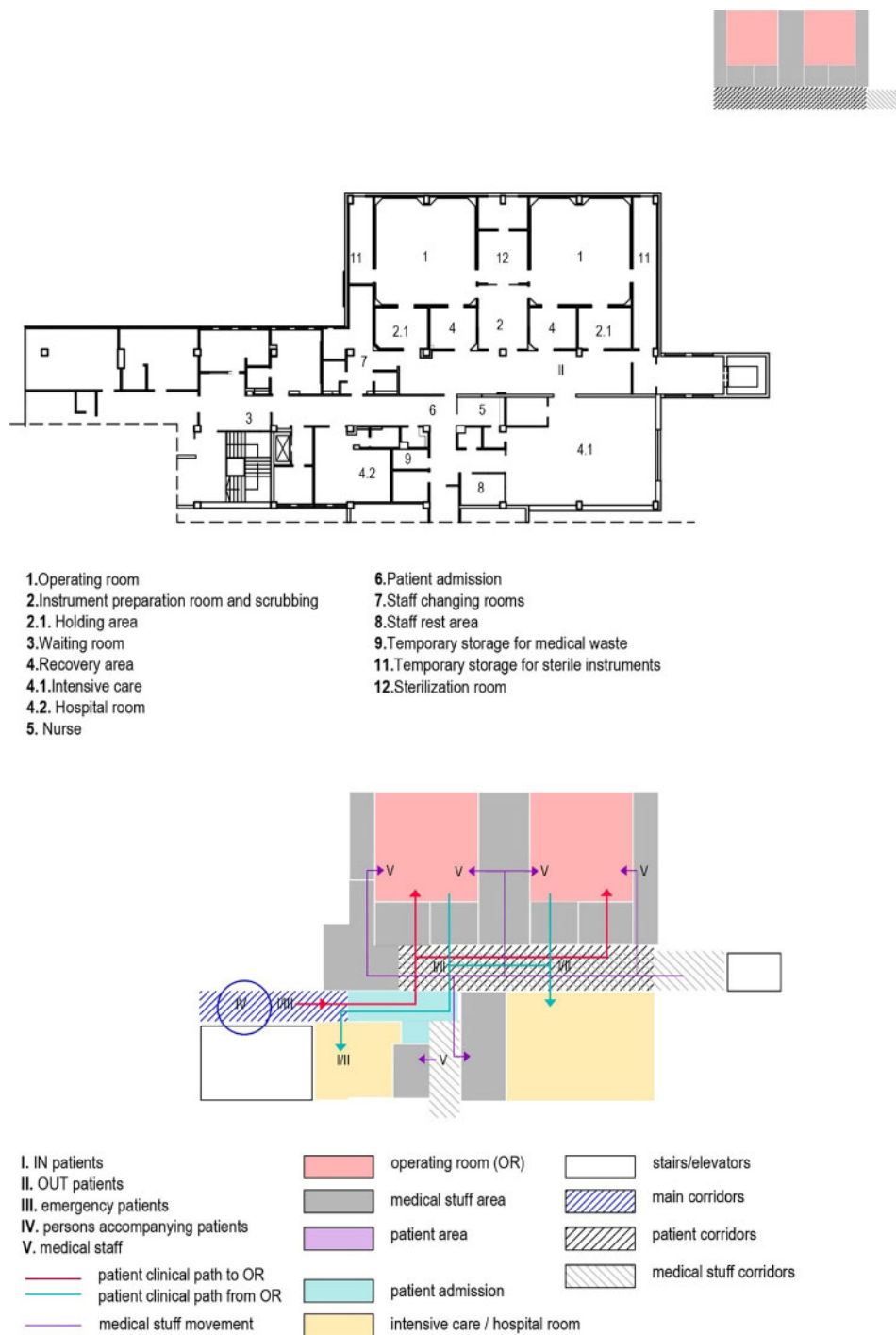


Figure 4: Architectural layout, circulation diagram and characteristic typology of surgical block – Cardiology Surgical Clinics (CSC) – UCCS. Source: authors

maintain hygiene focus on minimizing the risk of cross-contamination between surfaces and rooms (Wagenaar et al., 2018). Additionally, the connections between the surgical block and other departments should be as direct as possible. Short and efficient pathways within the surgical block can enhance the psychological well-being of patients before and after surgical interventions, as well as benefit the medical staff (Wagenaar et al., 2018; Vodicka, 1994).

Surgical Clinics (SC)

The surgical block of the Surgical Clinics (SC) is designed in a double-corridor layout, resembling the Latin letter “U” (Figure 3). This design typically results in longer distances for both patients and medical staff but allows for a more compact arrangement.

Cardiology Surgical Clinic (CSC)

The operating room within the Cardiology Surgical Clinic (CSC) is located on the second floor and follows a single-corridor layout (Figure 4). This design usually results in longer distances and potential cross paths for patients and medical staff.

Graphic method – Space Syntax Theory

Hospitals are complex structures governed by formalized rules that outline their spatial and programmatic requirements, placing these elements in a fixed arrangement within the architectural layout. In contrast, the dynamic aspect of Space Syntax involves the permeability of healthcare workflows, which adds social meaning to the space. This dynamic element reflects the spatial relationships within clinical settings, which depend on several factors, including distance, time, organization, and the types of users (Wurzer, 2013). The movement patterns of patients, as well as those of employees and visitors, provide crucial insights for developing functional spaces (Pramanik et al., 2015).

Space Syntax Theory introduces a shift in how we understand architecture by moving away from “dimensional” thinking and embracing “relational” reasoning. This theory analyses the spatial configurations of architectural layouts in isolation from their context and form, focusing instead on spatial relationships and user flow (Hillier and Hanson, 1989; Hillier, 1995; Hanson, 1998).

To facilitate this analysis, a graphical method is employed, consisting of various tools and techniques that enhance our comprehension of architectural configurations. This method allows for the evaluation of spatial configurations through topological graphs, which can be mathematically analysed or interpreted in relation to their architectural, urban, social, or spatial characteristics (Ostwald, 2011).

RESULTS

The graphic method represents a diagram that illustrates the spatial relations between users of the surgical blocks of the clinics. The purpose of the analyses is to interpretate the significance of the spatial organization, not only by examining the architectural layout’s physical characteristics, but also by analysing the diagrams of the social patterns and their flow within the space. To validate this method, comparisons will be made to identify similarities and differences between the established relational diagrams and the observable spatial organization of the architectural layout. The graphs generated through the graphic method are analysed with mathematical support (Ostwald, 2011). Two case studies of clinical hospitals are considered, focusing specifically on the surgical blocks. Each of these blocks adheres to the recommended standards for organizing medical rooms within the surgical block and exhibits similar organizational configurations in its architectural layouts.

The diagrammatic analysis begins with the architectural plans of the operating blocks in two surgical clinics, SC and CSC. These plans illustrate the relative types, sizes, locations, and orientations of the

rooms within the facilities. The architectural layout is then simplified into a “convex map” (Figure 5, 6) that reflects the configurations of selected features from the plan. This map highlights the basic program units and their connections, emphasizing the relationships between them. From this, we derive a preliminary graph of the spatial-program relations, represented as nodes and lines. In this context, the nodes signify spaces with their own specific functions, while the lines illustrate the connections between the rooms. In the case of the surgical blocks, we further analyse the spatial-program relations, which detail the patient’s pathway from the moment of admission, through preparation, surgery, awakening, and intensive care, ultimately leading to their transfer to the inpatient ward.

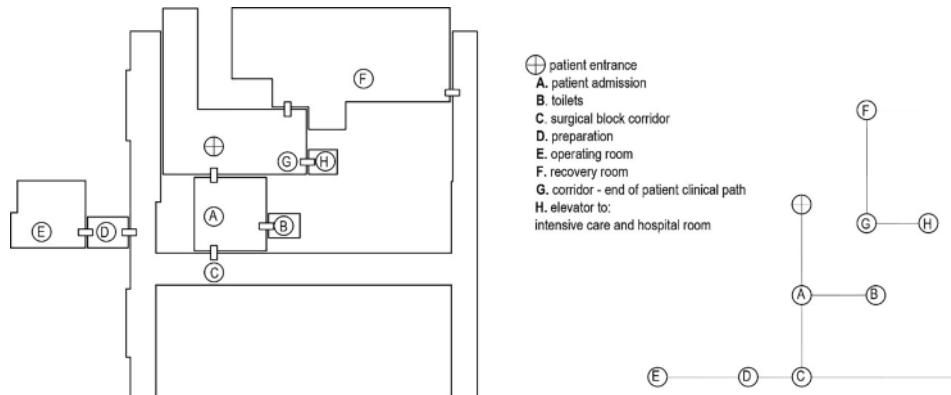


Figure 5: Convex map and preliminary graph – patient movement in Surgical Clinics (SC) -UCCS

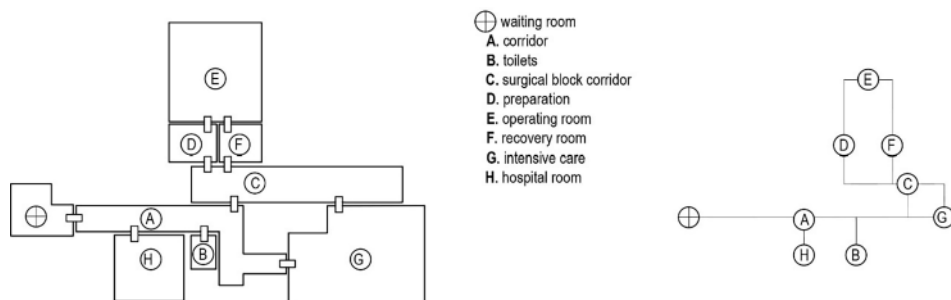


Figure 6: Convex map and preliminary graph – patient movement in Cardiology Surgical Clinics (CSC) -UCCS

Additionally, a graph of the graphic method is presented, separate from the spatial organization in the architectural layout. In this case, the length of the lines is not significant; instead, the diagram is organized by step depth, with a designated starting point that indicates the main carrier of the sequence (Figure 7,8). This starting point is positioned at the bottom of the diagram, from which the main carrier extends, illustrating the connections between the rooms. The horizontal dashed lines denote boundaries marked with depth levels ranging from 0 to 5 (7). The diagram is interpreted through the concepts of symmetry, asymmetry, distributivity, and non-distributivity (Hillier and Hanson, 1989), which allow for an analysis of the relation within the spatial configurations.

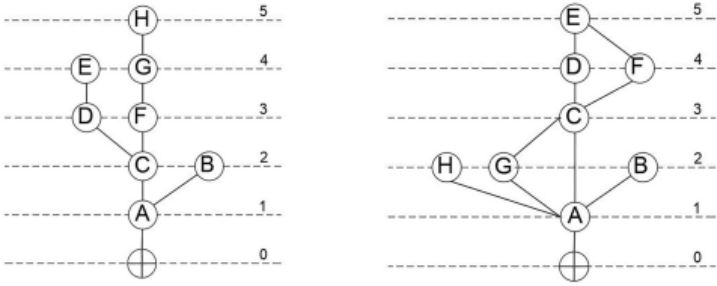


Figure 7: Graph – patients – SC, UCCS, Source: authors; **Figure 8:** Graph – patient – CSC, UCCS, Source: authors

The provided tabular data details the mean depth, relative asymmetry, and level of integration, illustrating the connectivity of spaces within the patient’s clinical path (Table 1 and 2).

Table 1. Distance data table for the surgical block of Surgical Clinics (SC)

Exterior carrier		
space	attributes	value
Surgical Clinics (SC) – surgical block	K – number of nodes	9
	MD – mean depth	3
	RA – relative asymmetry	0.571
	i-integration	1.75

Table 2. Distance data table for the surgical block of Cardiology Surgical Clinic (CSC)

Exterior carrier		
space	attributes	value
Cardiology Surgical Clinic (CSC) – surgical block	K – number of nodes	9
	MD – mean depth	2.875
	RA – relative asymmetry	0.536
	i-integration	1.865

Moreover, the surgical block of Surgical Clinics (SC) is characterized by a linear but also asymmetrical spatial configuration, which implies the need to traverse different nodes along a fixed path in order to gain access to the deepest parts of the interior, which also suggests a lack of spatial consistency and flow. The surgical block in Cardiology Surgical Clinic (CSC) is characterized by a spatial configuration that is relatively symmetrical or evenly distributed from the diagrammatic carrier, which also implies the presence of defined zones or a greater hierarchy in the control system.

CONCLUSION

This study employs practices and methods that prioritize sufficiency over perfection, focusing on immediate goals. In this case, Evidence-Based Practices (EBP) through Evidence-Based Design (EBD) offer a comprehensive examination of the space syntax of architectural plans and represent an iterative decision-making process that starts with the analysis of current data. This approach provides both qualitative and quantitative data on existing practices in healthcare facilities, serving as a platform for further knowledge and information.

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