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ÇİĞDEM ÇAĞNAN

AN EXPLORATION OF PHYSICAL PROPERTIES
FOR WAYFINDING WITHIN TRANSITIONAL SPACES
EMERGENCY DEPARTMENTS IN THE UNITED ARAB EMIRATES

PRELIMINARY COMMUNICATION
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TABLE I CONCRETE MODEL FOR WAYFINDING TRANSITIONAL SPACES FOR EMERGENCY DEPARTMENTS

Identification of the Entrance and Exit



Entrance – Features:
 (A) A recess
 (B) A canopy
 (C) A red sign carrying the name
 (D) An asymmetrical façade in shape



Exit – Features:
 (A) A recess
 (B) A canopy
 (C) A green sign indicates the Exit
 (D) An asymmetrical façade in material

Well definition by interior features for the pathway



Pathway – Features:
 (A) Two parallel, continuous, long walls
 (B) Repetitive (light, handrail)
 (C) Contrast in the tone of the floor

Create a visual character landmark and differentiation of space for a distinct identity through interior design



Pathway 1
 Landmark: Sided o'clock
 Interior design: Medium grey colour scheme

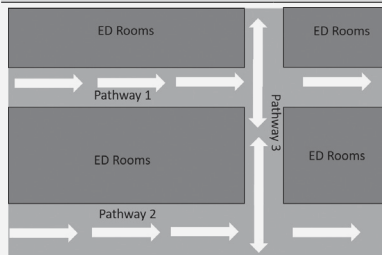


Pathway 2
 Landmark: Furniture setting
 Interior design: Light grey colour scheme



Pathway 3
 Landmark: Wall Art
 Interior design: Dark grey colour scheme

Easy navigation within circulation routes



Layout Design – Features:
 (A) Straight movement pattern,
 (B) Linear spatial design

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AN EXPLORATION OF PHYSICAL PROPERTIES FOR WAYFINDING WITHIN TRANSITIONAL SPACES EMERGENCY DEPARTMENTS IN THE UNITED ARAB EMIRATES

EMERGENCY DEPARTMENT
HOSPITAL
PHYSICAL PROPERTIES
TRANSITIONAL SPACE
WAYFINDING

Wayfinding has only recently gained significance in the architecture of medical facilities. While several studies have examined hospital architecture, few have focused on wayfinding within emergency departments in the UAE. This study investigates the influence of transitional spaces and their physical properties on wayfinding. The Wayfinding Transitional Spaces Matrix (WTS-M), derived from the 2023 International Health Facility Guidelines, was utilized in a mixed-method approach. The regulations provide criteria from an architectural standpoint. This research examined five physical properties:

entrances and exits, pathways, landmarks, circulation routes, and interior design. The paper assessed three emergency departments in hospitals across the UAE, employing binary coding ($\sqrt{=1}$, $\times=0$) to evaluate each aspect. The data was converted into percentages for comparative analysis. Landmarks were absent in any of the cases; in contrast, circulation routes were seen at a rate of 100%. The presence of other features differed. The conclusion provides a preliminary measure to define localized criteria that can improve the overall wayfinding experience in medical buildings in the UAE.

INTRODUCTION

Wayfinding is the process of determining one's current location and navigating to a desired destination with optimum effectiveness and effortlessly (Fewings, 2001; Brunyé *et al.*, 2010). The design of a built environment is essential to wayfinding. An effectively built environment facilitates understanding and aids people in navigation, hence preserving their sense of direction and orientation (Farr *et al.*, 2012). Medical facilities, particularly hospitals, play a significant role in humanity. Hospital architecture is fundamentally a "basic" form of architecture, as it not only facilitates care and treatment but also fulfils essential architectural functions, including shelter, habitation, and aesthetic enjoyment (Wagenaar and van den Berg, 2006). According to prior studies, hospital visits and wayfinding issues are psychologically challenging; whether visitors are present for personal reasons or due to illness or injury, they are often not there voluntarily and often experience distress, discomfort, and/or anxiety (Berger, 2005; Mollerup, 2008; Carpman and Grant, 2016). A multitude of variables influence wayfinding. Rooke *et al.* (2010) identified physical properties, coded information, and social practices as the primary dimensions impacting the wayfinding system (Rooke, Koskela, and Tzortzopoulos, 2010a).

Wayfinding in emergency departments has not been extensively studied in the United

Arab Emirates (UAE). No studies in the UAE address the necessity of wayfinding guidelines or parameters to adhere to while constructing an ED. This research analyses the hospital's emergency department (ED) as a case study due to the presence of wayfinding challenges. Firstly, EDs are intricate systems defined by elevated patient traffic, unpredictable patient arrivals, and a diverse array of medical ailments (Ansah *et al.*, 2021; Samadbeik *et al.*, 2024). Diverse patients with limited prior experience are served in EDs under stressful conditions (Ulrich *et al.*, 2008). The ED serves as a vital point of entry to other healthcare systems (Pini, Ralli, and Shanmugam, 2021). Consequently, navigational errors might yield severe consequences for the entire hospital system. This research represents a continuation and expansion of previous work published in the Buildings journal concerning wayfinding in the emergency department (Haj-Saleh and Çağnan, 2025).

Previous research aimed to examine the spatial design in the light of the variable "social practice" and how it influences the wayfinding process, utilizing the software "space syntax" (Haj-Saleh and Çağnan, 2025). However, this research will focus on another variable, "physical properties". Here, the aim is to explore and evaluate the physical properties of transitional spaces from an interior and architectural viewpoint to enhance wayfinding experiences using international standards. Drawing attention to patterns and insights found throughout the case studies that could guide future practice in UAE. Furthermore, this study aims to offer design-oriented recommendations to assist interior designers and architects in enhancing transitional spaces for navigation framing them in the UAE context rather than universal norms.

This research posits that the physical properties of transitional spaces in ED neglect the wayfinding considerations. Therefore, these departments require development approaches that incorporate the concept of wayfinding. The paper will continue on the same case studies, although the methodology differs. Both papers investigate two variables that may contribute to a coherent model which would aid interior designers and architects in optimizing better solutions for ED.

The researchers collected the architectural floor plans from the construction companies in both PDF and AutoCAD formats. Field visits for the three case studies were carried out to closely examine the EDs. Moreover, the researchers observed and captured photos of transitional spaces in each case study. According to the field visits and literature review, the researchers identified the following as the physical properties of transitional

spaces: entrances/exits, pathways, circulation routes, interior design, and landmarks (IHG Part W, 2023). This paper utilized the Wayfinding Transitional Spaces Matrix (WTS-M) to analyse the findings from three samples of emergency departments in the UAE. The Wayfinding Transitional Spaces Matrix contains five wayfinding requirements, derived from the 2023 International Health Facility Guidelines (IHFG). IHFG was selected due to its comprehensive, internationally acclaimed guidelines that tackle healthcare-specific wayfinding challenges across over 50 countries. These guidelines offer measurable criteria that consider a diverse range of user demographics, are easily understandable, and feature a unique interior and architectural approach in their 2023 edition (TAH-PI, 2025). The matrix assesses five physical properties related to transitional spaces. It considers a number of interior architectural features that contribute to the design of physical properties. The research assigns a specific percentage to each physical property based on its consistency with the wayfinding criteria. The five wayfinding requirements for these spaces are identified as: the identification of entrances/exits, well-defined pathways, visual characteristics indicated by landmarks, easy navigation within circulation routes, and to establish a distinct identity through interior design.

Results present localized evidence to inform hospital design and policy development in the UAE. The findings also have practical consequences for architects and interior designers in the UAE hospital system, while providing broader academic value for scholars studying wayfinding and navigation in healthcare environments globally.

LITERATURE REVIEW

- **The Concept of Transitional Space** – Transitional space is a concept employed across several disciplines and manifested in diverse forms (Chun, Kwok, and Tamura, 2004; Pitts and Saleh, 2007, 2007). They are defined as ephemeral locations that serve as delimitations. Boundary positions are typically delineated by ‘barrier’ features, including doors, windows, gates, fences, walls, steps, doorsteps, and various other guardrails (Luz, no date). Transitional spaces include temporary spaces and transit areas that are essential when designing all private and public buildings (Pitts and Saleh, 2007; Al-Ramahi, Iranmanesh, and Denerel, 2023). Another feature of theirs is that they function as a link or connection between two or more areas (Pitts and Saleh, 2007). Furthermore, these spaces are part of the components of exterior and interior buildings, including entrances/exits,

points, lobbies, passageways, corridors, atriums, stairways, and other ancillary spaces (Pitts and Saleh, 2007; Kwong, Adam and Tang, 2009; Luz, no date). Synonymous with “Liminal Spaces”, and “In-Between Spaces” (Cothorn, 2003; Luz, no date), they are characterized either as an independent concept shaped by the surrounding binaries or as an intermediary between two entities that rely on one another. It is a fundamental component of all public edifices and constitutes a considerable portion of their volume (Nassar and El-Samaty, 2007). According to previous studies, the term ‘transition spaces’ is interpreted as a variable based on its function and attributes (Awal, 2022). Another research article identifies these areas as passage spaces, or movement spaces, which influence the distribution and redirection of users (Boettger, 2014).

- **Wayfinding and Hospitals** – Kevin Lynch coined the phrase “wayfinding” in his 1964 book “The Image of the City”, defining it as the process of navigating to a destination using spatial and environmental data (Lynch, 2007). The concept gained prominence in the 1970s, supplanting the phrase “spatial orientation” in scholarly discourse (Arthur and Passini, 1992; Lynch, 2007). Devlin and Bernstein define wayfinding as the process by which individuals orient themselves and navigate spatial settings (Devlin and Bernstein, 1995). In contrast, Passini *et al.* (2000) define wayfinding as an individual’s capacity to mentally visualize or depict a physical environment and to position oneself spatially within that depiction (Passini *et al.*, 2000). Wayfinding is also described by the factors that influence its procedure, referring to a set of tools intended to aid individuals in navigating a novel environment. Knowledge can be acquired from several navigation assistance systems, such as information booths, signage, and maps, in addition to the architectural and spatial features that define an environment (Passini, 1992). This paper asserts that a wayfinding system necessitates the collection of environmental information derived from the architectural features inherent in the built environment. Interpreting a building’s form or configuration may be either arduous or straightforward. The characteristics of structures, complex or not, convey subtle but substantial information: Landmarks, including doorways, elevators, corridors, stairs, and floor finishes, are utilized to navigate to a certain destination (Dogu and Erkip, 2000). Furthermore, the wayfinding method may rely on physical qualities and potential architectural aspects, including entrances, walkways, and circulation systems (Rooke, 2013).

TABLE II THE WAYFINDING REQUIREMENTS BY PHYSICAL PROPERTIES IN TRANSITIONAL SPACES

Identification of Entrance and Exit	
1	Projection/Recessing
2	Signs
3	Canopy, Portico, or Marquee
4	Symmetry or Asymmetry façade
Well-defined pathway based on interior features	
1	Two parallel continuous long walls
2	Repetitive (columns, lighting, etc.)
3	Floor tone
Visual character created with a landmark	
1	Outstanding (objects, architectural elements, or sculpture)
Easy navigation within circulation routes	
1	Straight movement pattern
2	Linear spatial design
Differentiation of space for distinct identity by interior design	
1	Distinguished (colour, material, texture, style)
2	Furniture setting

Prior research on healthcare architecture indicates that the constructed environment may facilitate healing. Healing architecture is related to the science of medicine, but it is also reflected in other disciplines and theoretical domains, such as sociology, perception theory, environmental psychology, space/place theory, and experiential aesthetics, which means that physical, social, and cultural aspects are important in an architecture capable of supporting health and well-being (Huisman *et al.*, 2012). Wayfinding is an essential concept and should be prioritized throughout the design process. According to studies on the relationship between hospital design and navigating the hospital environment, losing one's way can be a significant cause of the feeling of powerlessness; such difficulty can also generate bodily indicators such as elevated blood pressure and headache, as well as weariness during navigation (Carpman and Grant, 2016).

Rooke, Koskela, and Tzortzopoulos (2010) state that the wayfinding system in medical settings is shaped by three main elements: social practice (such as the roles of staff and volunteers), coded information (such as signage and graphic systems), and physical properties (such as entrance and pathway design; Rooke, Koskela and Tzortzopoulos, 2010). The experience of navigating healthcare facilities is influenced by these interconnected factors taken together. Based on the same case studies in the United Arab Emirates (UAE), this study expands on a previously published work in the *Building Journal* (Haj-Saleh and Çağnan, 2025). The previous study focused on social practices in emergency departments (EDs), emphasizing the spatial connection and visibility of human-related elements such as reception spaces and nurse stations. This research broadens its scope to include physical properties to enhance knowledge and suggest more effective modifications. Collectively, these two studies provide significant insights for improving navigation from both interior design and architecture viewpoints. The third dimension, encoded information, is an interesting domain for further investigation, especially for scholars in graphic and information design.

- **Physical Properties of Transitional Spaces for Wayfinding** – Rooke *et al.* (2009) asserted that an individual's spatial awareness of an area depended on its physical properties and diversity, which might enhance wayfinding independent of instructive signage (Rooke *et al.*, 2009). The visual attributes of the physical setting can be considered as establishing a level of imageability, facilitating the formation of mental representations of the surrounding context, which subsequently

influences individuals' wayfinding (Lynch, 2007). Lawson states that spaces within our ownership or control ought to convey messages through their physical properties. He asserts that this 'human language of space' ought to be an essential instrument for architects (Lawson, 2001). A comparable assertion was made regarding how architectural features and the discernibility of physical properties provide users with wayfinding cues that facilitate intuitive orientation, independent of signage, elucidating the research's reliance on photographic documentation and field observations for physical properties (Ibrahim, 2019). In this research paper, the criteria for evaluating the physical properties of transitional spaces as seen in Table II were constructed from the International Health Facility Guidelines for 2023 for wayfinding. The physical properties are; entrance/exit, pathways, landmarks, circulation routes, and interior design. The table illustrates architectural and interior features that contribute to the design of the physical properties and exhibits the five wayfinding requirements (iHG Part W, 2023).

Entrances and Exits within hospitals are the same. However, identifying an entrance or exit is essential for wayfinding. This criterion can be fulfilled by employing architectural elements to highlight the entry, making it visible and identifiable from afar. The architectural features that facilitate identification include: the projection/recessing of the entrance to give prominence – creating a Canopy, Portico, or Marquee, Symmetry or Asymmetry façade and lastly, Signs (iHG Part W, 2023; Karakurt, 2023). Paths represent the routes within transitional spaces that appear to facilitate wayfinding (Ibrahim, 2019). Pathways must be well-defined for users to have a successful wayfinding experience. The interior features; continuous long walls, the tone of the floor, and repetition (columns, light, etc.) collaborate to establish a pathway design that meets wayfinding needs (iHG Part W, 2023). The term landmark refers to a distinctive visual that serves as a reference point for providing instructions and is easily recalled by both first-time users and returning visitors. Landmarks may be a series of elevators, a courtyard or garden view, outdoor sculptures, an atrium, or other distinctive architectural elements. They are intended to provide a visual representation of the location, hence aiding in wayfinding requirements (iHG Part W, 2023; Karakurt, 2023). Hospital departments/ zones should also be roughly demarcated using simple primitive impressions such as rectangles which would assist in simplifying the circulation of a system of straight corridors between nodes (iHG Part W, 2023). Based on previous

research, this easy-to-navigate wayfinding system can be reached by using a spatial design as a linear organization (Ching, 2012; Zamani, 2019; Natapov *et al.*, 2020; iHG Part W, 2023). Elements of interior design significantly facilitate wayfinding. Design elements, for example, decorations, furniture, lighting, and colour, as well as materials for walls, floors, and ceilings, serve as distinctive aspects of interior spaces that function as navigational cues inside a hospital (Huelat, 2007). Consequently, interior design can establish a unique identity and differentiation of space to simplify the wayfinding task by distinguishing (colour, material, texture, style) and furniture setting (Yesiltepe, 2021; iHG Part W, 2023).

The literature review section explores the concepts of transitional spaces, wayfinding in hospital environments, and physical properties for wayfinding. The section highlights the importance of physical properties to the hospital's wayfinding systems, particularly in emergency departments. The literature review serves as the foundation for the following methodology section, which extracts the matrix from the International Guidelines of Wayfinding in 2023.

METHODOLOGY

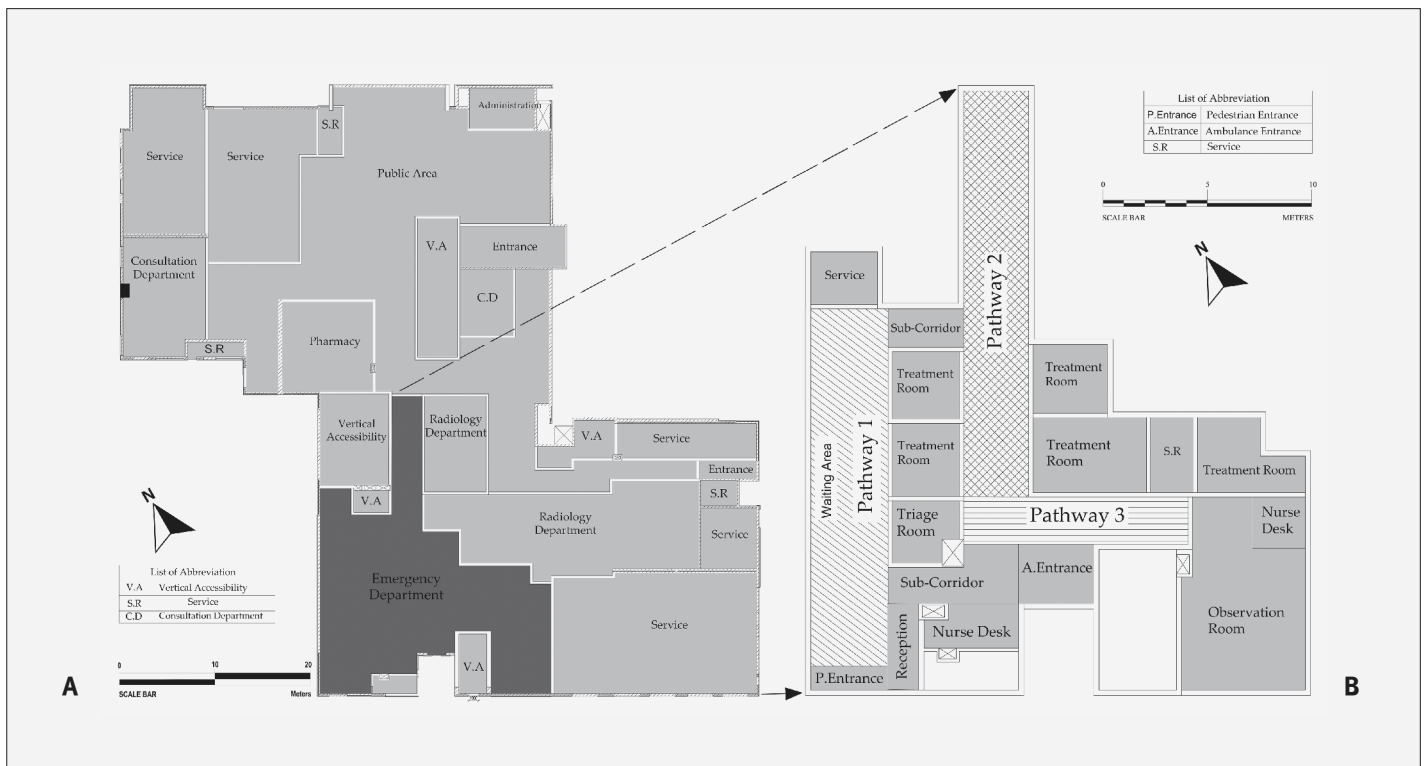
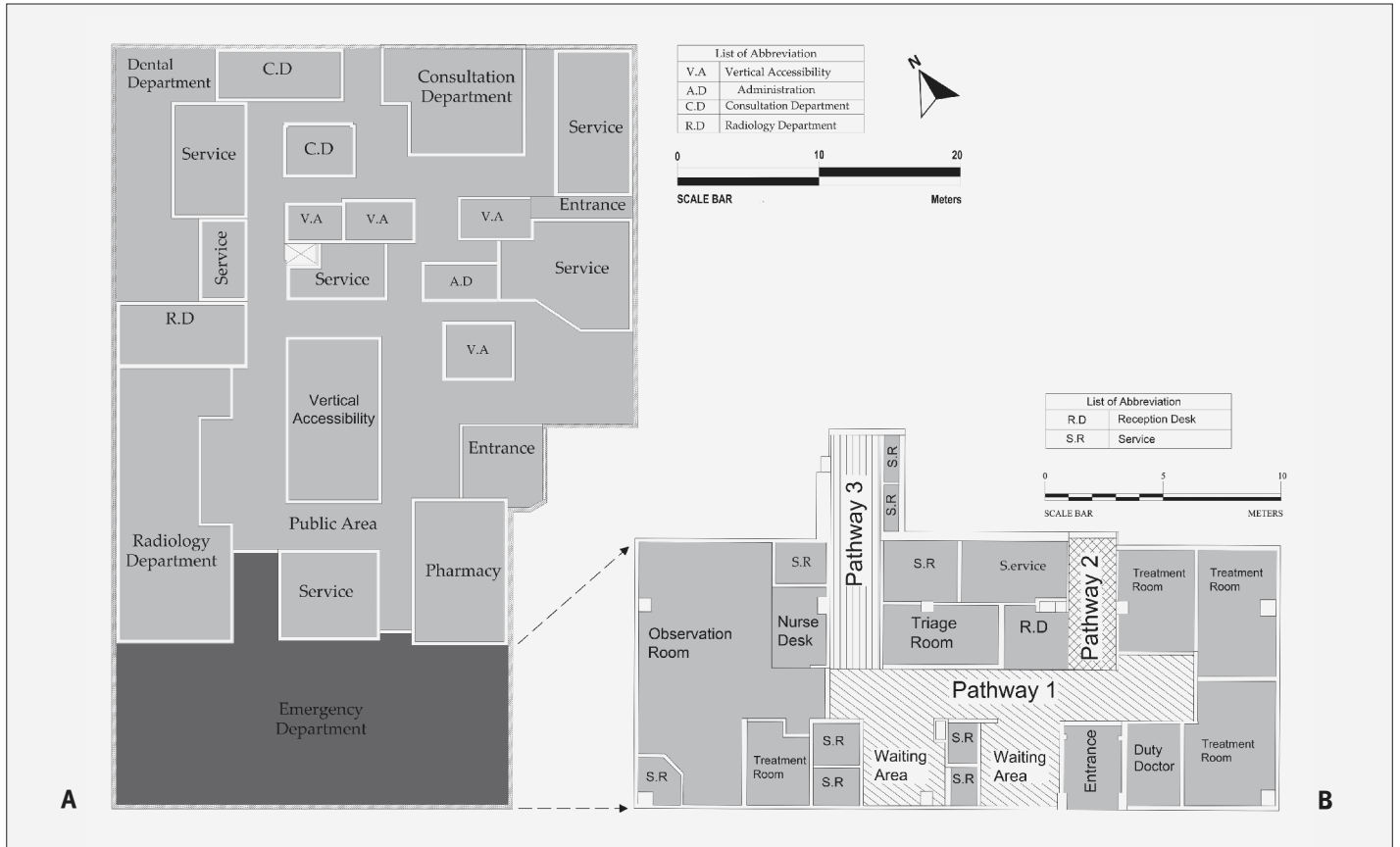
This study employed a qualitative and quantitative approach through a literature review, field visits, observation, and photographic documentation to explore the transitional spaces in EDs. The exploration of the "International Health Facility Guidelines for 2023 for Wayfinding" resulted in the Wayfinding Transitional Space Matrix (WTS-M). This study utilized the WTS-M as a reference for assessing the three selected case studies. In particular, the research focuses on the physical properties of transitional spaces, that is: the entrances/exits, three pathways (one of which includes a waiting area), landmarks, circulation routes, and interior design. It attempts to examine and determine to what extent these physical properties comply with the requirements of the wayfinding guidelines. The WTS-M technique employs a quantitative approach, counting the architectural and interior features and providing a percentage for the presence of each physical property. The evaluation was carried out using standardized, rigorous field observations, which guarantee uniform measurement standards across all facilities utilizing the same observational framework and comprehensive architectural analysis. The Wayfinding Transitional Spaces Matrix (WTS-M) paradigm was employed, offering an objective and systematic approach for examining physical properties pertinent to wayfinding. The ap-

proach and scoring process are elaborated upon in the relevant sections (The Wayfinding Transitional Spaces Matrix). This study presents the data anonymously and does not disclose the identities of individual hospitals for two reasons. First, it ensures the ethical protection of healthcare institutions and prevents any potential reputational concerns arising from the interpretation of results. Second, all hospitals operate under a unified organizational structure and are managed by the same medical operator (Medical Group, UAE). Anonymity allows the research to focus on comparing spatial typologies and wayfinding design within a standardized system rather than across specific locations. This study selected hospitals that exemplify three diverse emergency department layouts within the system, facilitating a comparative analysis of varied spatial arrangements. This allows us to generalize the findings and make them relevant for a broader context of similar healthcare facilities.

In the findings section, the cases describe the presence of attributes in words and photographs. After evaluating the three case studies, the research will compare them to identify which of them possesses physical properties that are most aligned with the wayfinding requirements, and which exhibit least alignment.

CASE STUDIES

This research focused on emergency department as a case study to examine transitional spaces from a wayfinding perspective. Haj Saleh and Çağnan (2025) previously analysed these identical case studies, examining emergency departments (Haj-Saleh and Çağnan, 2025). The research employs a markedly different methodological approach compared to previous studies, albeit utilizing the same three hospitals as case studies, shifting from previous research on social aspects of wayfinding, which utilized space syntax software, to a physical-environmental perspective, utilizing systematic field observations and architectural analysis informed by the WTS-M framework. This transition facilitates the creation of new insights into the spatial and architectural characteristics of transitory zones within emergency rooms. Employing identical case studies guarantees methodological uniformity, facilitating a controlled comparative analysis that incorporates both social and physical dimensions. The method enhances triangulation and facilitates the formulation of more comprehensive design principles for emergency healthcare settings. Furthermore, since this research focuses on the same case studies, it offers significant



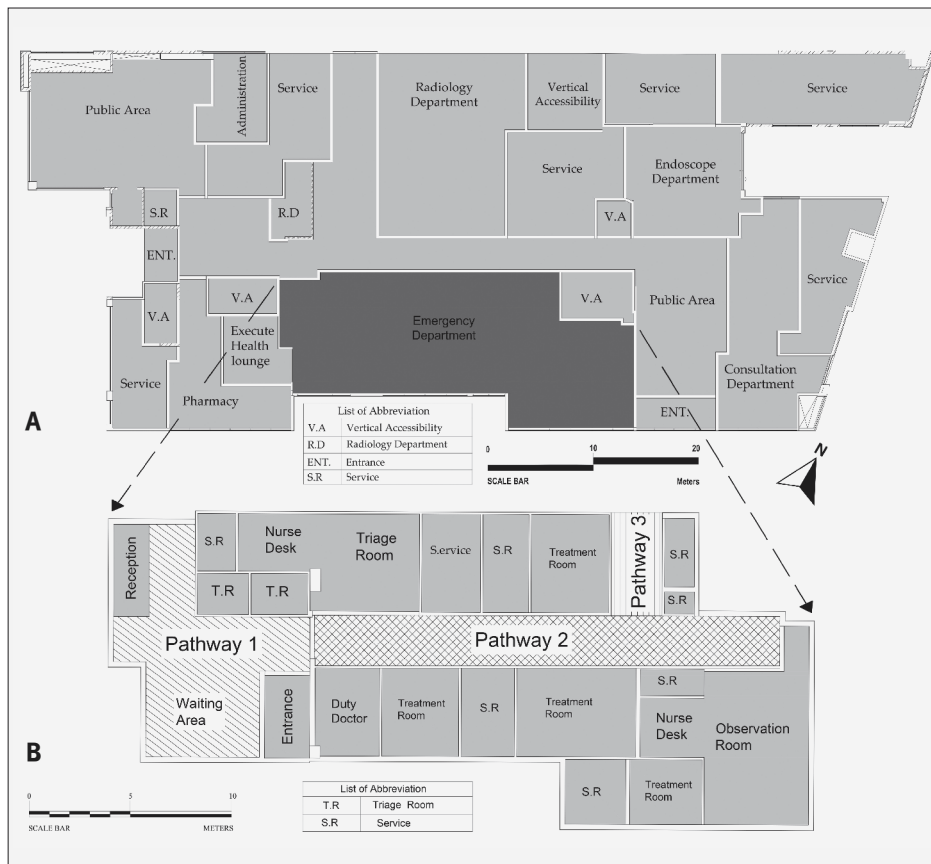
context-specific insights and deepens the understanding of wayfinding difficulties within a cohesive healthcare and urban environment, as the hospitals are located in the United Arab Emirates, where specialized navigation design requirements are lacking.

The three selected case studies are located in the United Arab Emirates (UAE) in the Gulf Area in the Middle East. Dubai and Sharjah are the two emirates where the cases are located. All three cases are private hospitals with 100+ beds, and the ED serves the local district 24/7. Approximately 30,000 patients visit each hospital emergency department annually. The drawings were gathered from the construction companies that built the medical buildings. To maintain discretion and adhere to institutional regulations, the precise names of the hospitals are withheld; the case studies are instead designated anonymously as Case Study A, Case Study B, and Case Study C throughout the research. The subsequent points present broad information regarding the three case studies. The following points provide general information about the three case studies:

- Case study A: located in Dubai in the UAE, 100+ beds in a private hospital that serves the local district. 24/7 in the Emergency departments, with 465 m² area (Fig. 1).
- Case study B: located in Dubai in the UAE, 100 beds in a private hospital that serves the local district. 24/7 in the Emergency departments, with 352 m² area (Fig. 3).
- Case study C: located in Sharjah in the UAE, 100+ beds in a private hospital that serves the local district. 24/7 in the Emergency departments, with 400 m² area (Fig. 2).

THE WAYFINDING TRANSITIONAL SPACES MATRIX

The Wayfinding Transitional Space Matrix (WTS-M) assesses the physical properties in the case studies based on five wayfinding criteria. The attributes of transitional areas where movements transpire are defined by five physical properties: entrance/exit, three pathways (one of them includes a waiting area), landmarks, circulation routes, and interior design. The five wayfinding requirements are: (I) identification of the entrance and exit; (II) definition by interior features for pathways; (III) creating a visual character with a landmark; (IV) easy navigation within circulation routes; and (V) differentiation of space for distinct identity by interior design. The appearance of physical properties depends on the quantity of architectural and interior features that contribute to wayfinding requirements.



The scoring utilized in the WTS-M framework was derived from researchers' systematic field observations and architectural analysis. This guaranteed an impartial and uniform assessment of the physical characteristics affecting wayfinding throughout all case studies. Every physical property has sub-scores resulting from the quantity of existing features. Scores mean: 1 = by indicating with a (✓) sign if present and a (×) sign if not present, these signs were converted to numbers (✓ = 1 and × = 0), to evaluate all of the listed attributes in a specific space where sub-scores were collected resulting in extracted percentages to compare and find the variances. The evaluation on the basis of the wayfinding transitional spaces matrix for three case studies A, B, and C is in Table III.

RESULTS

The quantitative analysis of the matrix was conducted to assess and compare the physical properties of the transitional spaces in the three emergency departments. Scoring in the matrix was based on the presence or absence of specific features, enabling an evaluation of each physical property. Each feature in the matrix contributed one score to the as-

FIG. 3 (A) ED IN THE ARCHITECTURAL PLAN FOR CASE STUDY B, (B) TRANSITIONAL SPACE IN ED IN CASE STUDY B

(PREVIOUS PAGE)

FIG. 1 (A) ED IN THE ARCHITECTURAL PLAN FOR CASE STUDY A, (B) TRANSITIONAL SPACE IN ED IN CASE STUDY A

FIG. 2 (A) ED IN THE ARCHITECTURAL PLAN FOR CASE STUDY C, (B) TRANSITIONAL SPACE IN ED IN CASE STUDY C

TABLE III THE WAYFINDING TRANSITIONAL SPACES MATRIX FOR THREE CASE STUDIES A, B, AND C

Identification of the Entrance and Exit	Case study A			Case study B			Case study C						
	Ent.	Exit	Total	Ent.	Exit	Total	Ent.	Exit	Total				
Projection or Recessing	×	×	0	✓	×	1	✓	×	1				
Signs	✓	✓	2	✓	✓	2	✓	✓	2				
Canopy, Portico, or Marquee	×	×	0	×	×	0	×	×	0				
Symmetrical or asymmetrical façade	✓	×	1	✓	×	1	✓	✓	2				
Sub scores	2	1	3	3	1	4	3	2	5				
Total in percentage	37.5%			50%			62.5%						
Well-defined pathway based on interior features	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	
	Continuous long wall	✓	✓	✓	3	×	✓	✓	3	✓	✓	✓	3
	Repetitive (handrail, lighting, etc.)	✓	✓	✓	3	✓	✓	✓	2	✓	✓	✓	3
	Floor tone	×	×	×	0	×	✓	✓	2	✓	×	×	1
	Sub scores	2	2	2	6	1	3	3	7	3	2	2	7
Total in percentage	66.7%			77.8%			77.8%						
Visual character created with a landmark	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	
	Outstanding (objects, or sculpture)	×	×	×	0	×	×	×	0	×	×	×	0
	Sub scores	0	0	0	0	0	0	0	0	0	0	0	0
Total in percentage	0%			0%			0%						
Easy navigation within circulation routes	Circulation Plan	Total		Circulation Plan	Total		Circulation Plan	Total					
	Straight movement pattern	✓	1	✓	1	✓	1	✓	1				
	Linear spatial design	✓	1	✓	1	✓	1	✓	1				
	Sub scores	2	2	2	2	2	2	2	2				
Total in percentage	100%			100%			100%						
Differentiation of space for distinct identity by interior design	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	Pathway 1	Pathway 2	Pathway 3	Total	
	Distinguished (colour, material, texture, style)	×	×	×	0	×	×	×	0	✓	×	×	1
	Furniture setting	✓	×	×	1	✓	×	×	1	✓	×	×	1
	Sub scores	1	0	0	1	1	0	0	1	2	0	0	2
Total in percentage	16.7%			16.7%			33.4%						

Key of the matrix: 1 = by indicating with a (✓) sign if present and a (×) sign if not present, these signs were converted to numbers (✓ = 1 and × = 0)

assessment, resulting in a calculated percentage for the extent of physical property presence, as presented in Chart I.

The comparative analysis of the three case studies examines five physical properties in transitional spaces. Entrance/exits show the following results from Case study A (37.5%), to B (50%), to C (62.5%), indicating enhanced identification. The pathways are well defined across all cases, with Case A at 66.7% and both Cases B and C achieving 77.8%. Interior design elements demonstrate identical metrics in Cases A and B (16.7%), while Case C shows significant improvement (33.4%). Remarkably, circulation routes exhibit 100% performance in every scenario, demonstrating movement patterns that improve easy navigation. Nevertheless, landmarks exhibit a persistent absence (0%) throughout all trials, highlighting a distinct opportunity for enhancement. Case study C exhibits exceptional performance across most parameters, especially in entrance/exit identification and distinguished identity by interior design.

FINDINGS AND DISCUSSION

In this section, the findings from the three case studies will be presented and explored. The physical properties within the transitional spaces for the three case studies discussed in this article are: The entrance/exit and three pathways, with one of the pathways open to the waiting area, landmarks, circulation routes, and interior design. The numeric findings come from the (WTS-M) in Table I.

CASE STUDY A

The architectural features of the Entrance and Exit that contributed to identifying the entrance were two: a red illuminated sign indicating the department's name and a symmetrical-appearing façade. For the exit door, a green illuminated sign was hung above it (Fig. 4). A total sub-score of 3 out of 8 features contributes to identifying the entrance and exit in this case study, with a percentage of 37.5% (IHFG Part W, 2023).

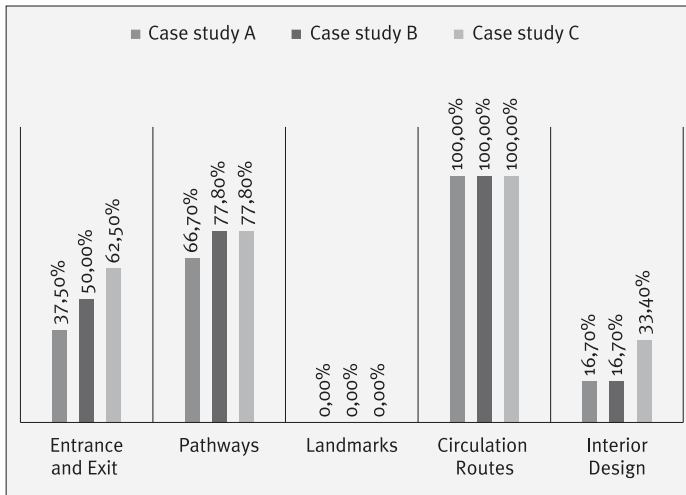
The emergency department contains three pathways. The interior features that contributed to defining the pathways were; the repetition of lighting in the ceiling, the continuous handrail hanging on the wall, and long parallel walls. The colour scheme of the pathway floor was in harmony with the rest of the colours used. Therefore, the tone of the floor did not create any distinctive feature for the pathway. The total sub-score was 6 out of 9 for the paths with a percentage of 66.7% (IHFG Part W, 2023). The landmark element was entirely omitted. The interior of the transitional pathways lacked landmarks (Fig. 6).

Resulting in an absence of remembered images or visual cues for navigation; thus, the total sub-score is 0, equating to 0% (Dinata and Wijono, 2020; iHFG Part W, 2023.; Karakurt, 2023).

The movement pattern consists of straight lines due to a rectangular spatial arrangement, resulting in a circulation route characterized by linear organization (Fig. 7). The overall thematic core has two out of the two features, resulting in a 100% alignment with the navigational and wayfinding criteria established by numerous studies and standards (Ching, 2012; Zamani, 2019; Natapov *et al.*, 2020; iHG Part W, 2023).

Interior design, the transitional space has one identity. The style, colour scheme, lighting system, and flooring were all in the modern style, which means the differentiation of space was missing, except for a pathway (3) which included the waiting area with furniture (a set of sofas; Figs. 5 and 6). The three pathways in total scored 1 out of 6, indicating a percentage of 16.7% (Ibrahim, 2019; iHG Part W, 2023; Yesiltepe, 2021).

Chart II delineates the variables of physical properties, including their percentages depending on the quantity of architectural and interior features identified following the assessment of the transitional space in the WTS-M, while the figures display all documented photographs of transitional spaces within the emergency departments of case study A.



CASE STUDY B

The emergency department entrance is set back from the main street within a secondary facade, making it less visible. The entrance is marked by a projecting element in the facade, which shelters the entry. A red sign clearly identifies the department.

The asymmetrical form of the facade is further emphasized by the materials used in its construction. The exit is marked by a green-lit sign (Fig. 8). Both the entry and exit possess 4 out of 8 features, representing a 50% presence (Dalke *et al.*, 2013; iHG Part W, 2023).

CHART I COMPARATIVE ANALYSIS OF THE PHYSICAL PROPERTIES EVALUATED IN THE MATRIX



FIG. 4 (A) ENTRANCE: 1. RED SIGN, 2. SYMMETRICAL FAÇADE; (B) EXIT: 3. GREEN SIGN

FIG. 5 (G) WAITING AREA IN PATHWAY 1: 1. FURNITURE SETTING



FIG. 6 (C,D,E) 1. REPETITION IN LIGHTING AND HANDRAIL, 2. PARALLEL WALLS

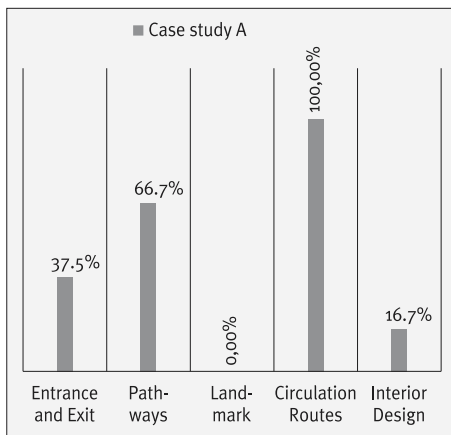
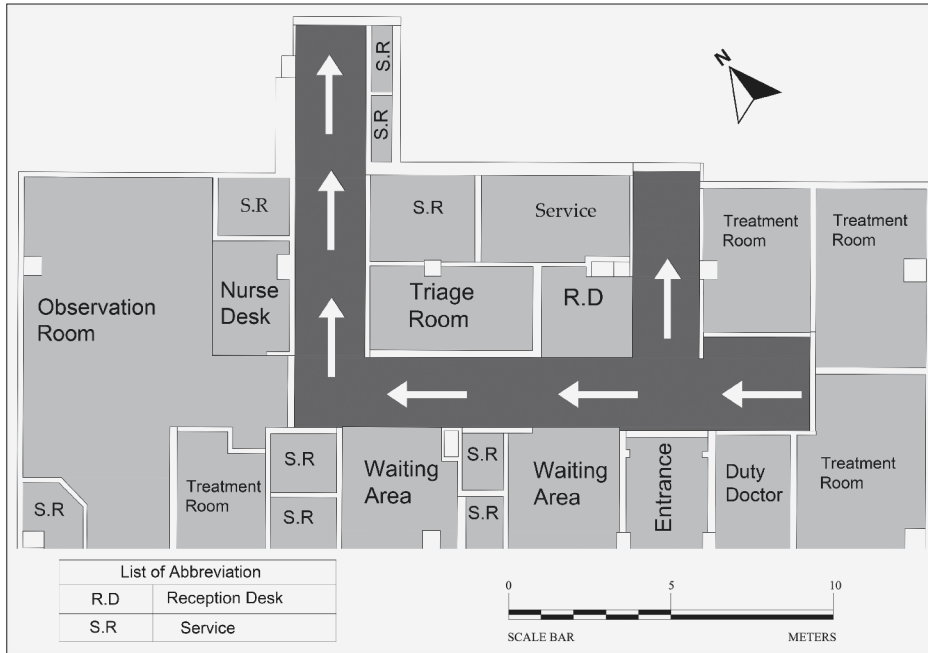


FIG. 7 (F) CIRCULATION PLAN: 1. LINEAR LAYOUT, 2. STRAIGHT MOVEMENT PATTERN

CHART II FINDINGS OF PHYSICAL PROPERTIES EVALUATED IN THE MATRIX – CASE STUDY A

The department is comprised of three paths. The initial corridor, which encompasses the waiting area, lacked parallel walls, and the flooring’s hue harmonized with the surrounding hues, leaving it devoid of any distinctive elements. The sole interior feature was the repetitive lighting system. The second and third pathways are characterized by several interior features, including elongated parallel walls, repetitive railings and lighting, and a contrasting floor colour (Fig. 9). The paths were delineated by 7 of the 9 features, achieving a percentage of 77.8% (Dalke *et al.*, 2013; iHG Part W, 2023). The location lacked any visually recognizable landmarks, and no objects were utilized to assist in navigation or orientation within the emergency department (Fig. 9). Resulting in a total score of 0 in contributed features (Dinata and Wijono, 2020; iHFG Part W, 2023.; Karakurt, 2023) .

Circulation routes, with the total features that worked together being two, achieved a 100% alignment with the navigational and wayfinding requirements set by various studies and standards. Because of its rectangular physical arrangement, the movement pattern is made up of straight lines, creating a circulation route with a linear organization (Fig. 10; Ching, 2012; Zamani, 2019; Natapov *et al.*, 2020; iHG Part W, 2023).

Wayfinding criteria necessitate that interior design differentiates between various sections and internal spaces. This sector was overlooked as the design was internally cohesive, lacking distinguishing stylistic as-

pects. However, in the pathway (1), which includes the waiting room, the furniture arrangement is notable (Figs. 9 and 11). Consequently, the overall sub-score is 1 out of 6, equating to 16.7% (Ibrahim, 2019; iHG Part W, 2023; Yesiltepe, 2021).

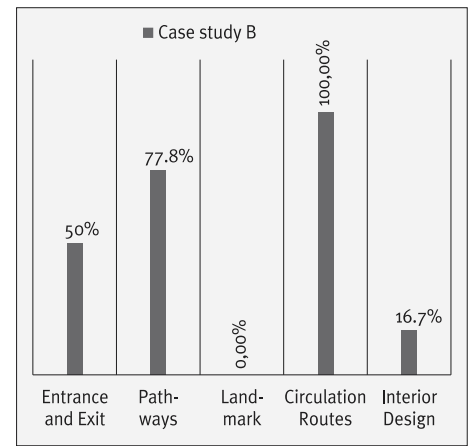
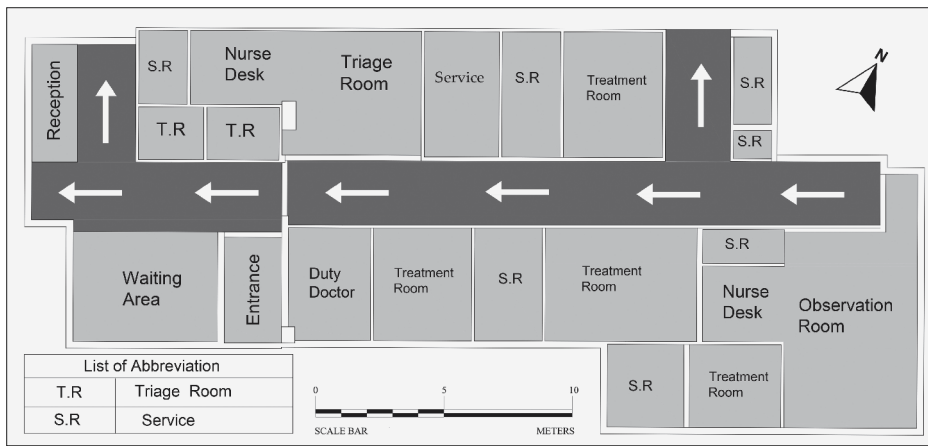
Chart III illustrates the variables of physical properties, including their percentages, based on the quantity of architectural and interior features identified after assessing the transitional space in the WTS-M, while figures present all recorded photographs of the transitional spaces within the emergency departments of the case study B.

CASE STUDY C

There are two entrances to the emergency department on one façade of the hospital building. One is for pedestrians and the other for the ambulance. The architectural features identifying the entrances are: a projection, signs, and an asymmetrical façade in the used material. The pedestrian entrance façade was covered with a stone tile material whose colour and texture is completely different from the rest of the hospital façade. The material of the door itself was glass, contrasting with the material of the wall where the door is located. The glass was also marked by a printed sign with a distinctive green colour to indicate the entrance. The Ambulance Entrance is in a recessed part of the building’s façade. The façade has a smooth aluminium material and a white-silver colour, contrasting with the material of the adjacent façade. Finally, a red sign displaying the name is hung above the two entrances. Exits are indicated by a green sign that was hung over the door (Fig. 12 a,b,c).

The total sub-score is 5 out of 8 features with a 62.5% percentage, coming in as the highest result among the three case studies (Dalke *et al.*, 2013; iHG Part W, 2023).

The emergency department in the third case study contains three main pathways. The architectural features that define the first path are two long parallel walls, repetitive lighting, furniture, and handrails fixed along the two walls as well as a distinct tone of the floor. The second and third pathways contain long parallel walls, repetitive lighting, and a handrail. They score seven out of nine features with 77.8% (Dalke *et al.*, 2013; iHG Part W, 2023). As for the landmarks, there were no distinctive landmarks (Fig. 13 d,e,f). The space had a unified character without any unexpected objects, scoring 0 and reflecting 0% (Dinata and Wijono, 2020; iHFG Part W, 2023.; Karakurt, 2023).



The spatial layout reflects a linear circulation arrangement with simple straight paths (Fig. 14 g). Achieving 100% with a total of 2 scores (Ching, 2012; Zamani, 2019; Natapov *et al.*, 2020; iHG Part W, 2023).

In this case study, the first pathway where the waiting area is located has achieved both features (distinguished by colour, material, texture, and furniture setting). The wall texture, colours, lighting, and furnishings exhibit a distinctive character that sets it apart from other transitional areas (Fig. 13 d). Conversely, pathways 2 and 3 present an identity devoid of distinction in material, style, or colour (Fig. 13 e,f). Hence, the interior design physical property has achieved two out of the six features required in transitional spaces, set at 33.4% (Ibrahim, 2019; iHG Part W, 2023; Yesiltepe, 2021). Chart IV depicts the variables of physical properties, including their percentages derived from the quantity of architectural and interior features identified following the evaluation of the transitional space in the WTS-M, whereas figures displays all documented photographs of the transitional spaces within the emergency departments of case study C.

LIMITATIONS AND FUTURE RESEARCH

Comparable to the majority of research, the present research methodology contains limitations that create opportunities for further investigation. This study has recognized that the wayfinding system is a complex human behaviour that is influenced by a variety of inputs and variables. This study aligns thematically with a prior examination on the social dimensions of navigation in emergency departments; however, it diverges in both methodology and conceptual framework. The previous research utilized the space syntax tool, highlighting variables related to social practices (Haj-Saleh and Çağnan, 2025). This study employs architectural analysis through the Wayfinding Transitional Spaces Matrix (WTS-M), designed to evaluate variables related to physical properties, including entrances/exits, pathways, landmarks, circulation, and interior design. It is essential to highlight that, although both studies investigated the same three emergency departments, they had distinct analytical objectives. The employment of identical case studies in both publications facilitates methodological triangulation, thereby enhancing

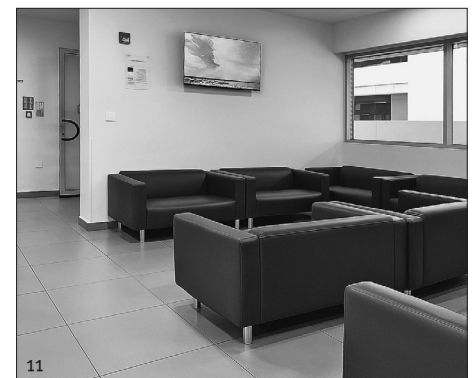


FIG. 8 (A) ENTRANCE: 1. PROJECTION, 2. RED SIGN, 3. ASYMMETRICAL FAÇADE; (B) EXIT: 1. GREEN SIGN

FIG. 9 (C) 1. REPETITIVE IN LIGHTING; (D,E) 1. PARALLEL WALLS, 2. REPETITIVE IN LIGHTING AND HANDRAIL, 3. CONTRAST IN FLOOR TONE

FIG. 10 (F) CIRCULATION PLAN; 1. LINEAR LAYOUT, 2. STRAIGHT MOVEMENT PATTERN

CHART III FINDINGS OF PHYSICAL PROPERTIES EVALUATED IN THE MATRIX – CASE STUDY B

FIG. 11 (G) WAITING AREA IN PATHWAY 1: 1. FURNITURE SETTING



FIG. 12 (A) ENTRANCES: PEDESTRIANS ENT. LEFT SIDE, RIGHT SIDE AMBULANCE – ENT. BOTH HAVE: 1. PROJECTION, 2. RED SIGNS, 3. ASYMMETRICAL FAÇADE IN MATERIAL; (B) PEDESTRIANS EXIT, (C) AMBULANCE EXIT – EXITS: 1. GREEN SIGN

FIG. 13 (D) PATHWAY 1: 1. PARALLEL WALLS, 2. REPETITIVE IN LIGHTING AND HANDRAIL, 3. CONTRAST IN FLOOR TONE, 4. FURNITURE SETTING; (E) PATHWAY 2, (F) PATHWAY 3 – (E,F) PARALLEL WALLS, 2. REPETITIVE IN LIGHTING AND HANDRAIL

the knowledge of wayfinding in transitional areas. Certain constraints and recommendations may seem analogous, such as the necessity for a more extensive case study sample or additional qualitative investigation; yet, they underscore enduring and pervasive issues recognized through various analytical perspectives.

Subsequent research may expand upon the methodological framework of this study by implementing the Wayfinding Transitional Spaces Matrix (WTS-M) in a wider array of healthcare environments, such as inpatient wards or outpatient clinics, to evaluate its adaptability and generalizability. Furthermore, incorporating the WTS-M with digital tools like Building Information Modelling (BIM) or real-time wayfinding simulations could improve its accuracy and use in initial design stages.

A significant limitation of the current study is its inadequate exploration of the lived experiences of users. The study conducted a comprehensive analysis of spatial configurations but did not include real-time behavioural observations or cognitive feedback. Subsequent studies ought to incorporate a variety of approaches, including path mapping with broad user demographics and ethnographic observation, to elucidate the emotional, cognitive, and experiential facets of wayfinding. The study's limitations include the absence of surveys, which hinders the ability to document users' subjective experiences. Instead, it focuses on objective evaluation of physical and spatial characteristics, a crucial initial step for user-centered research. Future studies may incorporate social and experiential aspects. Furthermore, broadening the focus beyond emergency departments to encompass additional transitional healthcare environments across diverse cultural and institutional settings would facilitate the creation of

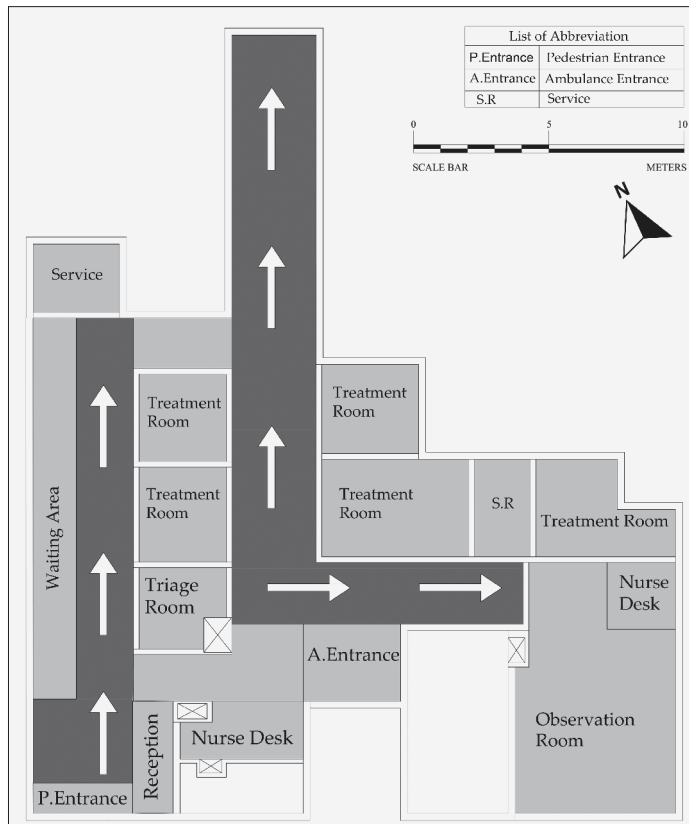
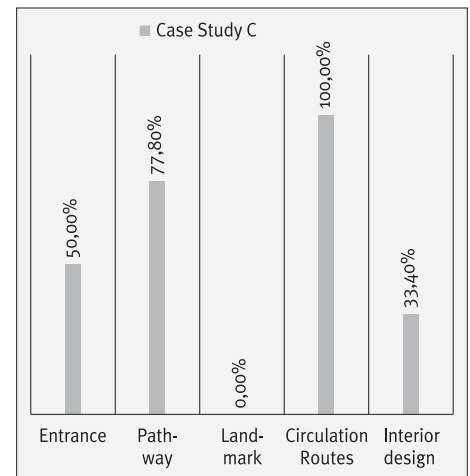


FIG. 14 (G) CIRCULATION PLAN: 1. LINEAR LAYOUT, 2. STRAIGHT MOVEMENT PATTERN

CHART IV FINDINGS OF PHYSICAL PROPERTIES EVALUATED IN THE MATRIX – CASE STUDY C



more universally applicable and resilient design concepts. Additionally, future research may be obtained by examining how navigation is impacted by cultural landmarks or symbolic cues unique to the United Arab Emirates, especially when contrasting local design approaches with Western hospital models. Incorporating cultural factors with architectural and spatial elements will facilitate a comprehensive understanding of wayfinding, acknowledging that navigating in healthcare settings is influenced by both physical and social circumstances.

These constraints must be acknowledged while analysing the results. Nevertheless, the physical insights obtained from the WTS-M framework enhance the broader domain of healthcare design and illustrate the importance of environmental signals in influencing user navigation within the UAE context.

CONCLUSION

The current development of the WTS-M focuses on examining the physical properties of transitional spaces in emergency departments in the UAE. It aims to provide designers with a framework for integrating and evaluating these properties in light of wayfinding requirements within the UAE context. This paper suggests that designing the physical properties of transitional locations – such as entrances/exits, paths, landmarks, circulation routes, and interior design – serves as part of a complex system that affects the wayfinding during the various phases of building design.

The building's bulk and façade design influence the configuration of the entrance. Furthermore, the spatial design drawings, which serve as initial drawings for building design, create the circulation routes. In the later phases of emergency department design, interior finishes and landmarks can help resolve issues in transitional areas that affect wayfinding requirements, such as using contrasting textures to create distinct identities for each pathway. On the other hand, incorporating a prominent landmark into the pathway can enhance the wayfinding process. Architects and interior designers ought to participate in the planning and evaluation of these physical property designs as one of the wayfinding solutions during the phases of emergency department design, rather than

relegating this responsibility solely to graphic designers, as is typically practiced in sign design.

The following points present a model for the physical properties of transitional spaces in emergency departments in the UAE, accompanied by supporting visuals. This study articulates its recommendations as context-specific guidelines, not universally applicable standards, based on the analysis of case studies, which seek to enhance the current discourse on wayfinding in hospital settings, specifically within the context of the UAE. Patterns identified in the architectural and spatial arrangements of transitional spaces in emergency rooms could potentially facilitate more intuitive navigation; however, these should not be construed as prescriptive design guidelines. This research establishes a basis for comprehending the impact of spatial configurations on wayfinding in high-stress emergencies and serves as a preliminary framework for practitioners and scholars to investigate more comprehensive design solutions. The visuals can be seen in Table 1:

- The entrances and exits have four features that can continue to create an identification property: An asymmetrical façade in shape or material, a recess in the façade that can create a canopy, and a red sign carrying the name of the emergency department, together with a green sign indicating the Exit.
- Pathways should be designed with two parallel walls with a repetitive lighting system and a continuous handrail, and lastly, a distinguished floor tone that creates a contrasting view with the walls and ceiling
- Each pathway's interior design should possess a distinct personality through the utilization of specific colour themes or materials. Similar to landmarks, a memorable sign should be employed to generate a distinctive indication for each pathway, for instance, the green pathway with a suspended clock.
- The emergency room layouts that utilized linear spatial configurations with direct, straight circulation routes (e.g. rectangular layouts with perpendicular corridors) reduce wayfinding challenges, as per the guidelines. This indicates that linear planning serves as both a design principle and a vital element for improving wayfinding within the UAE healthcare system.

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