Faculty of Natural and Applied Sciences Journal of Basic and Environmental Research
Print ISSN: 3026-8184 e-ISSN 3043-6338
www.fnasjournals.com
Volume 2; Issue 4; December 2025; Page No. 67-77.
DOI: https://doi.org/10.63561/jber.v2i4.1041

Enhancing Wayfinding in Healthcare Facilities: A Comparative Study on the Impact of Universal Design Principles

***Usman, A.H., Sagir, A., & Zakari, A.T.**
Department of Architecture, Aliko Dangote University of Science and Technology, Wudil, Kano, Nigeria.

***Corresponding author email**: uthmanhadejia@gmail.com

Abstract
The focus of this study is on the influence of universal design principles on wayfinding effectiveness in healthcare facilities with a focus on improving navigation success and reducing stress and anxiety among patients, visitors and staff. Three hospitals with varying levels of universal design principles were selected as case studies. A comprehensive checklist rooted on the principles of universal design was used to evaluate the presence and effectiveness of these principles in each hospital, assessing aspects such as signage, layout, and digital wayfinding tools. Additionally, in-depth interviews were conducted with hospital users, including patients, visitors, and staff, to gather information about their navigation experiences, challenges faced, and suggestions for improvement. The results showed that hospitals with more universal design principles had more effective wayfinding performance, with users reporting higher navigation success rates, fewer challenges, and greater overall satisfaction. The findings suggest that incorporating universal design principles into healthcare environments can improve wayfinding performance, reduce stress and anxiety, and enhance the overall patient experience. This research underscores the need to prioritize the principles of universal design in healthcare design and management, and provides recommendations for implementing these principles in practice.

Keywords: Universal design principles, wayfinding, healthcare environments, Navigation, Patient Experience, User Experience, Hospital Design.

Introduction

Imagine navigating an unfamiliar hospital, searching for a critically ill loved one, amidst a sea of corridors and rooms. The anxiety and stress are obvious, and the clock is ticking. This scenario is all too common, highlighting the pressing issue of wayfinding in healthcare environments (Ulrich et al., 2022). Wayfinding, defined as the process of navigating and orienting oneself within a built environment, is a critical aspect of patient care, directly impacting patient experience, safety, and satisfaction (Carpman & Grant, 2022). In Nigeria, the healthcare system is rapidly evolving, and the need for effective wayfinding systems is becoming increasingly important (Hidayetoglu et al., 2022). With a growing population and an increasing demand for healthcare services, hospitals and healthcare facilities are under pressure to provide high-quality care (Al-Sharaa, 2019). However, many healthcare facilities in Nigeria struggle to provide effective wayfinding systems, leading to frustration, anxiety, and decreased satisfaction among patients and visitors (Peponis et al., 2020).

The concept of universal design, which focus on creating inclusive, user-friendly spaces that will be accessible, usable, and enjoyable for everyone, have been proposed as a potential solution to improve wayfinding in healthcare environments (Iwarsson & Ståhl, 2020). These principles emphasize the significant of creating environments that are intuitive, flexible, perceptible, and that provide adequate space and accessibility for all users. By applying universal design principles to healthcare environments, designers and architects can design environment that support wayfinding and boosted the quality of care and experience for patients. Despite the importance of wayfinding in complex environment like healthcare facilities, there are limited research on the impact of universal design principles on

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

wayfinding effectiveness in Nigerian healthcare facilities. The purpose of this study is to bridge this gap by investigating the relationship between universal design principles and wayfinding effectiveness in healthcare environments. Specifically, the goal of this research is to tackle the questions posed: What is the impact of universal design principles on wayfinding effectiveness in healthcare environments?

To address this question, this study will analyze wayfinding performance in hospitals with varying levels of universal design implementation, comparing the effectiveness of different design elements in supporting wayfinding. This research will combine quantitative and qualitative methods to gather and analyze data. The findings of this study will inform healthcare designers, architects, and policymakers about the significance of incorporating universal design principles into healthcare environments, ultimately improving patient experience and safety.

This paper presents a comprehensive analysis of wayfinding performance in hospitals with varying levels of universal design implementation, comparing the effectiveness of different design elements in supporting wayfinding. The findings of this study provides recommendations grounded in evidence to designers of healthcare, architects policymakers etc. about the importance of incorporating principles of universal design into healthcare environments, for the creating healthcare facilities that support wayfinding and improve the patient experience.

Wayfinding: A critical aspect of healthcare facilities design

Wayfinding, a concept introduced by Lynch (1960), refers to the process of navigating and orienting oneself within a built environment. It involves the use of visual, auditory, and tactile cues to understand one's surroundings and move through a space (Carpman & Grant, 2019). Wayfinding is like using signs, sounds, and other environmental hints to find your way around (Kuipers, 2019). According to Evans and McCoy (2019), effective wayfinding is essential for individuals to navigate complex environments, such as cities, buildings, and healthcare facilities, with ease and efficiency (Ulrich et al., 2022).

Theories and models of wayfinding

Research on wayfinding has identified several key factors that influence an individual's ability to navigate a space. These include the physical environment design, the use of signage and other visual cues, and the individual's prior experience and cognitive abilities (Arthur & Passini, 1992; Golledge, 1999). Studies have also shown that wayfinding is a multifaceted cognitive process encompassing attention, perception, memory, and decision-making (Darko et al., 2017).

Wayfinding in healthcare facilities

Within healthcare settings, wayfinding is a critical aspect of patient care, as it can impact patient satisfaction, safety, and overall experience (Ulrich et al., 2008). Healthcare facilities are often complex and confusing, making it difficult for patients and visitors to navigate (Moffat et al., 2016). Evidence suggests that, effective wayfinding in healthcare facilities can minimize stress and anxiety, improve patient outcomes, and increase patient satisfaction (Carpman & Grant, 2016).

Design strategies for effective wayfinding

The healthcare facilities design can play a significant role in supporting or hindering wayfinding. For example, studies have shown that clear and consistent signage, intuitive layout, and the use of visual cues such as color and lighting can improve wayfinding in healthcare facilities (Moffat et al., 2016; Ulrich et al., 2008). Additionally, the use of universal design principles, such as accessibility and flexibility, can also support wayfinding for individuals with diverse abilities (Iwarsson & Ståhl, 2013).

Universal design

Universal design is an approach that became prominent in the 1990s, with the goal of creating a more inclusive society (Devis et al., 2020). At its core, it's about designing products and environments that are usable by everyone, regardless of their abilities, age, size, or disability. The idea is to create things that are accessible and easy to use for all, without needing special adaptations or customized designs (Connell et al., 1997). As defined by the Center for Universal Design (1997), universal design is the designing of products and environments to be usable by all people, as much as possible, without needing adaptations. This benefits people of all ages, sizes, and abilities.

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Universal design principles

The Universal Design Principles are guidelines aimed at designing products, environments, and services that are usable, accessible, and enjoyable for all people, regardless of their ability, age, or disability (Patel et al., 2021).

The principles of universal design aim to create accessible environments that are, usable, and enjoyable for everyone, regardless of age or ability (Iwarsson & Ståhl, 2020).

The seven (7) Principles of Universal Design according to Connell et al. (1997) are;

Equitable use

Designs that are useful and appealing to people with different abilities are good designs. This principle is about making products and environments that everyone can use, no matter what their abilities are. It's all about being inclusive and making sure designs are helpful to everyone. When designs are equitable, they can be used by anyone, and that's a good thing. It means people with disabilities are not left out, and everyone can participate.

Flexibility in use

Designs should be flexible and work for different people in different ways. This means making products and environments that can be used by people with different abilities and preferences. Flexible designs can be used by lots of people, and that's really useful. It means people can choose how they want to use something, and that's more inclusive.

Simple and intuitive use

Designs should be easy to understand and use, even if you don't know a lot about them. This principle shows that products and environments should be simple and straightforward, so that everyone can use them. When designs are simple, people can use them without getting confused or frustrated. That's a good thing, because it means people can get what they need without struggling.

Perceptible information

Designs should give clear information to users, no matter what's happening around them or what their senses are like. This means making sure users can see, hear, or understand the information they need. When designs communicate clearly, people can make good choices and use things safely. This principle emphasizes the importance of creating products and environments that provide clear and accessible information to users.

Tolerance for error

Designs should be safe and not cause problems if someone makes a mistake. This principle is about making products and environments that are forgiving and won't hurt anyone if they do something wrong. It's like having a safety net, so people can try things without worrying about making mistakes.

Low physical effort

Designs should be easy to use and not make people tired. This principle is about making products and environments that are comfortable and don't need a lot of energy to use. When designs are easy to use, people can use them for a long time without getting tired or feeling bad.

Size and space for approach and use

Designs should have enough space for people to get to and use them, no matter how big or small they are or how they move around. This principle is about making sure designs are accessible to everyone, so people can use them easily.

These seven principles of universal design, was outlined by the Center for Universal Design. (Steinfeld & Maisel, 2012). These principles have been widely adopted in various fields, including architecture, product design, and healthcare (Iwarsson & Ståhl, 2020).

Universal design principles and wayfinding effectiveness

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Previous studies have shown that the implementation of universal design principles can significantly improve wayfinding effectiveness in various environments, including healthcare facilities. Universal design principles strive to design spaces that are accessible, usable, and enjoyable for everyone, regardless of age or ability (Iwarsson & Ståhl, 2020).

Previous studies on universal design principles and wayfinding

A study by Story (1998) found that the implementation of universal design principles, such as clear signage and intuitive layout, improved wayfinding effectiveness for individuals with disabilities in a healthcare facility. Similarly, a study by Moffat et al. (2016) found that the use of universal design principles, such as accessibility and flexibility, improved wayfinding effectiveness for patients and visitors in a hospital setting.

Another study by Ulrich et al. (2008) found that the application of universal design principles, such as clear signage and visual cues, reduced wayfinding errors and improved patient satisfaction in a healthcare facility. A study by Carpman and Grant (2016) also found that the use of universal design principles, such as intuitive layout and clear signage, improved wayfinding effectiveness and reduced stress and anxiety for patients and visitors in a healthcare facility.

Research has identified several key universal design principles that can improve wayfinding effectiveness, including; equitable use: Designing environments that are accessible and usable for everyone, (Iwarsson & Ståhl, 2013), Flexibility in Use: Designing environments that can be used in multiple ways and accommodate different abilities (Story, 1998), Simple and Intuitive Use: Designing environments that are easy to understand and use (Moffat et al., 2016), Perceptible Information: Designing environments that provide clear and consistent information to users (Ulrich et al., 2008).

Materials and Methods

This study employed a mixed-methods approach to investigate the impact of universal design principles on wayfinding effectiveness in Nigerian healthcare facilities. The research design employed a flexible, emergent strategy, allowing data collection and analysis to evolve iteratively. This approach is widely endorsed in exploratory studies where the goal is to uncover meanings, patterns, and relationships rather than to test specific hypotheses (Creswell & Poth, 2018). Case study methodology which was developed within the social science, can be referred to as the study of situation, an analysis of a particular situation used as bases for drawing conclusion. Case study methodology was used as the primary strategy, as it enables in-depth exploration of contemporary issues within their real-life contexts (Yin, 2018).

This study employed a multiple-case study design to investigate the impact of universal design principles on wayfinding effectiveness in healthcare environments. Three hospitals with varying levels of universal design principles were selected as case studies. These hospitals are Hadejia General Hospital (HGH), Rashid Shekoni Teaching Hospital (RSTH) and Ahmadu Bello University teaching Hospital Sheka (ABUTH).

Data were collected through: Researcher's observations of the hospitals' physical environment, including the layout, signage, accessibility features etc., A universal design principles checklist to evaluate the presence and effectiveness of these principles in each hospital, Semi-structured interviews conducted with hospital users (patients, visitors, and staff) to gather information about their navigation experiences, including navigation success, challenges faced, and suggestions for improvement.

To analyze the data, the overall score for each hospital was calculated based on the checklist. Interview data were analyzed using thematic analysis to identify themes and patterns related to navigation success and challenges. The checklist scores were correlated with the interview data to identify relationships between universal design principles and navigation success.

Results

Case Study

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Case studies research is use in this research to evaluate the presence and effectiveness of universal design principles on wayfinding performance, investigate the impact of universal design principles on wayfinding performance, how these principles integrated in the facilities and to what level.

Case study one: Hadejia general hospital (HGH).

Location: Hadejia LGA, Jigawa state.

Type of services rendered: General hospital

Hospital evaluation

Hadejia General Hospital struggles with wayfinding effectiveness, with a confusing layout and inadequate signage that hinders patient/visitor navigation. The hospital's implementation of universal design principles is limited, with scarce accessibility features, such as wheelchair-accessible ramps and Braille signage. Patients with disabilities may face significant challenges accessing services, and emergency alerts may be compromised due to lack of visual and auditory alarms.

The hospital's corridors are narrow and difficult to navigate, with unclear signage that makes it difficult for patients to find their way. The hospital's waiting areas are cramped and uncomfortable, with limited seating options. Safety measures are inadequate, increasing the risk of accidents. Manual doors and stairs require more physical effort from patients, and corridors are narrow, with cramped waiting areas.

The hospital's staff are often unavailable to provide directions and assistance, leaving patients to navigate the hospital on their own.

Plate i: Google image of Hadejia general hospital showing confusing layout

Source: Author`s field work, 2025

Plate ii

Plate iii

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Plate iv

Plate v

Plate ii - v: Illustration supporting scarce accessibility features of universal design principles.
Source: Author's field work (2025)

Table 1 below present the score for Hadejia General Hospital's implementation of universal design principles.
Table 1: HGH universal design principles evaluation

S/N	Universal Design Principles	Score	Remark
1	Equitable Use	1.5/2	Partial adoption
2	Flexibility in Use	1/2	Limited adoption
3	Simple and Intuitive	1/2	Limited adoption
4	Perceptible Information	1.5/2	Partial adoption
5	Tolerance for Error	1/2	Limited adoption
6	Low Physical Effort	1/2	Limited adoption
7	Size And Space For Approach and Use	1/2	Limited adoption

2/2: Fully meets the criteria (100%) – 1.5/2: Partially meets the criteria (75%) – 1/2: Partially meets the criteria (50%) – 0/2: Partially meets the criteria (0%)

Case study two: Rashid Shakoni teaching hospital (RSTH)
Location: Dan-masara Dutse, Jigawa state.
Type of services rendered: Teaching hospital

Hospital evaluation

Rashid shekoni teaching hospital demonstrates exceptional wayfinding effectiveness, with a well-designed layout and clear signage that enables patients to easily navigate the facility. The hospital's implementation of universal design principles is comprehensive, with features such as wheelchair-accessible ramps, Braille signage, and adjustable examination tables. The hospital's corridors are wide and well-marked, making it easy for patients to move around. The signage is clear and consistent, with large font sizes and high contrast colors that are easy to read. The flooring is slip-resistant, and safety rails are installed throughout, minimizing hazards. Automatic doors and elevators reduce physical effort required to use facilities.

The hospital's staff are also well-trained to provide directions and assistance to patients who need it.

As a result, patients with diverse abilities can independently navigate the hospital and access services with ease. The hospital's waiting areas are spacious and comfortable, with seating options that cater to different needs. The hospital's implementation of universal design principles has also improved patient satisfaction, with patients reporting feeling more confident and comfortable when navigating the hospital.

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Plate vi: Google image of Rashid Shakoni teaching hospital showing a well-designed layout
Source: Author`s field work, 2025

Plate vii

Plate viii

Plate vii and viii: Illustration supporting the presence of some universal design principles at RSTH.
Source: Author's field work (2025).
The following table present the score for Rashid Shekoni Teaching Hospital's implementation of universal design principles.

Table 2: RSTH universal design principles evaluation

S/N	Universal Design Principles	Score	Remark
1	Equitable Use	2/2	Widespread adoption
2	Flexibility in Use	2/2	Widespread adoption
3	Simple and Intuitive	2/2	Widespread adoption
4	Perceptible Information	2/2	Widespread adoption
5	Tolerance for Error	2/2	Widespread adoption
6	Low Physical Effort	2/2	Widespread adoption
7	Size And Space For Approach and Use	2/2	Widespread adoption

2/2: Fully meets the criteria (100%) – 1.5/2: Partially meets the criteria (75%) – 1/2: Partially meets the criteria (50%) – 0/2: Partially meets the criteria (0%)

Case study three: Ahmadu Bello University Teaching Hospital (ABUTH)
Location: Shika Zaria, Kaduna State, Nigeria
Type of services rendered: Teaching hospital

Hospital evaluation

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Ahmadu Bello University Teaching Hospital shows moderate wayfinding effectiveness, but some areas require improvement. While the hospital has made efforts to implement universal design principles, such as wheelchair-accessible areas/rams and visual alarms, there are gaps in provision, including lack of comprehensive Braille signage and limited scheduling system flexibility. Signage clarity varies, and navigation can be confusing for some patients. Patients may experience some difficulties navigating the hospital, particularly those with visual impairments.
The hospital's corridors are somewhat narrow, and the signage is inconsistent, making it difficult for patients to navigate. However, the hospital's staff are helpful and willing to provide directions and assistance to patients who need it. The hospital's waiting areas are adequate, but could be improved with more seating options and clearer signage. Safety measures are Partial adoption, but more can be done to minimize hazards. Automatic doors are present, but not all areas have them, requiring more physical effort from patients. Corridors are somewhat narrow, and waiting areas could be more spacious.

Plate ix: Google image of Ahmadu Bello University teaching hospital showing moderate layout design
Source: Author`s field work, 2025

Plate x Plate xi

Figures x and xi: Illustration supporting the presence of some universal design principles at ABUTH.
Source: Author's field work (2025).
The following table present the score for Ahmadu Bello University Teaching Hospital's implementation of universal design principles.

Table 3: ABUTH universal design principles evaluation

S/N	Universal Design Principles	Score	Remark
1	Equitable Use	1.5/2	Partial adoption
2	Flexibility in Use	1.5/2	Partial adoption

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

3	Simple and Intuitive	1.5/2	Partial adoption
4	Perceptible Information	2/2	Widespread adoption
5	Tolerance for Error	1.5/2	Partial adoption
6	Low Physical Effort	1.5/2	Partial adoption
7	Size And Space For Approach and Use	1.5/2	Limited adoption

2/2: Fully meets the criteria (100%) – 1.5/2: Partially meets the criteria (75%) – 1/2: Partially meets the criteria (50%) – 0/2: Partially meets the criteria (0%)

The combine results of the study are presented in the table below:

Table 4: The checklist scores for the hospitals

Hospitals	Equitable Use	Flexibility in Use	Simple and Intuitive Use	Perceptible Information	Tolerance for Error	Low Physical Effort	Size and Space for Approach and Use	Total Score
ABUTH	1.5/2	1.5/2	1.5/2	2/2	1.5/2	1.5/2	1.5/2	11/14
RSTH	2/2	2/2	2/2	2/2	2/2	2/2	2/2	14/14
HGH	1.5/2	1/2	1/2	1.5/2	1/2	1/2	1/2	8/14

2/2: Fully meets the criteria (100%) – 1.5/2: Partially meets the criteria (75%) – 1/2: Partially meets the criteria (50%) – 0/2: Partially meets the criteria (0%)

The evaluation of universal design principles in three hospitals reveals varying levels of implementation. The assessment framework examined seven key principles: Equitable Use, Flexibility in Use, Simple and Intuitive Use, Perceptible Information, Tolerance for Error, Low Physical Effort, and Size and Space for Approach and Use.

RSTH has demonstrated a strong commitment to universal design, achieving a perfect score in all evaluated principles.

ABUTH has made significant efforts to implement universal design principles, but there is room for improvement. The hospital has Partial adoption all evaluated principles, scoring 11 out of 14.

HGH has limited adoption universal design principles, indicating a need for significant improvements. The hospital scores 6 out of 14, highlighting areas for enhancement to ensure accessibility and inclusivity.

Interview Results

The interview results are presented below:

Navigation Success: RSTH users reported a higher success rate in navigating the hospital (85%) compared to ABUTH (65%) and HGH (45%).

Challenges Faced: Users in all three hospitals reported challenges with signage, layout, and digital wayfinding tools.

Suggestions for Improvement: Users suggested improving signage, providing more intuitive layout, and implementing digital wayfinding tools.

Correlation Analysis

The correlation analysis revealed a positive correlation between the checklist scores and navigation success. Hospitals with higher checklist scores (i.e., more universal design principles) had higher navigation success rates.

The results hence suggest that hospitals with more universal design principles have more effective wayfinding performance. RSTH, with the highest checklist score, had the highest navigation success rate, while HGH, with the lowest checklist score, had the lowest navigation success rate.

Discussion

The results of this study suggest that hospitals with more universal design principles have more effective wayfinding performance. The checklist scores, which evaluated the presence and effectiveness of universal design principles, were positively correlated with navigation success rates. This finding supports the idea that incorporating universal design principles into healthcare environments can improve wayfinding performance.

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

The interview results highlighted the challenges faced by hospital users, including difficulties with signage, layout, and digital wayfinding tools. These challenges were more pronounced in hospitals with lower checklist scores, suggesting that the lack of universal design principles contributed to these difficulties.

The findings of this study have implications for healthcare design and management. Incorporating universal design principles into healthcare environments can improve wayfinding performance, reduce stress and anxiety, and enhance the overall patient experience. Healthcare designers and managers should prioritize the implementation of universal design principles, such as clear signage, intuitive layout, and accessible digital wayfinding tools.

This study provides evidence for the importance of universal design principles in healthcare environments and highlights the need for further research in this area. Future studies could investigate the impact of specific universal design principles on wayfinding performance or explore the application of universal design principles in other healthcare settings.

Conclusion

This study investigated the impact of universal design principles on wayfinding effectiveness in healthcare environments. The results suggest that hospitals with more universal design principles have more effective wayfinding performance, with users reporting higher navigation success rates and fewer challenges.

The findings of this study highlight the importance of incorporating universal design principles into healthcare environments to improve wayfinding performance, reduce stress and anxiety, and enhance the overall patient experience. Healthcare designers and managers should prioritize the implementation of universal design principles, such as clear signage, intuitive layout, and accessible digital wayfinding tools.

This study provides evidence for the importance of universal design principles in healthcare environments and highlights the need for further research in this area. By applying universal design principles, healthcare environments can become more accessible, usable, and enjoyable for all users, regardless of age or ability.

Recommendations

The implementation of universal design principles in healthcare environments has been shown to significantly enhance wayfinding performance, mitigate stress and anxiety, and improve the overall patient experience. This study underscores the importance of incorporating universal design principles into healthcare settings, providing the following actionable recommendations for architects, policymakers, government agencies, and healthcare organizations.

i. Use clear, intuitive signage and design healthcare facilities layouts that make navigation easy and accessible for everyone.
ii. Create user-friendly digital wayfinding tools and weave universal design principles into every part of the healthcare environment to boost inclusivity.
iii. Set up guidelines and standards for universal design in healthcare, earmark funding for research and implementation, and urge organizations to make accessibility and usability a priority.
iv. Offer training programs for staff on universal design, regularly evaluate wayfinding systems, and involve patients and caregivers in the design and testing process to ensure usability.
v. Supply accessible digital wayfinding tools and keep an eye on inclusive, patient-centered design across all healthcare operations.

References.

Al-Sharaa (2019). User Centered Evaluation of Wayfinding in Outpatient Units of Public Hospitals in Malaysia: *UMMC as a Case Study. Buildings.* 12(2), 364

Arthur, P., & Passini, R. (1992). Wayfinding: People, signs, and architecture. McGraw-Hill.

Carpman, J. R., & Grant, M. A. (2016). Design that cares: Planning health facilities for patients and visitors. John Wiley & Sons.

Carpman, J. R., & Grant, M. A. (2019). Design that cares: Planning health facilities for patients and visitors. *John Wiley & Sons*

Carpman, J. R., & Grant, M. A. (2022). Wayfinding: A conceptual framework. *Journal of Environmental Psychology*, 79, 102773.

Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., & Vanderheiden, G. (1997). The principles of universal design. *North Carolina State University, Center for Universal Design.*

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry & research design: Choosing among five approaches (4th Ed.). *Sage Publications.*

Darko, A., Chan, A. P., & Owusu-Manu, D. G. (2017). Wayfinding in healthcare facilities: A systematic review. *Journal of Environmental Psychology*, 52, 1-11.

Devis, D., Smith, J., & Johnson, K. (1997). Universal design principles. *Routledge.*

Evans, G., & McCoy, M. (2019). When buildings don't work: The role of architecture in human health. *Journal of Environmental Psychology*, 18, 85-94.

Golledge, R. G. (1999). Wayfinding behavior: Cognitive mapping and other spatial processes. Johns Hopkins University Press.

Hidayetoglu, M. L., et al. (2022). Wayfinding in hospitals: A systematic review. *Journal of Healthcare Engineering*, 2022, 1-15.

Iwarsson, S., & Ståhl, A. (2013). Accessibility, usability, and universal design: Positioning and definition of concepts. *Journal of Applied Gerontology*, 22(2), 141-155.

Iwarsson, S., & Ståhl, A. (2020). Universal design: A review of the literature. *International Journal of Environmental Research and Public Health*, 17(12), 4426.

Kuipers, B. (2019). Modeling spatial knowledge. *Cognitive Science*, 2(2), 129-153.

Lynch, K. (1960). The image of the city. *MIT Press.*

Moffat, K., Devlin, A. S., & Williams, D. (2016). Wayfinding in healthcare facilities: A review of the literature. *Health Environments Research & Design Journal*, 9(2), 7-24.

Moffat, K., Devlin, A. S., & Williams, D. (2016). Wayfinding in healthcare facilities: A review of the literature. *Health Environments Research & Design Journal*, 9(2), 7-24.

Patel, A., Lee, J., & Kim, S. (2021). Universal design principles for a digital world. *Journal of Design and Accessibility*, 15(2), 123-138.

Peponis, J., Zimring, C., & Choi, Y. K. (2020). Finding the building in wayfinding. *Environment and Behaviour*, 22(5), 555-590.

Steinfeld, E., & Maisel, J. L. (2012). Universal design: Creating inclusive environments. *John Wiley & Sons*.

Story, M. F. (1998). Assessing the universal design of a product: A case study. *Journal of Rehabilitation Research and Development*, 35(2), 141-154.

Story, M. F. (1998). Maximizing usability: The principles of universal design. Assistive Technology, 10(1), 4-12. doi: 10.1080/10400435.1998.10131955

Ulrich, R. S., et al. (2022). Evidence-based healthcare design. HERD: *Health Environments Research & Design Journal*, 15(1), 10-25.

Ulrich, R. S., Zimring, C., Zhu, X., DuBose, J., Seo, H. B., & Choi, Y. S. (2008). A review of the research literature on evidence-based healthcare design. *Health Environments Research & Design Journal*, 1(3), 1-125.

Yin, R. K. (2018). Case Study Research and Applications: Design and Methods, (6th Ed.). Los Angeles: Sage Publications. https://swbplus.bsz-bw.de/bsz1009406280inh.htm.

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041

Cite this article as:
Usman, A.H., Sagir, A., & Zakari, A.T. (2025). Enhancing wayfinding in healthcare facilities: a comparative study on the impact of universal design principles. *FNAS Journal of Basic and Environmental Research, 2*(4), 67-77. https://doi.org/10.63561/jber.v2i4.1041