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Implications of Signage on Wayfinding Behaviour of Users: Towards Inclusive Design of Hospital Environment in Nigeria

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Inadequate signage systems and architectural design create physical barriers that cause uneven access to users of hospital buildings during wayfinding, which causes stress, uncertainty, and an unpleasant experience for both staff and patients. The study examines the effects of signs on wayfinding behaviour to achieve inclusive wayfinding in the design of hospitals in Nigeria. The study was conducted at the University of Ilorin Teaching Hospital (UITH), Ilorin Kwara State, Nigeria. A mixed-methods approach was employed for data collection through a survey administered to 140 participants (70 male and 70 female). Thirty respondents were interviewed, and the hospital buildings were observed. According to the findings, direction signage has the most impact on wayfinding since users rely on it the most to make wayfinding decisions, followed by identification signage (text/support icons) that aids in the recognition of target locations. Also, the result illustrates that signage was supported with pictographs while text was interpreted in the main local language (Yoruba), which enhanced understanding of signs across cultures in the state. As a result, the conceptual design and placement of signage and other inclusive navigation components in the hospital should be purposefully and suitably employed, simplified, useful, and appealing for inclusive access, meaning, and interpretation. The main limitation of this study is the non-utilisation of digital signs and various assistive technologies for impaired (sensory and mobility) people of varied ages and abilities.

Keywords: hospital wayfinding, hospital buildings, Inclusive design, Nigeria, signage systems

INTRODUCTION

A well-designed signage system in hospitals can decrease users' stress, enhance their safety, and boost the effectiveness of care due to efficient wayfinding (de Aboim Borges, 2020; Grey *et al*., 2018). Globally, there are attainable policies and principles through which hospital signage is evolved and enforced (Simoes, 2019). Signs help people to identify the destination, and recognize potential risk with safe escape routes in an emergency (Ferleger, 2022; Morag, 2016). Wayfinding systems employ signage as a method that allows people to efficiently use their abilities (language, observation, knowledge, memory, and problem-solving abilities) to get from one location to another (Harper *et al*., 2020; Man-chang, 2016). Despite efforts to provide hospital signage, a varied set of users considered it inefficient for hospital navigation since the signs are not accessible and useful for a wide range of individuals (Liu *et al*., 2018). This inaccessible and ineffective signage by a wide range of individuals causes stress, getting lost, frustration, time wasted, and, in emergency circumstances, death (binti Azman, 2019; Hashim, 2014). There is still a paucity of knowledge of signage accessibility by different users (Rodrigues *et al*.,2020). Buyruk (2019) investigated users' behaviour toward signage systems, and the findings revealed that users had difficulty finding their way due to flaws in

existing signage. This finding did not address navigation challenges in outpatient clinics, where they may be more prevalent due to waiting time. Signage information represents a form of social control that limits people's movement and behaviour (Chapelle, 2018). Hospital signage systems should take into account users' different requirements and abilities, such as the old, the unlearned, the blind, and the crippled. Thus, the study assesses the effects of signs on wayfinding behaviour to achieve inclusive wayfinding design in hospitals in Nigeria.

LITERATURE REVIEW

Signage Design Trends and Inclusive Wayfinding

A wayfinding system is designed to direct and assist people in going from one area to another. In a hospital setting, this entails assisting patients and visitors in moving from one portion of a hospital facility to another via other buildings dispersed around a bigger hospital campus (de Aboim Borges, 2020). A navigation system is intended to familiarise regulars with their surroundings to make transactions secure, comfortable, and repeat trips easier (Garg & Dewan, 2022; Wu & Wang, 2017). Jefferies and Klisans (2020) espoused that the complexity of building layout, in addition to visual access and spatial distinction, signage has the greatest influence on wayfinding performance. Effective hospital wayfinding can reduce stress, increase care efficacy and improve safety (Grey *et al.*, 2018). Accessibility and inclusive design are to ensure that people's needs especially those with functional and limited mobility are properly taken into consideration (Simoes, 2019). Patients with disabilities, such as the elderly or the disabled, are unable to visit hospitals if the buildings are physically inaccessible to them. Accessibility means people with disabilities and special needs are not prevented by architectural barriers in reaching their desired destinations (Prandi *et al.*, 2021). Hospital architecture and hospital wayfinding systems must accommodate various types of users in terms of travel accessibility and building quality-of-use (Shen *et al.*, 2020). Disabled people visit hospitals more frequently than able-bodied people, and the majority of people who visit hospitals are disabled due to their medical conditions (Kompany, 2011; Mollerup, 2009).

Signage as a factor comprises arrow-shaped directional and destination signs, labelling and numbering of rooms or buildings, pictographs, and maps that portray meaning symbolically (Iftikhar *et al.*, 2021). For visually challenged users, Braille and tactile signs are required, whereas signs for the mobility impaired (wheelchairs and the elderly) are normally situated at 1200 mm (Wu & Wang, 2017). A clear sign can be confusing if it is situated in the middle of a competing visual cluster (Prandi *et al*., 2021). A well-designed and placed sign cannot compensate for other poor environmental cues throughout the circulation area (Arthur & Passini, 1992). The two basic techniques of conversing complex thoughts during navigation are through words and signs (Upadhyay & Balakrishnan, 2022).

Wayfinding in hospitals is influenced by culture due to the diverse users' cultural and linguistic backgrounds (Lee *et al.*, 2014; Liu *et al*., 2018). Also, medical terminology, low literacy rates, and language consistency for multilingual populations continue to offer challenges (Shen *et al.*, 2020). There is an increasing demand for universal and recognisable symbols to be developed to facilitate communication with users from various cultural and language backgrounds (Rodrigues *et al.*, 2019). Rodrigues *et al.* (2020), stated that a well-organized layout and signage can reduce wayfinding issues.

Jefferies and Klisans (2020), espoused that the usage of pictographs would aid in reducing wayfinding problems in nations with significant illiteracy rates or among immigrants. However, if a building's design fails to provide adequate visual access, distinctiveness, and clarity, signage may be insufficient for wayfinding (Sadek, 2015).

A building layout that has an open core provides users the visual and mobility access to the structure of the circulation network (Haghani & Sarvi, 2017). Other factors that influence the use of signage in hospital navigation include circulation space and colour. As a result, architectural distinctiveness and circulation spaces are important factors in the use of signage in navigation (Ruototo *et al.*, 2018). The use of colour in buildings and signage plays an important role in wayfinding. Colour strips are frequently utilised in hospitals to direct patients to specific locations (Ekstrom *et al*., 2018). Furthermore, bold contrasting hues draw the eye, but not too many should be used to avoid confusion (Jefferies & Klisans, 2020).

Rodrigues *et al*. (2020), investigated users' perspectives on current signage in Portuguese hospitals. The results show that consumers were hopeful about the existing signage. However, their comments and observed behaviour exposed that the majority were inclined to dismiss the indications and chose to seek assistance from employees, resulting in a waste of time. Wu and Wang (2017) created accessible signs in a Taiwanese urban park using inclusive design thinking. Findings revealed that the elderly and disabled populations must be taken into account when designing signage for wayfinding. Man-Chang (2016) examined the effect of signage on elderly wayfinding, discovering that signs were simplified and an acceptable ratio of visuals and text was employed in both the Chinese and English languages. The result shows a high colour contrast between the background and graphics to provide a match of visibility, legibility, and identification for efficient navigation. However, there has been a dearth of research on the effects of signs on wayfinding behaviour to accomplish inclusive wayfinding design in the hospital setting (Mustikawati *et al.*, 2017). This knowledge gap in signage necessitates the study to examine the inclusiveness of signage in hospital navigation systems as it affects how users interact with them.

RESEARCH METHODOLOGY

A mixed-method approach with a concurrent strategy was employed for administering the survey questionnaire and semi-structured interviews that serve as instruments. From the medical information unit, the average number of daily outpatients at the hospital is 220, which constitutes the population at the general outpatient department (GOPD). The survey participants were enlisted at GOPD using a simple random sample technique, whereas the interview was conducted using purposive sampling. Bartlett *et al*. (2001) states that Cochran's formula for categorical data in equation (I) should be assumed to have a 95% confidence level and a 5% sampling error, which was used to calculate the sample size as follows:

$n_0 = (t)^{2*} (p) (q) / (d)^2$ …….. (I)

Where t = the chosen alpha value in each tail = 1.96; d = acceptable margin of error, and alpha =.05. Therefore, $n_0 = (1.96)2* (.5) (.5)/(.05)2 = 384$.

As a result, for sample size, Cochran's corrective formula in equation (II) was applied as follows:

$n_1 = 1 + n_0/(1 + n_0/\text{population})$ …… (II)

Where there are 220 people, $n_1 = 384/1+384/220) = 140$; n_0 = needed return sample size according to Cochran's formula = 384; n_1 = required return sample

size as a sample greater than 5% of the population = 384. Thus, the surveys predicted sample size of 140 respondents (70 male, 70 female) that was used. The number of survey questionnaires sent out was 150 to allow for incomplete or unreturned survey, however, only 140 were returned. This resulted in a 93.3 per cent response rate. The sample size for the interview was determined by theoretical data saturation, which means the point at which more interviews will not provide any new information (Sing & Masuku, 2014). As a result, saturation was achieved at 30 interviews, which served as the study's sample size. Previous research has suggested that minimum sample size limits of 10-15 interviews are appropriate for theoretical data saturation in qualitative interviews (Morse, 2000).

Ethical approval for the study was granted by the University of Ilorin Teaching Hospital, Ethical Research Committee. The purpose of the study was explained to the participants, verbal informed consent was obtained from them before their participation in the study. The study questionnaire includes 41 questions divided into three sections: signage, inclusive design, and wayfinding behaviour. Thirty (30) respondents were interviewed in both English and Yoruba. The introduction of staff nurses as research assistants increased the respondents' confidence and response rate (93.3%). The questions were graded on a 5-point Likert scale to determine the frequency and percentages of the users' perceptions. For each interview, the minimum length for the interview session and audio recording was between 30 and 40 minutes. The audio recording was made known to the respondents.

Data Analyses

The survey questionnaire data were descriptively analysed using the Statistical Package for the Social Sciences (SPSS) edition 23. To obtain frequencies and percentages, the poll used a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The weighted score (WS) and weighted mean value (WMV) for each item were calculated and ranked based on the mean values.

The data from the interviews were transcribed and evaluated using content analysis. The recurring themes were determined from the texts, which emerged to reflect a wide range of navigational expertise from all of the respondents. The frequency of related categories was calculated to determine the number of recurrences to avoid repetition and promote commonalities as stated by Miles *et al*. (2014). Peer debriefing was used by allowing expert researchers to read through the analysed data to increase credibility (Nguyen, 2008). This was done to ensure transparency, sensitivity, and understanding throughout the whole data gathering and analysis process.

RESULTS AND DISCUSSION

Survey Results

Table 1 revealed that the majority (85%) of the respondents could read the signs and placed signage, and room numbering ranked first as the most influential features in the wayfinding process. The findings support the findings of earlier research that indicate signage has a favourable impact on patients' ease of navigating in hospitals (Brunye *et al.*, 2018). Other qualities, such as landmarks, building arrangement, colour strips on the walls, symbols, and pictographs, were effective and contributed to successful wayfinding. This finding supports the findings of Basri and Sulaiman (2013), which revealed that providing is insufficient for wayfinding, and other factors such as landmarks, building layout, colour strips, and signage height signage alone all contribute significantly to the effectiveness of the wayfinding experience. Traditional maps, tactile maps, and Braille signs were not fully incorporated into the hospital's signage design, as ranked 17th (37.2 %)

and 18th (34.2 %), respectively, and were disagreed upon by the respondents. Consequently, the visually challenged patients were excluded from the signage, which had a detrimental impact on the hospital's inclusive design for a wide range of users.

Table 1: Use of Signage in hospital wayfinding

Item	WS	WMV	Ranking	reading
A1: Information from signage and room numbers helps to find direction and destination	119	4.25	1st	Agree
A10: Signage is accessible, well placed, and well lighted	117	4.18	2rd	Agree
A18: In the hospital, I pay more attention to directional signs	115	4.11	3rd	Agree
A2: Prominent landmarks including signs help to provide orientation and ease wayfinding to all users..	114	4.07	4th	Agree
A9: Signs adequately give useful information for directions at junctions	112	4.00	5th	Agree
A7: The symbol used is clear and understood by all users.	110	3.93	6th	Agree
A8: Pictographs and symbols help people recognise and understand quickly their destinations..	108	3.86	7th	Agree
A11: Signs are placed at a lower level where they can be seen by all users, bearing in mind wheelchair	106	3.79	8th	Agree
A4: Buildings layout is logically organised and ranked for easy wayfinding of all users.	102	3.64	9th	Agree
A17: Wall colour strips used were helpful for directional guide to the destination during wayfinding.	99	3.54	10th	Agree
A6: Designed signage system makes destination easy to identify from the hospital entrance.	97	3.46	11th	Agree
A5: Usual maps are helpful for wayfinding, finding direction, and identifying accessible routes.	86	3.07	12th	Agree
A16: Tactile maps and models at the entrance to a building helps ease wayfinding for the visually impaired.	74	2.64	13th	Agree
A3: Signs have Braille built-in that helps the visually impaired to easily locate destinations.	70	2.50	14th	Agree
A13: Signage with lower case signs is easy to read by people with visual impairments.	66	2.36	15th	Disagree
A12: Signs are located where they cause obstruction and confusion	55	1.96	16th	Disagree
A14: Signs have Braille integrated to help the visually impaired to reach and locate destination easily.	52	1.86	17th	Disagree
A15: The hospital has tactile signs of embossed lettering and raised pictograms for easy wayfinding of the visually impaired	48	1.71	18th	Disagree

*WS = Weighted Sum; WMV = Weighted Mean Value; Source: Author's fieldwork, 2021

Based on Table 2, circulation spaces (WMV of 4.32), entry and exit ramps (WMVs of 4.25 and 4.20, with 85%, 84%, respectively), handrails and ventilation controls were deemed most accessible. The majority (86.4% of respondents agreed that these qualities provided easy wayfinding to destinations. The hospital

environment was found to be user-friendly for diverse categories of users in terms of navigation. Certain sensory and physically challenged (elderly and visually impaired) respondents had differing opinions on chairs and elevator controls. This indicates that attention should be placed on the conceptual design of signage systems in hospitals that promote inclusive wayfinding. This validates the findings of earlier study of Wu and Wang (2017) that signage and inclusive wayfinding design are the most effective factors in reducing navigational errors such as wrong turns and backtracking.

Table 2: Users' responses on Inclusive design factors for wayfinding

Item	WS	WMV	Ranking	Interpretation
B6: Circulation spaces allow all groups of users to move freely for easy wayfinding (e.g. wheelchair, visually impaired, elderly and children).	121	4.32	1st	Agree
B2: Building entrance has ramps and tactile signs	119	4.25	2nd	Agree
B7: Entrance door handles are at a height reachable by all users.	118	4.20	3rd	Agree
B4: Building entrance is visible with an adequate minimum landing area of 1200mm × 1200mm for the physically challenged.	116	4.15	4th	Agree
B5: Easy identification of stairway and lift by all users	114	4.07	5th	Agree
B3: Handrails and contrasting surfaces are provided to risers and treads on internal circulation.	107	3.82	6th	Agree
B1: Pathways is sufficient to enable wheelchairs and baby buggies negotiate routes conveniently and safely at junctions.	105	3.74	7th	Agree
B8: Ventilation controls are positioned for use by wide range of hospital users.	98	3.50	8th	Agree
B10: Seating arrangements were provided to ensure wheelchair and other users' easy navigation.	70	2.49	9th	Disagree
B11: WCs, basins and showers are accessible by all users at the entrance level.	69	2.47	10th	Disagree
B9: Seating of different types, designs and colours are located along the routes to ease navigation.	69	2.46	10th	Disagree
B12: Lift controls are large and contrasting with audible and visual signs/signals.	67	2.40	12th	Disagree

Table 3 shows that the hospital site layout was confusing to the majority of respondents (82.8%), as ranked first. Furthermore, verbal instruction ranked second since it was frequently (78.6%) utilised to help patients find their way in the hospital, Patients' anxiety to arrive on time and without making a mistake ranked third. In addition, respondents made incorrect turns before arriving at their destinations, ranking fifth, sixth, and seventh.

Results show that the hospital environment was unfriendly to a wide spectrum of users, including the physically impaired and those with formal language challenges. This result corroborates the findings of Iftikhar *et al*. (2021) that patients on wheel chairs and those with language barriers are excluded from signage design in the hospitals

examined. However, the direction map pasted on the wall by the main entrance for users' wayfinding was not visible and was not used for direction-finding. This finding substantiates on the study of Liu *et al*. (2018) that patients ask for verbal direction due to the absence of direction map in hospitals. The design implication is to assure a simple composition of building layout and various forms of signage for able-bodied, visually impaired, and wheelchair users.

Table 3: Users' responses on wayfinding behaviour in the hospital

Item	WS	WMV	Ranking	Interpretation
C6: The hospital site layout was very confusing	116	4.14	1st	Agree
C9: Spoken direction was used to find your way around the hospital	110	3.93	2nd	Agree
C8: You were worried when you arrived at the hospital.	106	3.79	3rd	Agree
C7: Getting to destinations was difficult.	98	3.50	4th	Agree
C3: 2 or 3 wrong turn was taken before reaching the destination.	94	3.36	5th	Agree
C5 More than 3 wrong turn was taken before reaching the destination	90	3.21	6th	Agree
C2: One wrong turn was taken before reaching the destination.	87	3.11	7th	Agree
C4: You were happy and relaxed when you arrived at the hospital.	80	2.86	8th	Disagree
C1: The hospital site layout was user-friendly	68	2.43	9th	Disagree
C10: Map was handed out to you for direction or information to find your way.	68	2.43	10th	Disagree
C11: Did you notice map around the hospital for direction.	65	2.32	11th	Disagree

Interview Results

Table 4 shows the content analysis of their responses and the development of the fundamental concept. The excerpts from the respondents states that "*Signs and symbols were key characteristics that aided my travel in the hospital"* (R1), and *"I used the pictographs and signposts on the wall and the door"* (R6). This suggests that the signage served as landmarks and was visible and intelligible. This finding supports the study of Buyruk (2019) that signage are usually used as the main landmarks in wayfinding. The wall colour strips, on the other hand, were confusing to a few patients.

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Table 4: Use of signage for wayfinding in the hospital

Theoretical framework: Identifying themes	**Indexing: coding and merging similar issues**	**Charting: Data abstraction and summary**	**Mapping and Interpretation**
Theme: Use of signage *Signs and symbols are accessible & well placed (12) * Signs are visible to wheelchair users at lower level (4) *Pictographs & symbols are used adequately to clarify understanding of destinations (6) * Signs with Braille are not well placed to help the visually impaired (2) * Use of signs with tactile embossed lettering and raised pictographs are easy to access by the visually impaired (2) *Wall colour strips are confusing (3). *Signs are easy to read by visual impaired users (1)	(A) Signs are visible to all users (**16**)* (B) Tactile signs (**2**) * (C) Signs with Braille **(2)*** (D) Pictographs and symbols (**6**)* (E) Confusing wall colour strips (**3**)* (F) Easy to read signs by few visual impaired users (**1**)*	(A) Signage: signs, symbols & pictographs (**23**)* (R1, R6) (B) Braille & Tactile signs (**4**) * (C) Confusing wall colour strips (**3**)* (R2, R10)	**The major Concept:** Accessible & well placed signs, symbols and pictographs **Interpretation:** Good signage system

A survey asked respondents how they have used inclusive design elements for wayfinding systems in hospitals, schools and other public spaces. Table 5 depicts the result of the content analysis as well as the emergent core notion. Similar ideas were combined and interpreted to come up with a new way of looking at hospital wayfinding.

Table 5 shows that the majority of respondents glanced at the pictures (pictographs), read the signs, and used the signage to find their way to their destinations. For example, the following quotes from respondents bolstered the claim: *"I see the pictures on the wall, look and read the signage; extremely useful; the ward M has a pregnant woman drawn on it and I could locate it"* (R8); *"the labels on the doors are little to see, but I follow the directional signs"* (R9). In this case, the usage of signage was prominent in the hospital's wayfinding for directional and destination identification (See Figures 1 and 2).

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Table 5: Use of inclusive design for wayfinding systems

Identifying themes	Indexing: coding and merging similar issues	Charting: Data abstraction and summary	Mapping and Interpretation
Theme: Use of Signage *Reading signs and symbols for direction (**8**) *Looking at the pictures (**4**) Observing the direction signs (**3**) *I was directed (**4**) *Use of ramps in the hospital (**6**) *I used tactile signs (**2**) *I used signs with Braille (**2**) *Signs were at lower level for wheelchair users (**1**)	(A) Reading signs & symbols for direction (**9**)* (B) Used pictographs & direction signs (**7**) (C) Verbal direction (**4**) (D) Used ramp (**6**) (E) Used tactile signs (**2**) (F) Used Braille signs (**2**)	A and B = **(16)*** (R8, R9) Look at the pictures and read both directional and destination signs C = Verbal direction (**4**)* D) Used ramp (**6**) (E) Used tactile signs (**2**) (F) Used Braille signs (**2**)	The main trend was the use of signage and pictographs (direction & destination signs, symbols, and pictures). **Core concept:** Reading and looking at the symbols and pictographs and the signage

*Frequency of count of concepts

Figure 1*:* Blood bank, UITH Ilorin

Figure 2*:* Laboratory complex, UITH Ilorin

Pictographs were prominently used at the entrance hall, emergency complex, and radiology departments. Patients were seen looking at the pictographs during wayfinding. Except statements from the participants in italics were as follows: *'I used the pictures and sign post on the wall at the Accident and Emergency section, Radiology to know my destinations'….* (P15). This implies that pictographs were efficiently utilised by respondents to navigate the hospital to identify their desired destination (See Figures 3 and 4). Signal was found to be the most significant variable in hospital wayfinding, but there was less use of Braille and tactile signs. This implies that inclusive wayfinding design needs to be improved upon to enable a varied group of users to effectively find their way around the hospital.

Figure 3: Emergency complex, UITH Ilorin

Figure 4: Radiology, UITH Ilorin

CONCLUSION

This study seeks to examine the implications of signs on wayfinding behaviour towards inclusive design in a hospital setting in Nigeria. The major findings revealed that signs are most effective navigation element in the hospital setting. However, inclusive signage for the visually impaired was overlooked for navigating. Sign materials were also translated into the research area's principal native language (Yoruba), to identify and make accessible locations. Direction signage has the largest impact on wayfinding since users rely on it the most. Identification signage (text/support icons) aids in the recognition of target locations. Hospital navigation must contain pictographs, symbols, Braille, and tactile features for the sensory and movement of the disabled patients. This study could not examine the use and efficiency of digital signage in the hospital as it was not accessible. Further research in hospital navigation could concentrate on digital signage equipped with a variety of assistive technologies for people of all ages and abilities.

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