Evaluation of Circulation Efficiency, Flow Patterns and User Satisfaction with Circulation Systems in Health Care Facilities in Osun State

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Abstract- ***The efficiency of circulation systems in healthcare facilities significantly influences patient experience, staff productivity, and overall service delivery. In Osun State, Nigeria, where rural healthcare infrastructure is often outdated and under-resourced, poorly designed circulation patterns contribute to delays, congestion, and low user satisfaction. This study evaluates circulation efficiency, flow patterns, and user satisfaction across selected general and state hospitals in Osun State to identify critical spatial and operational gaps. The study addresses a pressing need to improve healthcare design and delivery in rural Nigerian contexts, where research has historically focused on urban centers. A quantitative research approach was employed. Structured questionnaires were administered to 321 respondents (patients and healthcare staff) across six hospitals selected using stratified and purposive sampling from the state's three senatorial districts. Responses were analyzed using descriptive statistics, mean ranking, standard deviations, and Relative Importance Index (RII) to prioritize key issues affecting circulation efficiency. Findings revealed strong alignment between patients and staff on the importance of logical departmental flow (Mean: 4.29 and 4.05; RII: 0.86 and 0.81, respectively), which ranked highest across all indicators. Both groups also valued environmental comfort, with ventilation in circulation areas scoring high (Patients' RII: 0.76; Staff: 0.79). However, only 62% of patients were satisfied with directional signage, and 66% reported difficulties navigating congested corridors during peak hours. Significant perception gaps emerged: Patients ranked the lack of separation between staff and patient pathways second (RII: 0.77), citing concerns over privacy and cross-infection, while staff placed it 19th (RII: 0.64), showing less concern. Likewise, staff ranked circulation cleanliness 3rd (RII: 0.80), whereas patients ranked it 24th (RII: 0.57), highlighting inconsistency in perceived hygiene standards. Ingress/egress accessibility was valued more by staff (RII: 0.81) for emergency response, but less by patients (RII: 0.63). Satisfaction assessment revealed that 83% of patients found intra-department movement relatively easy (RII: 0.79), while 71% of staff indicated that poor flow patterns significantly delayed service delivery (RII: 0.56). Both groups moderately agreed that current layouts support workflow and reduce stress (RII: 0.69 for patients, 0.68 for staff). In conclusion, the study highlights the critical need for improved circulation design to enhance user satisfaction and operational efficiency in Osun State healthcare facilities. Priorities include optimizing space layouts, reducing cross-traffic delays, improving accessibility, and integrating inclusive, well-ventilated circulation paths. These findings offer actionable insights for healthcare designers, planners, and policymakers aiming to create functional, patient-centered environments in rural healthcare settings, ultimately promoting better health outcomes and equitable access to care.***

Indexed Terms- ***Circulation Efficiency, Flow Patterns, User Satisfaction, Healthcare Design Rural Healthcare Facilities***

I. INTRODUCTION

The architecture and organization of healthcare facilities can be likened to the infrastructure of a small town, where each component plays a vital role in ensuring the overall efficiency of the system (Adetunji & Oladipo, 2019). These facilities are more

than just spaces for medical services; they function as intricate networks of interconnected elements such as patient care areas, administrative offices, laboratories, and support services. The layout and circulation within these facilities greatly influence operational efficiency, patient outcomes, and user satisfaction (Molinari & Guo, 2021). Efficient circulation ensures the smooth movement of patients, healthcare workers, and materials, reducing delays, improving staff productivity, and enhancing the overall patient experience (Ulrich et al., 2008). Conversely, poorly designed circulation systems can result in bottlenecks, increased stress, operational inefficiencies, and elevated risks of cross-infection (Oleribe et.al, 2018)). Designing hospital layouts with a focus on circulation efficiency is thus a crucial aspect of healthcare facility design (Dalton, Hölscher & Montello, 2019; Gupta, & Kant, 2020).). However, many healthcare facilities in Nigeria remain under-optimized in this regard (Oluwadare & Olorunsola, 2020). In Osun State, these challenges are intensified by infrastructural deficits, outdated layouts, and growing patient demand, particularly in rural areas where healthcare infrastructure often struggles to meet contemporary healthcare delivery standards (Aregbesola, Adeyemi, & Olayinka, 2020).

Despite growing awareness of the significance of circulation systems in healthcare facilities, research in Nigeria has predominantly centered on urban settings where resources and infrastructure are comparatively more available, leaving rural areas underrepresented (Adeyemo, 2018; Fenny et.al, 2018). Healthcare facilities in rural Osun State face persistent challenges stemming from inefficient circulation and poorly planned flow patterns, contributing to overcrowding, prolonged patient wait times, operational delays, and reduced quality of care. The absence of clearly defined pathways for patients and staff elevates confusion, stress levels, and the risk of healthcare-associated infections, especially where infection control protocols are difficult to enforce due to resource limitations (Ellner, & Phillips, 2017). Furthermore, inefficiencies in flow patterns negatively impact both patient satisfaction and staff performance (Ulrich et al., 2008; Olanrewaju et.al ,2019)). In Nigerian healthcare facilities, where staff shortages and high patient volumes are prevalent, inefficient circulation imposes additional burdens on healthcare workers, increasing fatigue and dissatisfaction (Federal Ministry of Health, 2016). Despite the global emphasis on integrating sustainable design principles to enhance operational and environmental efficiency in healthcare (Fogliatto et.al, 2019), such practices remain scarcely applied within rural Nigerian healthcare contexts. Addressing these infrastructural shortcomings is therefore essential for improving both service delivery and the user experience in Osun State's healthcare facilities.

This study seeks to assess the circulation efficiency and flow patterns within healthcare facilities in Osun State, Nigeria, with a particular focus on how these factors impact service delivery and user satisfaction. Specifically, it aims to assess the impact of circulation efficiency and flow patterns in the study area and to evaluate the levels of staff and patient satisfaction with existing circulation systems. Additionally, the study will explore how sustainable design principles can be incorporated into the proposed design of a comprehensive healthcare center for Garage Olode in Ife, Osun State, to improve operational flow, reduce healthcare-associated infections, and address environmental concerns (Norman, & Verganti, 2014).). By addressing these critical issues, the research intends to contribute valuable insights for enhancing healthcare infrastructure, promoting equitable access to care, and supporting the broader goals of sustainable healthcare delivery in rural Nigerian communities.

Study Area

Osun State is one of the 36 states in Nigeria, located in the southwestern region of the country. It shares boundaries with Ekiti State to the east, Kwara State to the north, Ogun State to the south, and Oyo State to the west, with approximate coordinates of 7.5°N latitude and 4.5°E longitude (National Bureau of Statistics, 2020). The state features a varied landscape of forest reserves, rivers, and hills that shape its socio-economic activities, particularly agriculture, which remains the backbone of its economy. Major crops such as cocoa, cashew, and oil palm contribute significantly to local and regional markets (Ogunleye, 2019).

Despite its agricultural potential, Osun State faces persistent healthcare infrastructure challenges, particularly in rural areas. Issues such as inadequate facilities, poor funding, and disparities between urban and rural healthcare services hinder effective healthcare delivery (Federal Ministry of Health, 2016). Rural health centres often struggle with inefficient building designs and circulation patterns, leading to overcrowding, extended wait times, and limited access to timely care (Okafor et al., 2019).

Culturally, Osun State is predominantly inhabited by the Yoruba ethnic group, alongside other minority communities. This cultural diversity influences healthcare practices, patient expectations, and infrastructural needs, making it essential for healthcare facility designs to reflect both modern standards and culturally sensitive provisions (Aluko et al., 2021). The state's ongoing efforts to enhance healthcare infrastructure align with Nigeria's national health objectives and the United Nations Sustainable Development Goal 3, which promotes health and well-being for all (United Nations, 2015). This study focuses on identifying the healthcare infrastructure challenges in Osun State, with particular attention to circulation efficiency, providing insights applicable to similar socio-economic and cultural settings.

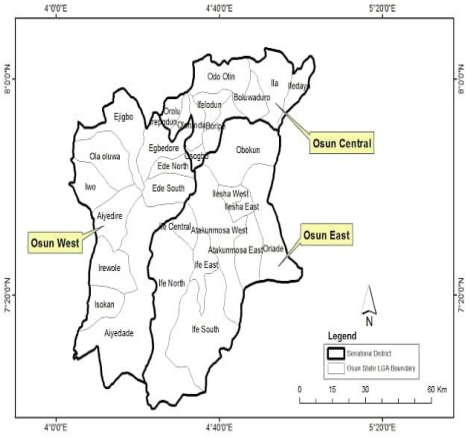

Fig 1.0: Map showing Osun State in the context of its senatorial District

Source: Adeyemo (2023)

II. LITERATURE REVIEW

The historical evolution of healthcare facilities reflects broader societal, medical, and architectural advancements. Early healthcare environments, particularly during the medieval and Renaissance periods, were primarily religious spaces offering basic care to the poor and sick in communal, undivided wards, emphasizing charity over medical sophistication (Henderson, 2006; Omole, 2023). The Industrial Revolution brought significant improvements, as new medical technologies like anesthesia and antiseptics demanded purpose-built, hygienic hospitals with organized layouts, specialized departments, and surgical suites (Risse, 1999; Ademole, 2020). Following World War II, facility design became increasingly patient-centered, prioritizing outpatient services, standardized guidelines, and comprehensive health campuses to accommodate advancing medical practices and technology (Stevens, 1989). The World Health Organization (WHO, 2008) later formalized healthcare facility classifications into primary, secondary, and tertiary levels, each providing distinct services ranging from community-based preventive care to highly specialized treatments in large referral hospitals (WHO, 2012, 2014). Central to modern healthcare delivery is the comprehensive healthcare model, which integrates preventive, curative, rehabilitative, and palliative care under one roof, promoting holistic, accessible, and coordinated services that improve health outcomes and reduce disparities (Orenyi & Joseph ,2018).

Equally important is the efficiency of circulation within healthcare facilities, as it directly affects the quality and timeliness of care. Circulation efficiency refers to the optimized movement of patients, staff, and equipment within a healthcare environment, ensuring seamless workflows, quick response times, and minimal delays (Mourshed & Zhao, 2012). Factors such as facility layout, patient volumes, staff communication, and technology integration play pivotal roles in determining how effectively a healthcare setting functions (Huisman et al., 2012; Joseph & Rashid, 2007). Poor circulation design can lead to congestion, staff fatigue, and patient dissatisfaction, while well-planned circulation pathways improve patient outcomes, operational

costs, and staff productivity (Ulrich et al., 2008; Sadler et al., 2008). Methods like time-motion studies, simulation modeling, and flow analyses are essential for assessing and refining circulation systems (Andersen et al., 2002; Batun et al., 2011). Ultimately, efficient circulation enhances patient safety, streamlines care delivery, boosts staff morale, and improves the overall healthcare experience for both providers and patients (Bowers & Kher, 1994; Gesler et al., 2004).

Flow patterns within healthcare facilities involve the organized movement of patients, staff, information, and materials throughout the healthcare environment. Understanding and optimizing these patterns is crucial for ensuring that healthcare services are delivered efficiently, safely, and effectively (Geremi et al., 2014). These patterns are shaped by factors such as facility layout, service organization, and operational protocols, all of which influence the quality and timeliness of care (Mazzocato et al., 2010). The main categories of flow patterns include patient flow, staff flow, and supply chain flow. Patient flow manages the progression of individuals through different stages of care, aiming to reduce bottlenecks and waiting times (Haraden & Resar, 2004; Powell et al., 2012). Staff flow focuses on enabling healthcare workers to move seamlessly within the facility, ensuring uninterrupted and efficient care delivery (Buchanan et al., 1997; Hendrich et al., 2008). Meanwhile, supply chain flow ensures the timely and accurate movement of essential medical supplies, equipment, and medications (Titze et al., 2020). Healthcare administrators commonly use tools such as workflow analysis (Liker & Morgan, 2006), time-motion studies (Titze et al., 2020), simulation modeling (Hulshof et al., 2012), and lean management techniques (Womack & Jones, 1996) to identify inefficiencies and optimize these operational processes. The ultimate goal is to create smooth, standardized, and predictable patterns of movement that enhance patient outcomes, improve staff productivity, and streamline overall healthcare operations.

Beyond operational efficiency, circulation systems within healthcare settings play a vital role in patient safety, infection control, and overall care quality. Efficient circulation routes enable quick and safe patient movement, particularly in emergencies, while minimizing travel distances for staff and reducing fatigue (Ulrich et al., 2008; Joseph & Rashid, 2007). In many developing countries, however, poor circulation remains a persistent challenge due to overcrowded, outdated infrastructures and limited resources, often resulting in delayed care and increased health risks (Chaudhury et al., 2009; Nguyen et al., 2013). Inadequate wayfinding systems further add to patient confusion and delays (Adeyemo, 2005). Addressing these issues involves infrastructural improvements, adopting modular designs for flexible layouts (Chaudhury et al., 2009), and engaging local communities in facility planning (Adeyemo, 2005). Innovations such as evidence-based design (Ulrich et al., 2008; Malkin, 2008), flexible and reconfigurable spaces (Verderber & Refuerzo, 2019), digital health technologies (Azevedo , 2017) and sustainable practices (McGain & Naylor, 2014; Guenther & Vittori, 2008) are transforming healthcare environments. These advancements not only improve operational efficiency and patient experiences but also enhance the adaptability of healthcare facilities in response to changing demands and public health crises. Together, effective flow patterns and innovative, resilient design form essential foundations for modern, high-quality healthcare systems.

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Circulation efficiency within healthcare facilities plays a vital role in shaping patient outcomes by directly influencing patient satisfaction, safety, and the financial performance of healthcare systems. Efficient circulation ensures patients experience shorter wait times, smoother transitions between care points, and quicker access to services, all of which significantly enhance patient satisfaction (Landon et al., 2012). Conversely, inefficient layouts and disorganized flow patterns often result in overcrowded waiting areas, delays, and patient frustration, leading to dissatisfaction with the care experience (Parker & Smith, 2010; Zimlichman et al., 2013). Moreover, the design of healthcare environments including clear signage, intuitive pathways, and well-positioned departments contributes to circulation efficiency by simplifying patient navigation and reducing anxiety (Ulrich et al., 2008; Chaudhury et al., 2005). Beyond patient experience, circulation efficiency is closely tied to patient safety. Inefficient flow can cause overcrowding, delayed treatment, and increased exposure to healthcare-associated infections, especially in high-pressure areas like emergency departments (Carayon et al., 2014; Pines et al., 2011). Prompt patient movement to appropriate care settings reduces infection risks and ensures timely interventions for critical conditions, improving clinical outcomes (Schull et al., 2011; Stelfox et al., 2013). Additionally, inefficient circulation contributes to higher operational costs, reduced staff productivity, and financial penalties due to prolonged hospital stays, increased overtime, and lower patient throughput (Aronsson et al., 2011; Litvak & Bisognano, 2011). Indirect costs also emerge as staff frustration leads to turnover, recruitment expenses, and a decline in the facility's reputation due to patient dissatisfaction, which can negatively impact future patient volumes and revenues (Hendrich et al., 2009; Press Ganey Associates, 2013). Thus, optimizing circulation efficiency is a fundamental strategy for enhancing patient outcomes, operational effectiveness, and the financial sustainability of healthcare facilities.

III. RESEARCH METHODOLOGY

This study employed a quantitative research design to assess circulation efficiency and flow patterns in

selected general and state hospitals across Osun State, Nigeria. Data were collected primarily through structured, close-ended questionnaires administered to adult patients and healthcare staff in six purposively selected hospitals with two each from the state's three senatorial districts, ensuring balanced representation of state and general hospitals. The total study population of 1,635 individuals (patients and staff) was stratified by hospital category and location, with a final sample size of 321 respondents determined using Yamane's formula at a 5% margin of error. Stratified sampling was used to select hospitals within each district, while purposive sampling targeted specific patient groups and experienced staff within those hospitals. Primary data captured patient satisfaction, staff workflow, and perceptions of hospital layout, while secondary data were sourced from hospital records, architectural design manuals, and existing literature. Data collection was conducted through questionnaires distributed on-site, and the results were analyzed using descriptive statistics such as frequencies, percentages, and means for quantitative data, while thematic analysis was applied to categorize open-ended responses on circulation challenges and improvement suggestions.

IV. RESULTS AND FINDINGS

This study examined circulation efficiency and flow patterns in selected healthcare facilities by analyzing feedback from patients and healthcare staff. The analysis considered mean rankings, standard deviations, and overall satisfaction to assess spatial organization, user experience, and operational performance.

4.1 Assessment of Circulation Indicators

Quantitative analysis revealed strong agreement between patients and staff on the critical role of spatial planning in healthcare delivery. The flow of movement between departments was the highest-ranked indicator for both groups (Mean: 4.29 for patients; 4.05 for staff), with low standard deviations (0.79 and 0.73), indicating strong consensus. Efficient movement within healthcare spaces reduces stress, minimizes delays, and supports patient care continuity.

Table 1: Assessment Indicator of both patients and healthcare staff

S/N	Assessment Indicator	PICEFPI Mean	Rank (P)	SD (P)	SICEFPI Mean	Rank (S)	SD (S)	Interpretation
1	Flow of movement between departments is logical and efficient	4.29	1st	0.79	4.05	1st	0.73	Highest rated by both groups; critical operational factor.
2	No adequate separation between patient and staff flow	3.84	2nd	0.88	3.18	19th	1.13	Patients highly concerned about privacy, less so staff.
3	Congestion and bottlenecks in waiting areas,	3.82	3rd	0.92	3.72	10th	0.95	Acknowledged issue by both, greater patient concern.
4	Layout supports patient flow from check-in to discharge	3.79	4th	0.86	3.84	7th	0.81	Valued by both for navigation ease and workflow.
5	Circulation areas are well ventilated	3.78	5th	0.89,	3.95	4th	0.77,	High importance for environmental comfort.
6	Dedicated pathways for persons with	3.70	,6th	,0.91,	3.51	14th	0.93,	Patients rate it higher for inclusivity needs.

	disabilities,							
7	Cross-traffic delays involving patients, staff, equipment,	3.70	6th	0.94,	3.47	15th,	0.96,	Both identify it as operationally disruptive.
8	Clear signs and directions throughout the facility,	3.67,	7th,	0.84	3.75,	9th,	0.79,	Essential wayfinding feature for both.
9	Organized and clear flow from one department to another,	3.67	7th	0.89	3.88	6th	0.82	Both groups value clear departmental flow.
10	Healthcare services are readily accessible	3.61	8th	0.93	3.93	5th	0.79	Slightly more crucial to staff for workflow.
11	Congestion in hallways at peak hours	3.54	9th	0.96	2.96	18th	1.17	Patients more affected by overcrowded corridors.
12	Colours aid wayfinding and ambiance	3.53	,10th	0.95	3.39	16th	0.97,	Moderately valued for environmental comfort.
13	Floor finishes are slippery,	3.51	11th	0.87	3.54	13th	0.85	Close alignment — a shared safety concern.
14,	Driveway is clearly defined and efficient,	3.50	12th	0.92	3.77	8th	0.81	More crucial to staff for emergency logistics.
15	Poor daylighting in circulation areas	3.50	12th	0.94	3.51	14th	0.90	Consistently moderate concern for both.
16	Longer waiting times are not common,	3.47	13th	0.89	3.54	13th	0.86	Both agree waiting times are manageable.
17	Circulation efficiency affects patient experience	3.41	14th	0.95	3.61	12th	0.89	Staff slightly more aware of its impact.
18	Layout affects staff productivity	3.36	15th	0.98	3.63	1th	0.87	Direct operational relevance to staff.
19	Movement encourages emergency preparedness,	3.29	16th	0.91	3.33	17th	0.95	Relatively low-ranked, exposing a design gap.
20,	Waiting areas (space & seating) are poor,	3.25,	17th	0.99	2.79,	24th	1.12,	Major patient concern, low staff prioritization.
21	Ingress and exit are easily accessible,	3.17,	18th,	1.04,	4.04	2nd	0.76,	Highly valued by staff for emergency readiness.
22	Ramp and step gradients are not gentle,	3.06	19th	1.03	2.84	23rd	1.09	Both see this as a physical access issue.
23	Walkways are not easily accessible	3.04	20th	1.08	3.11	20th	1.01	Moderate problem for both.
24	Steps and ramps poorly located,	3.02	21st	1.02	2.91	22nd	1.08	Low-ranking, but attention needed for inclusivity.

25	Not enough space in corridors,	2.99	22nd	1.11	2.68	25th	1.13	Bigger issue for patients due to overcrowding.
26	Visual privacy is poor	2.93	23rd	1.14	3.05	21st	1.06	Staff moderately more concerned with privacy.
27	Circulation areas clean and well-maintained	2.84	24th	1.16	4.00	3rd	0.78	Major perception gap staff prioritize it highly.

Source: Author's Compilation, 2025
Note: PICEFPI stands for:Patients' Circulation Efficiency and Flow Pattern Index
SICEFPI stands for: Staff Circulation Efficiency and Flow Pattern Index

Environmental comfort, especially ventilation and clear departmental flow, also ranked in the top five for both groups. These findings support established principles in healthcare architecture that prioritize indoor air quality, intuitive wayfinding, and spatial clarity to enhance user satisfaction and infection control. However, the data revealed notable divergences. For instance, patients ranked the lack of separation between staff and patient flows as their second most important concern (Mean: 3.84), while staff rated it much lower (Rank: 19th; Mean: 3.18). This indicates that patients are more sensitive to privacy, crowding, and potential exposure to clinical areas factors that may not be immediately visible to staff but significantly impact user perception and dignity.

Another striking contrast was seen in the rating of ingress and egress accessibility, which staff ranked second (Mean: 4.04) due to its relevance to emergency logistics, while patients ranked it 18th (Mean: 3.17), showing that their focus remains on internal navigation and comfort rather than entry and exit logistics. Similarly, cleanliness and maintenance of circulation areas was rated 3rd by staff (Mean: 4.00), suggesting a strong professional concern for hygiene standards. Patients, however, rated it near the bottom (Rank: 24th; Mean: 2.84), with a high standard deviation, implying mixed experiences across different facilities and inconsistent maintenance practices. Concerns over bottlenecks in hallways and waiting areas were shared by both groups but felt more intensely by patients. Congestion in waiting areas had a mean of 3.82 for patients compared to 3.72 for staff, while hallway congestion was rated 3.54 by patients versus 2.96 by staff. These results point to a pressing need for spatial reconfiguration to manage peak-hour traffic and reduce stress for facility users.

Accessibility issues, such as inadequate ramp gradients, lack of disability-friendly paths, and slippery floor finishes, received moderate ratings from both groups, but were generally rated higher by patients. This reflects the daily challenges faced by individuals with limited mobility and suggests that design improvements in inclusive access are still needed. Both groups recognized the role of spatial planning in operational outcomes. Staff rated the effect of layout on their productivity relatively high (Mean: 3.63), while patients acknowledged its impact on their experience (Mean: 3.41). The alignment here underscores the importance of user-centered and workflow-conscious design in healthcare environments.

4.2 Satisfaction with Circulation and Flow Patterns
To complement the ranking of circulation indicators, the study also evaluated overall satisfaction levels with specific aspects of movement, layout, and spatial functionality.

Table 2: Evaluation of patient/ Staff satisfaction level on circulation efficiency and flow pattern in the study area.

S/N	Assessment Indicator	PSCEFPI (Patients)	Rank (P)	SSCEFPI (Staff)	Rank (S)	Interpretation
1	Time taken to move from one department to another / Logical placement of space and facilities	3.93	1st	3.54,	1st	Both groups highly rate ease of intra-facility movement and logical space arrangement as critical to operational flow and satisfaction.
2	Accessibility	3.92	2nd	3.50	5th	Patients strongly value accessibility; staff input not directly measured here but implied in workflow satisfaction.
3	Wayfinding effectiveness	3.74	3rd	3.47	7th	Patients are generally satisfied with signage and wayfinding aids, reducing confusion and supporting circulation efficiency.
4	Staff response time / Safety perception	3.68	4th	3.42	2nd	Patients appreciate prompt staff response; staff feel safe and secure in their work environment, which improves overall service delivery.
5	Ease of accessing restrooms, waiting areas, essential services / Efficient workflow support	3.54	5th	3.39	4th	Both moderately satisfied with facility accessibility and workflow support infrastructure; improvements here would benefit both groups.
6	Ease of navigation and distance travel,	3.49	6th	3.25	6th	Both moderately concerned about hospital layout's ease of navigation and travel distances, indicating a shared area for improvement.
7	Layout minimizes stress and confusion / Communication and collaboration among staff,	3.44	7th	3.40	3rd	Patients note moderate satisfaction in layout intuitiveness; staff value how circulation patterns support teamwork and collaboration.
8	8,Flow patterns lead to delays / Level of delays and congestion due to circulation issues,	3.38	8th	2.79	8th	Both groups agree this is a major problem area especially staff, who rate it very low due to its operational and service delivery impact.

Both groups showed strong satisfaction with intra-facility movement and logical space arrangement, which ranked first for both patients (Mean: 3.93) and staff (Mean: 3.54). This confirms the value of direct, intuitive layouts that reduce confusion and enhance service efficiency. Accessibility was the second most important factor for patients (Mean: 3.92), indicating its centrality to patient experience. While not ranked explicitly for staff, it is implied within workflow assessments and impacts their ability to deliver timely care.

Wayfinding effectiveness, including signage and visual cues, was positively rated by patients (Mean: 3.74), indicating that most users could navigate the facility without undue stress. Although staff did not rank this directly, the reduction of directional inquiries likely improves their workflow as well. Staff response time and perceived safety scored relatively high among both groups. Patients rated responsiveness at 3.68, while staff scored their safety and security at 3.42. This points to a connection between effective spatial layouts and enhanced

communication and security two factors essential to service quality and staff morale. Moderate satisfaction was recorded for access to restrooms, waiting areas, and essential services, as well as workflow support (Patients: 3.54; Staff: 3.39). These findings suggest that while the core infrastructure is functional, there remains room for improvement in optimizing spatial relationships and accessibility.

One of the lowest satisfaction ratings was recorded for delays and congestion due to poor circulation patterns. Patients rated this at 3.38, while staff gave it the lowest score (2.79). The disparity highlights how layout inefficiencies translate into workflow

disruptions, increased wait times, and operational stress particularly for staff under pressure to deliver

coordinated care. Although both groups agreed on the importance of layout, their perspectives diverged in subtle ways. Patients valued intuitive navigation, short walking distances, and comfort. Staff emphasized workflow efficiency, emergency readiness, and personal safety. These variations underscore the importance of engaging multiple user groups in design evaluations and post-occupancy assessments.

CONCLUSION AND RECOMMENDATION

This study demonstrates that the efficiency of circulation systems in healthcare facilities plays a crucial role in shaping both patient experiences and staff productivity. Respondents consistently highlighted the importance of clear departmental flow, adequate ventilation, and accessible movement paths. Yet, several challenges persist most notably, overcrowded hallways, poor signage, inadequate access for people with disabilities, and a lack of separation between patient and staff circulation routes.

While both patients and staff value efficient navigation, their concerns differ. Patients emphasized comfort, privacy, and ease of access, whereas staff focused on operational flow, emergency movement, and environmental hygiene. These differences reflect varied daily interactions with the facility and point to the need for design strategies that address both user groups.

To address these issues, circulation systems must be redesigned for clarity, inclusiveness, and efficiency. Layouts should support direct movement between departments, with clearly defined, separate routes for staff and patients to minimize congestion. Improved wayfinding through signage, color-coding, and intuitive design can ease navigation, especially for first-time visitors. Greater emphasis on accessibility, including wider corridors and ramps, will ensure that facilities serve all users equitably. Upgrades in ventilation, lighting, and cleanliness within circulation spaces will further enhance user satisfaction and safety. Together, these improvements can transform healthcare environments into more functional, responsive, and user-centered spaces that better support care delivery in both rural and urban contexts.

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