

INFLUENCE OF TACTILE FEATURES ON SENSORY CUES OF VISUALLY IMPAIRED PATIENTS IN NATIONAL EYE HOSPITAL, SRI LANKA

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Abstract: A visually impaired person is someone whose' eyesight cannot be corrected to normal levels. Visually impaired people heavily rely on their other senses more than the visual sense to experience the surrounding world. Tactile features cater to the haptic cues of a visually impaired person through helping with tactile navigation & way finding, safety & hazard awareness, independence & self-awareness, communication & information access and spatial orientation & memory. This study is conducted to explore the sensory cues of visually impaired patients & how they can be catered using different tactile features, materials, lighting & colours. Also, the existing tactile features are identified along with the influence tactile features have on visually impaired patients at the National Eye Hospital Sri Lanka.

A mix method (qualitative & quantitative) study is carried out through a comprehensive literature review, observational study & questionnaire surveys. The Outpatient Department of the National Eye Hospital is chosen for the study as it's the tertiary care centre for the visually impaired patients in Sri Lanka. Visually impaired patients & staff members from the General Ophthalmology Clinics were chosen for the study. This study clearly shows that the existing tactile features are not sufficient for the visually impaired patients. Overall, most of the staff members think that implementing tactile features will be beneficial for the patients while almost 50% of the patients agree with them. Finally, this research clearly depicts the importance of implementing tactile features in the Outpatient Department of National Eye Hospital.

Keywords: *Tactile features, sensory cues, visually impaired patients, National Eye Hospital, Sri Lanka*

1. Introduction

Visually impaired people are an important category to consider when designing accessible spaces. The way they experience & react to the surrounding environment differs from a normal person. But as designers it's our responsibility to make them feel included and give them the experience in a space as a normal person.

1.1. RESEARCH QUESTION

The research question is "What is the influence of tactile features on sensory cues of visually impaired patients in National Eye Hospital, Sri Lanka?"

1.2. AIM & OBJECTIVES

The aim of this research is to explore the impact of having tactile features on sensory cues of patients with visual impairments at National Eye Hospital Sri Lanka. The objectives of the study are,

1. To investigate the sensory cues utilized by visually impaired patients in perceiving and navigating built environments.
2. To examine how tactile features, material qualities, lighting conditions, and colour contrasts can be employed to support and enhance these sensory cues.
3. To assess the existing tactile interventions implemented at the National Eye Hospital, Sri Lanka, and their effectiveness in addressing the sensory needs of visually impaired patients.
4. To evaluate the impact of tactile features on the perceived user experience, orientation, and comfort of visually impaired patients within hospital spaces.

1.3. SIGNIFICANCE OF THE STUDY

This study aims to enhance the lifestyle of visually impaired individuals by implementing effective solutions, creating a safe environment, and providing tactile features for independence.

1.4. LIMITATIONS OF THE STUDY

The space used for the study is limited to the General Ophthalmology Clinics of the National Eye Hospital Sri Lanka, smaller sample size & done during a shorter time duration.

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1.5. ETHICAL CONSIDERATIONS

The study will not disclose patient photographs or personal data, as permission from both participants and the institution was obtained prior to the study.

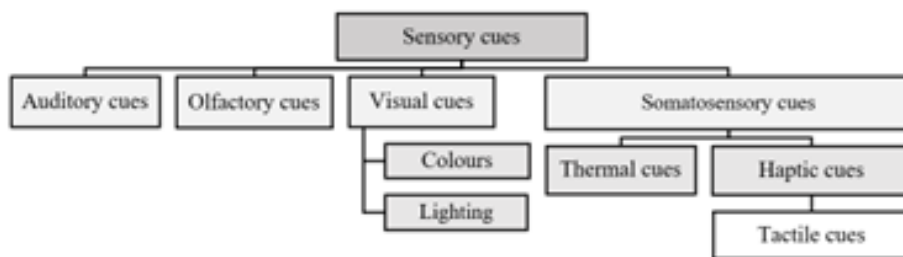
2. Literature review

2.1. VISUAL IMPAIRMENTS

Every human has an eye issue at some point in their lives that needs to be properly cared for. "Visual impairment" is the term used to describe various conditions that impact the visual system or vision functions. The terms "blindness" and "visually impaired" are not the same; blindness refers to the complete lack of visual perception, while visually impaired refers to the partial lack of visual perception (WHO, 2023; Bakir et al, 2022; Institute, n.d.). It can be caused due to various reasons such as refractive errors, cataract, age-related macular degeneration, diabetic retinopathy, glaucoma & retinitis pigmentosa (Mandal, 2023; NEI, Refractive errors, 2024).

2.2. SENSORY CUES

Humans use all five senses to interact with their surroundings, but those with diminished visual perception struggle to grasp accurate information. Architecture, as a key component, provides a deeper sensory experience for visually impaired users. Supportive sensory cues help with navigation, mobilization, and daily activities, divided into four parts (Jenkins et al, 2015; Almaz, 2022). The Flowchart 1 presents the Types of sensory cues.



Flow Chart 1: Types of Sensory Cues
(Source: By Author)

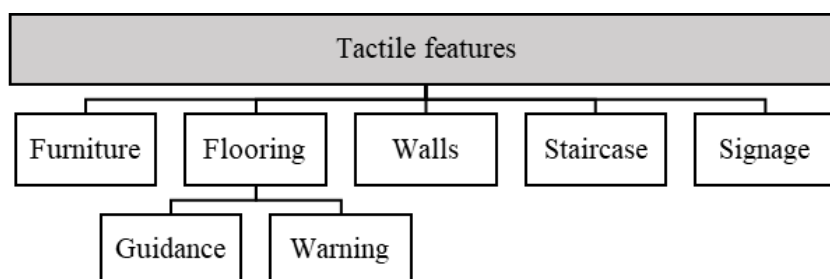
2.3. TACTILE FEATURES

Tactile features are unique material usage which assists visually impaired people can identify a space. They can be divided as flooring, wall finishes, staircases, signage & furniture (Mendis & Jayasinghe, 2018; Almaz, 2022).

These tactile features can influence visually impaired patients through tactile navigation & way finding, safety & hazard awareness, independence & self-awareness, communication & information access and spatial orientation & memory (Ungar et al; Tovar, 2023; Almaz, 2022; Bakir et al, 2022). The Flowchart 2 presents the Types of tactile features.

2.4. NATIONAL EYE HOSPITAL, SRI LANKA

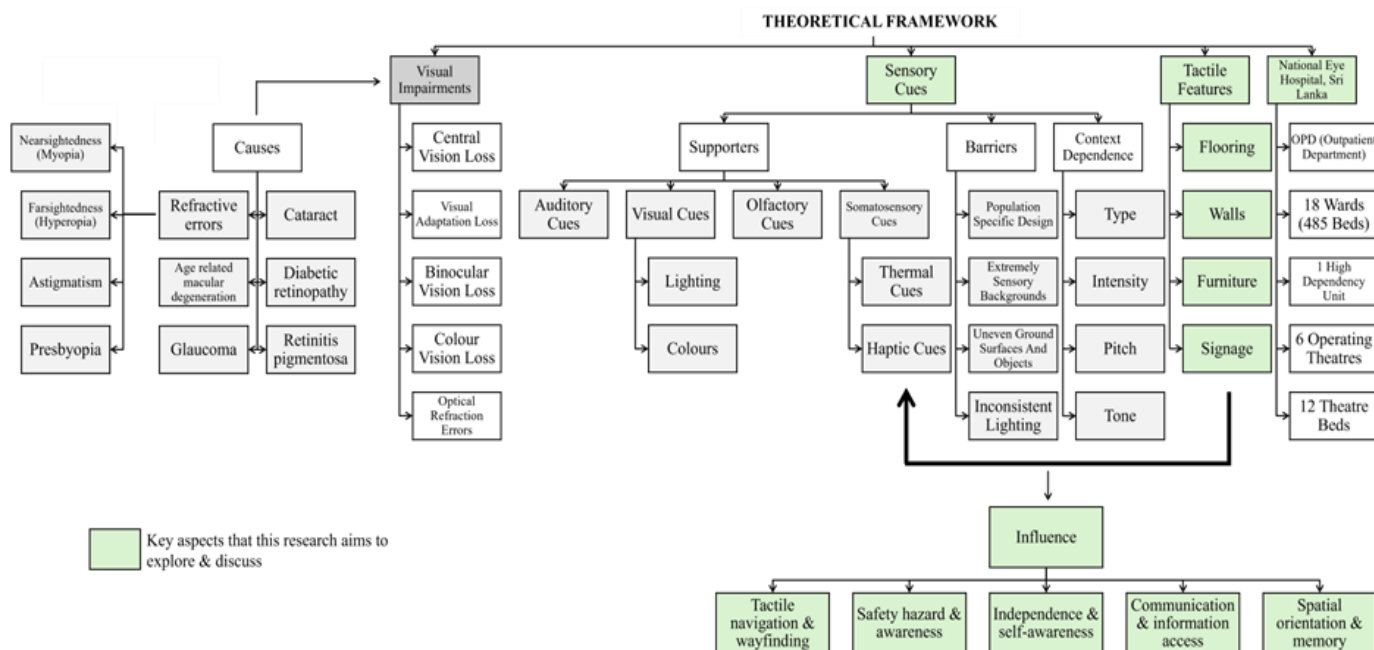
The National Eye Hospital is the tertiary eye care hospital in Sri Lanka. The hospital features an outpatient department, 18 wards including general wards with a total of 485 beds, one high dependency unit, and 06 operating theatres equipped with 12 surgical tables (Warnakulasooriya, 2024).



Flow chart 2: Types of tactile features
(Source: By author)

2.5. THEORETICAL FRAMEWORK

The below Flowchart 3 presents the theoretical framework that was employed in guiding the study.



Flow chart 3: Theoretical framework (Source: By author)

2.6. PARAMETERS

The Table 1 presents the parameters, sub-parameters, and their corresponding descriptions.

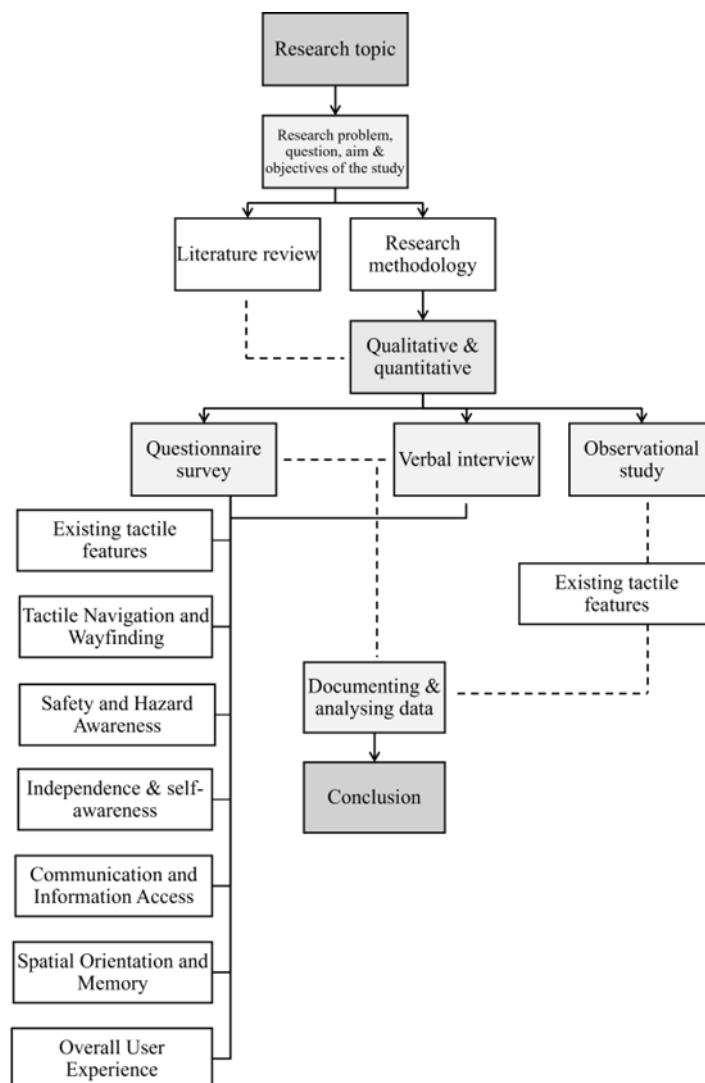
Table 1: Parameters (Source: By author)

Parameter	Sub-Parameter	Description
Tactile navigation and wayfinding	Recognition of floor textures and patterns	The capacity to recognize and interpret changes in floor textures to help assistance.
	Identification of pathways or directionality	Use of tactile lines or materials to understand routes or walkways.
	Awareness of spatial transitions	Identification of transitions between functional areas (e.g., clinic to waiting room).
	Use of tactile maps or guide paths	Familiarity with tactile direction aids such as floor markers, guide routes, and maps.
Safety and hazard awareness	Detection of elevation changes	The ability to recognize curbs, ramps, and stairs via tactile warnings.
	Identification of obstacles	Identifying uneven flooring or potentially tripping-hazardous items.
	Effectiveness of handrails and warnings	The perceived benefit of floor warning textures and tactile railings.
	Perceived safety in the environment	Emotional reaction to tactile cues to avoid accidents or discomfort.
Independence & self-awareness	Feeling of safety and familiarity	Emotional impact of textures in creating a sense of trust and ease.
	Influence on stress and calmness	Impact of the tactile environment on mental health.
	Support for independence	The ways that tactile elements assist or hinder confidence and self-navigation.
Communication and information access	Use of Braille or raised text signage	The accessibility and usefulness of written communication through touch.
	Labelling of rooms or furniture	Usefulness of tactile labels in determining an object's or space's purpose.
	Integration with auditory cues	Whether sound-based information complements and supports tactile cues.
	Clarity of instructions	The capacity to comprehend instructions using either tactile signals alone or in combination.
Spatial orientation and memory	Building a mental map	The capacity to use tactile information to cognitively recreate the layout.
	Recall of tactile landmarks	Landmarks or important textures that are memorable on subsequent visits.

Overall user experience	Satisfaction with tactile features	Overall perception of the usefulness and quality of tactile features.
	Suggestions for improvement	Suggestions to improve tactile navigation.
	Impact on healthcare experience	The impact of tactile features on comfort and care perception.

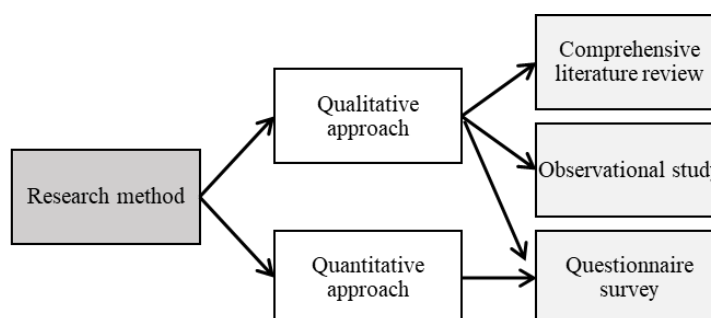
3. Methodology

The below research method was adopted to investigate the influence of tactile features on the sensory cues of visually impaired patients at the National Eye Hospital, Sri Lanka.



Flow chart 4: Methodology
(Source: By author)

3.1. RESEARCH STRATEGY



Flow chart 5: Research strategy
(Source: By author)

A mixed-method research strategy combining qualitative and quantitative approaches was employed to collect and analyse data. Although both data types were considered, the study primarily adopted a qualitative orientation due to the exploratory nature of the research objectives. Qualitative evidence was essential for understanding contextual dynamics, capturing user perceptions, and identifying nuanced patterns that are not easily measurable through numerical indicators.

Quantitative data were used in a supportive capacity to validate selected observations and provide supplementary empirical insight. This integrated strategy ensured methodological rigor while allowing the research to remain grounded in rich, context-specific interpretation.

3.2. RESEARCH DESIGN

The objectives of the study were achieved through the literature review, observational study & questionnaire survey (verbal interviews for patients who were unable to read).

Table 2: Research design
(Source: By author)

Objective	Parameter	Measurement
To explore the sensory cues of visually impaired patients	<ul style="list-style-type: none"> Sensory cues Visually impaired patients 	<ul style="list-style-type: none"> Literature review
To determine how these sensory cues can be catered using different tactile features, materials, lighting and colours	<ul style="list-style-type: none"> Tactile features Materials Lighting Colours 	
To explore the available tactile features that cater to the sensory cues of patients with visual impairments at National Eye Hospital, Sri Lanka	<ul style="list-style-type: none"> Available tactile features National Eye Hospital, Sri Lanka 	<ul style="list-style-type: none"> Observational study Questionnaire survey
To determine the influence of having tactile features on the user experience of visually impaired patients	<ul style="list-style-type: none"> Influence of tactile features User experience of visually impaired patients on the navigation and comfort of visually impaired patients. 	<ul style="list-style-type: none"> Questionnaire survey

3.3. CASE STUDY

The case study for the study is the General Ophthalmology Clinics at the Outpatient Department of National Eye Hospital, Sri Lanka, which is located at the Ven. Baddegama Wimalawansa Mawatha, Colombo 10.

3.4. POPULATION, SAMPLING & DATA COLLECTION

A study involving 100 visually impaired patients and 20 staff members was conducted, with two separate questionnaires. An indirect questionnaire (English, Sinhala & Tamil) was for patients who lack technical terminology knowledge, while a direct questionnaire was for staff members with technical terminology knowledge. The study underwent a pre-test, identified issues were corrected in the questionnaires.

3.5. DATA ANALYSIS

The Likert scale scoring method was used to analyze questions, assign numerical values to each answer, calculating the weighted score, dividing the total weighted score by the total number of responses, and identifying the impact.

- Step 1: Assigning a numerical value to each answer
- Step 2: Counting the number of respondents selected each option
- Step 3: Multiply the frequency by the score (Weighted score)
- Step 4: Calculate the average score
- Step 5: Calculate the average ranges & determine the impact

Table 3: Average impact
(Source: By author)

Score	Range	Impact	Value representing the impact (For bar charts 1 – 5)
1	1.00 – 1.80	Extremely negative	1
2	1.81 – 2.60	Negative	2
3	2.61 – 3.40	Neutral	3
4	3.41 – 4.20	Positive	4
5	4.21 – 5.00	Extremely positive	5

4. Results & discussion

4.1. EXISTING TACTILE FEATURES

4.1.1 Observational study

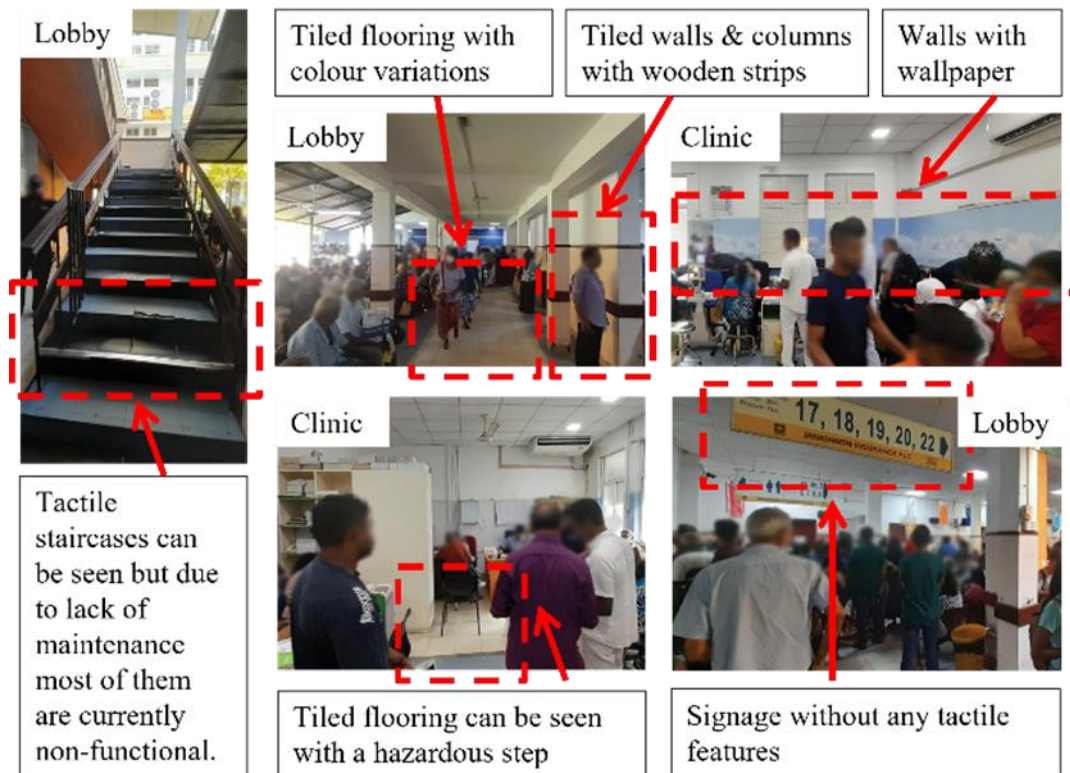


Figure 1: Existing tactile features observed in the outpatient Department: (a) tactile staircases, (b) tiled floor-ing with colour variations & tiled walls and columns with wooden strips, (c) wallpapered walls, (d) hazard-ous step in clinic area, and (e) signage without tactile features. (Source: By the author)

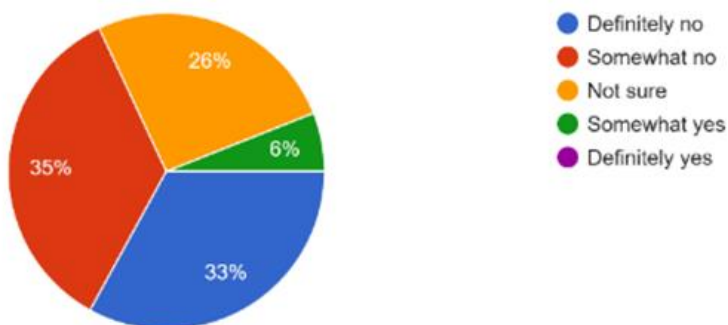
As shown in figure 1, it clearly depicts that there are some tactile staircases as shown in figure 1(a) & tactile wall finishes as shown in 1(b) & 1(c) can be found within the lobby area. But tactile flooring was completely missing as shown in figure 1(b) & 1(d). As signage within hands reach was not there, tactile signage was absent at the Outpatient Department as shown in figure 6(e).

After the data was analysed using the Liker scale scoring system, the following discussions emerged. The bar charts from 4.2 to 4.6 were created considering the average impact of the responses according to table 3.

4.1.2 Questionnaire survey

Patients' perception on existing tactile features – Average impact - Negative

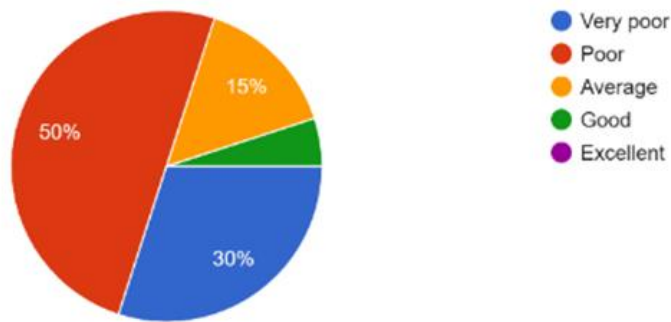
100 responses



Pie chart 1: Existing tactile features - Patients' perception

Staff perception on existing tactile features– Average impact - Negative

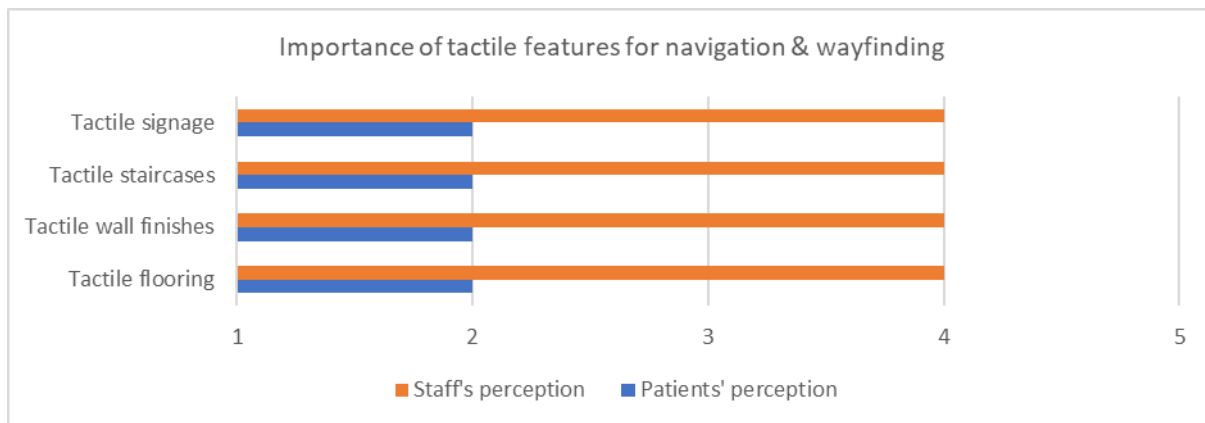
20 responses



Pie chart 2: Existing tactile features - Staff perception

According to pie charts 1 & 2, 33% of the patients say that the existing tactile features are not sufficient while 35% somewhat agree with them. Few patients agree the current facilities are sufficient. Most of the staff members (80%) believe that the current layout is poor and lacks landmarks to support the patients. A smaller sample (15%) of staff members holds a neutral opinion on the matter. staff members have a positive opinion on the usefulness of tactile features for navigation & way finding. But both The National Eye Hospital's OPD lacks sufficient tactile features, as evidenced by observational studies and patient and staff opinions.

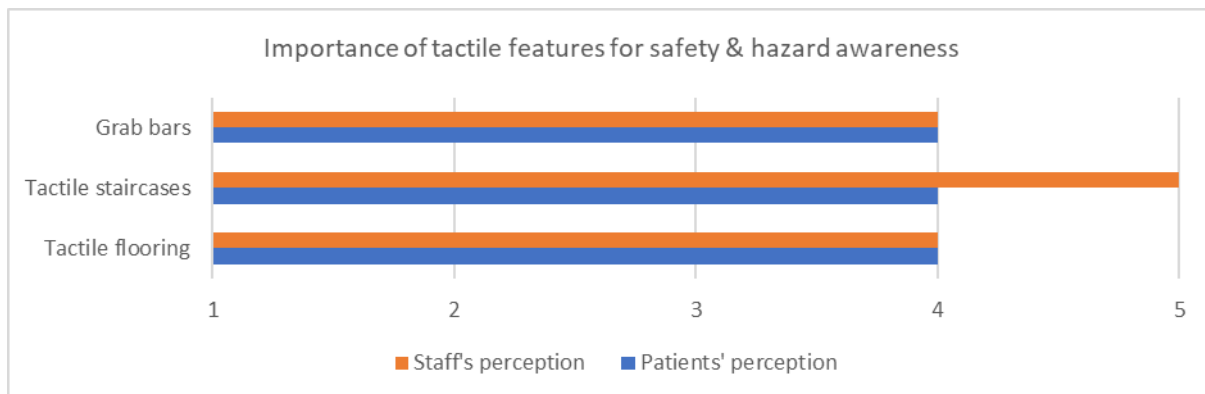
4.2. TACTILE NAVIGATION & WAYFINDING



Bar chart 1: Importance of tactile features for navigation & wayfinding (According to average impact score)

The staff members strongly believe that tactile features are important for visually impaired patients, especially for navigation & way finding but most of the patients think that tactile features will not help them with navigation & way finding.

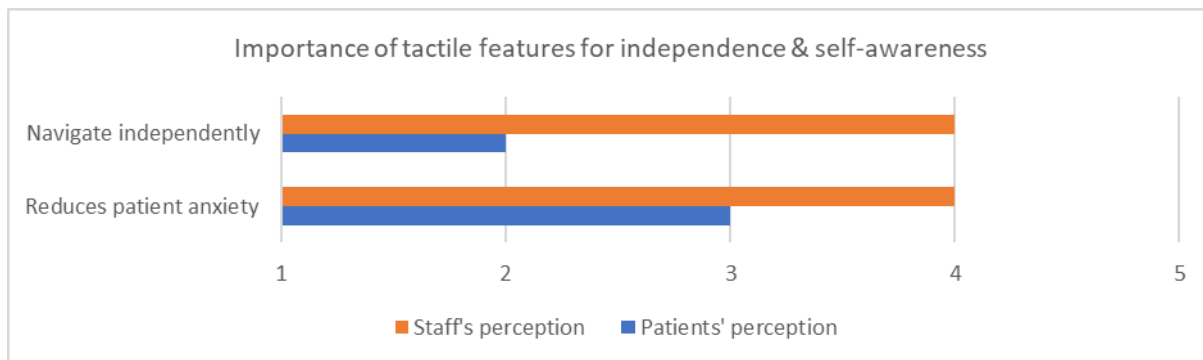
4.3. SAFETY & HAZARD AWARENESS



Bar chart 2: Importance of tactile features for safety & hazard awareness (According to average impact score)

The study clearly depicts that most patients & staff members believe that implementing tactile flooring, staircases and grab bars help to generate a safe, hazard free environment for the visually impaired patients.

4.4. INDEPENDENCE & SELF-AWARENESS

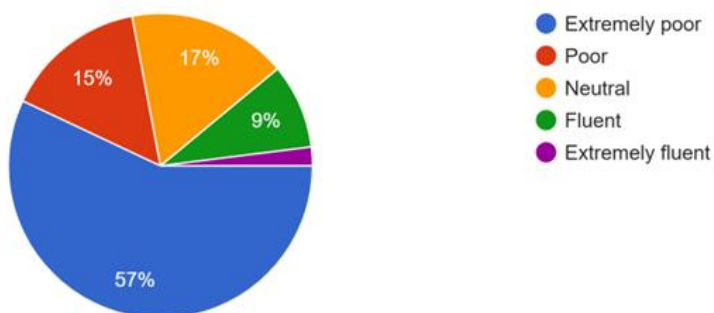


Bar chart 3: Importance of tactile features for independence & self-awareness (According to average impact score)

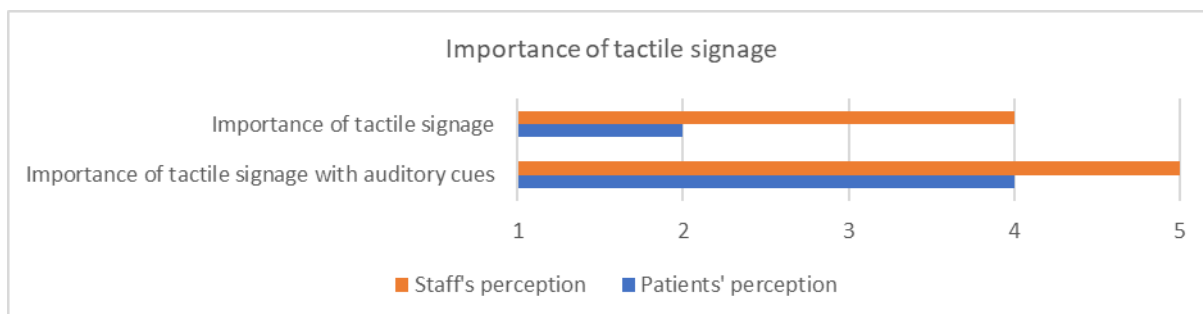
Both patients and staff members agree that tactile features have a positive impact on their familiarity, comfortability, calmness, stress & anxiety. Staff members also believe that tactile features will help patients to navigate without a bystander, but the overall patients' opinion differs on the matter.

4.5. COMMUNICATION & INFORMATION ACCESS

100 responses



Pie chart 3: Braille literacy level - Patients' perception

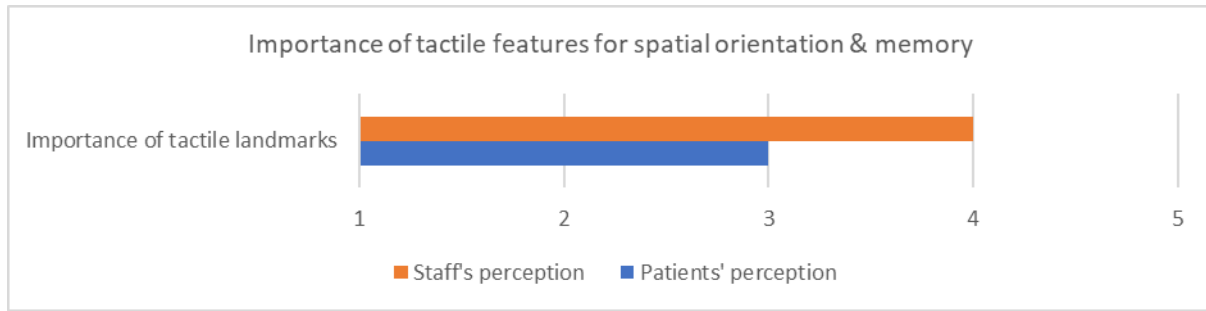


Bar chart 4: Importance of tactile features for communication & information access (According to average im-pact score)

Most of the patients can read existing signage within the OPD and they think tactile signage is challenging for them as their braille literacy level is extremely poor. Both patients & staff members agree that having auditory cues with tactile signage will help patients.

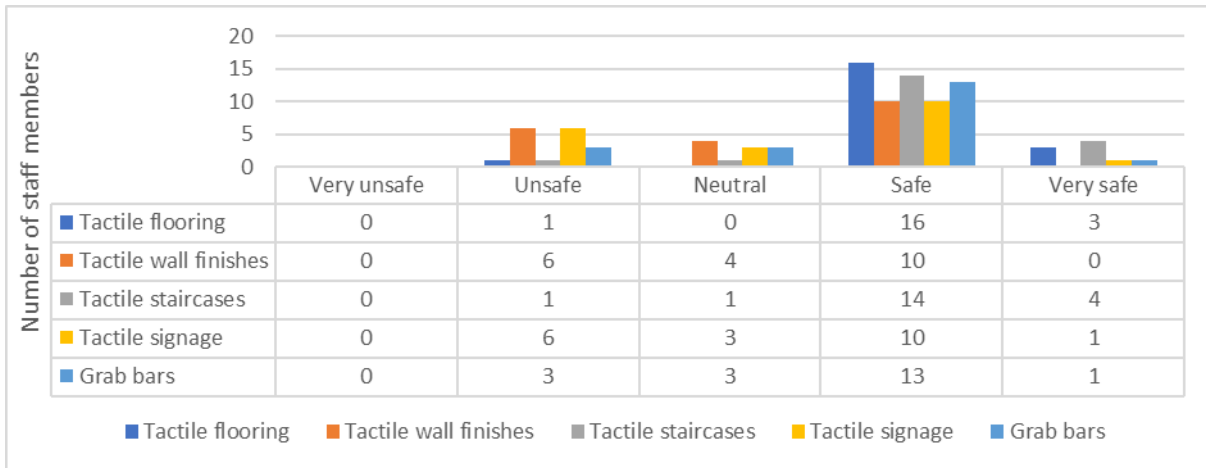
4.6. SPATIAL ORIENTATION & MEMORY

Though staff members believe that there is a positive impact on spatial orientation & memory from tactile features to create mental maps, overall patients' have a neutral opinion.



Bar chart 5: Importance of tactile features for spatial orientation & memory (According to average impact score)

4.7. HEALTH & HYGIENE

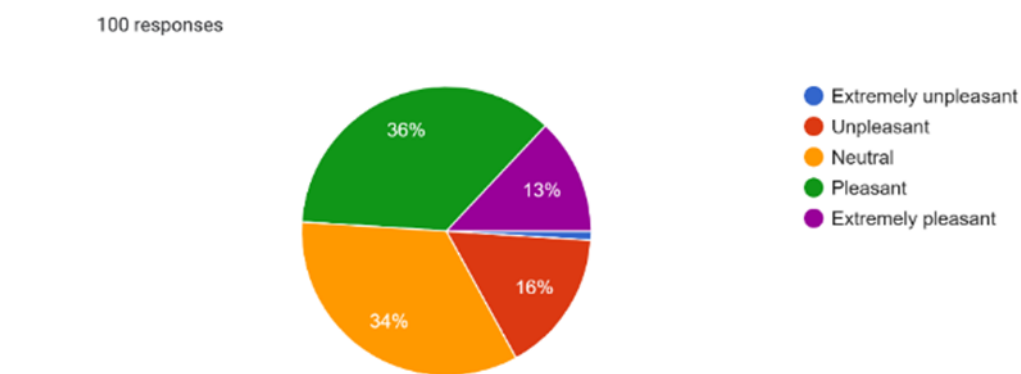


Bar chart 6: Health & hygiene impact of tactile features - Staff members' perception

Staff members believe that tactile wall finishes, signage and grab bars will impose a health & safety risk compared to flooring & staircases as it spreads infections due to all patients touching it.

4.8. OVERALL EXPERIENCE

Patients' perception on implementing tactile features – Average impact – Positive



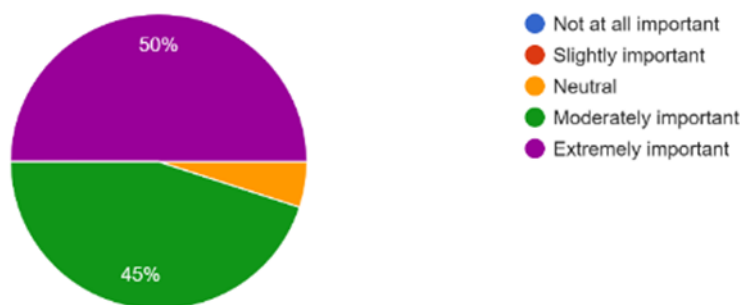
Pie chart 4: Overall experience - Patients' perception

This shows that the amount of people who think that tactile features are important is way high than the people who think it's not important. Also, the patients seem to prefer implementing tactile flooring compared to the other features. But there are people who doesn't seem to think that tactile features are not important as they are able to navigate spaces without the assistance of tactile features.

4.9. OPINIONS & SUGGESTIONS

Staff perception on implementing tactile features – Average impact – Extremely positive

20 responses



Pie chart 5: Opinions & suggestions - Staff perception

This shows that most of the staff members strongly support the implementation of tactile features as they believe that it's going to benefit the visually impaired patients immensely. But they strongly suggest that following health & safety protocols is extremely important.

4.10. CONCLUSION

The OPD lacks sufficient tactile features for visually impaired patients, with tactile signage unavailable. Staff members believe tactile features are important for navigation and wayfinding, but patients believe they won't help. Most patients and staff support the implementation of tactile flooring, staircases and grab bars to create a safe environment. Tactile features positively impact familiarity, comfort, calmness, stress and anxiety, but patients have a neutral opinion. Patients believe that implementing tactile signage will not be that effective as they have a very poor braille literacy level. Staff members believe tactile wall finishes, signage and grab bars pose a health and safety risk.

The research highlights the importance of implementing tactile flooring & staircases in the Outpatient Department of National Eye Hospital, with staff members and patients agreeing on its benefits.

5. Future recommendations & projections

Despite being a tertiary care facility, the National Eye Hospital has not yet been the focus of studies examining inclusive design for visually impaired patients, representing a significant research and design gap.

The findings of this study indicate that the integration of tactile flooring and tactile staircases can substantially enhance navigation, safety, and overall user experience for patients. Accordingly, it is recommended that hospital management, in collaboration with relevant governmental authorities, consider the implementation of these tactile elements as part of an inclusive design strategy.

Given the healthcare context, careful consideration of health and safety is paramount. In particular, the choice of materials and installation techniques should minimize the risk of bacterial contamination or pathogen accumulation. Therefore, a dedicated investigation into suitable, hygienic materials and appropriate installation methods is advised prior to implementation to ensure both effectiveness and patient safety.

6. Citations, References and Acknowledgements

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