ORIGINAL ARTICLE

Perception of signage and spatial orientation among users in a public pediatric referral hospital in Lima, Peru

Brandon E. Guillen-Calle[1], Guillermo Mantilla[2], Isabel Arauco-Carhuas[2], Nicole Rodriguez-Clemente[2]

[1] Faculty of Health Sciences, Universidad Científica del Sur, Lima 15067, Peru.
[2] Faculty of Medicine, Universidad Nacional Mayor de San Marcos, Lima 15081, Peru.

ABSTRACT

Objective: To evaluate users' perception of signage and their spatial orientation ability in a national pediatric referral hospital in Lima, Peru.
Methods: An observational, analytical, cross-sectional study was conducted at the Instituto Nacional de Salud del Niño San Borja. A total of 354 parents, guardians, or caregivers of pediatric patients were surveyed. Signage perception and self-assessed spatial orientation were measured using Likert scales. Non-parametric tests and Spearman correlation analysis were performed.
Results: Most respondents (88.4%) preferred asking staff for directions, while only 11.6% relied on signage or maps. No significant differences in orientation were found according to visit frequency or educational level, except for overall self-assessment scores, where males scored higher than females (7.77 vs. 6.92; $p < 0.05$). A moderate correlation was observed between signage perception and self-assessed spatial orientation (rho = 0.39; $p < 0.001$).
Conclusions: Most users rely more on staff than on signage to navigate the facility. Optimizing signage and exploring more effective orientation strategies are necessary to enhance the visitor experience.

Keywords: Hospitals; Orientation; Patient navigation; Signage; Pediatric Health Facilities (Source: MeSH)

Percepción de la señalización y orientación espacial de los usuarios en un instituto público pediátrico de referencia nacional en Lima, Perú

RESUMEN

Objetivo: Evaluar la percepción de la señalización y la capacidad de orientación de los usuarios en un en un instituto público pediátrico de referencia nacional en Lima, Perú.
Métodos: Se realizó un estudio observacional, analítico y transversal en el Instituto Nacional de Salud del Niño San Borja. Se encuestó a 354 padres, tutores o cuidadores de pacientes pediátricos. Se midió la percepción de la señalización y la autovaloración de la orientación espacial mediante escalas de Likert. Se utilizaron pruebas no paramétricas y análisis de correlación de Spearman.
Resultados: El 88,4% de los encuestados prefería preguntar al personal para orientarse, mientras que solo el 11,6% usaba señalización o mapas. No se encontraron diferencias significativas en la orientación según la frecuencia de visitas o nivel educativo, excepto en la autovaloración general, donde los hombres obtuvieron puntajes más altos que las mujeres (7,77 vs. 6,92; $p < 0,05$). Se halló una correlación moderada entre la percepción de la señalización y la autovaloración de orientación espacial (rho = 0,39; $p < 0,001$).
Conclusiones: La mayoría de los usuarios confía más en el personal que en la señalización para ubicarse dentro del centro. Es necesario optimizar la señalización y explorar estrategias de orientación más efectivas para mejorar la experiencia de los visitantes.

Palabras clave: Hospitales; Orientación Espacial; Navegación de Pacientes; Señalización (Fuente: DeCS)

Cite as:
Guillen-Calle BE, Mantilla G, Arauco-Carhuas I, Rodriguez-Clemente N. Perception of signage and spatial orientation among users in a public pediatric referral hospital in Lima, Peru. Investig Innov Clin Quir Pediatr. 2025;3(2):20-7.
doi: 10.59594/iicqp.2025.v3n2.147

Corresponding author:
Brandon E. Guillen-Calle
Telephone: +51 927739766
Email: emerson16cyesj@gmail.com

ORCID iDs
Brandon E. Guillen-Calle
https://orcid.org/0009-0001-5161-266X
Guillermo Mantilla
https://orcid.org/0009-0001-3130-8054
Isabel Arauco-Carhuas
https://orcid.org/0009-0005-8614-6020
Nicole Rodriguez-Clemente
https://orcid.org/0009-0003-3426-6448

Received : 06/19/2025
Accepted : 09/15/2025
Published : 11/05/2025

INTRODUCTION

Hospital signage plays a crucial role in user orientation, as it facilitates the localization of services, promotes safety, improves emergency response, and contributes to a more efficient hospital experience (1,2). Adequate signage not only optimizes hospital time and resources but also creates a safer and more welcoming environment for patients' companions (3). Lack of clarity in visual information may lead to disorientation, directly affecting the quality of care and resulting in missed medical appointments, as well as increased user stress. Furthermore, disorientation represents a hidden cost for institutions, as it increases staff time demands and reduces operational efficiency (4).

In complex hospital environments, companions of pediatric patients face several challenges when trying to find their way (5). Architectural complexity, combined with the emotional stress associated with illness, hinders navigation in these spaces, particularly for those unfamiliar with the environment. Such disorientation constitutes an additional stressor that may affect both users' well-being and the quality of care received (4,6,7).

Hospital signage must be inclusive and accessible to all users, considering the diverse needs of the population (8). Appropriate design incorporating pictograms, braille, and multilingual options facilitates orientation for individuals with visual, cognitive, or language barriers (6,9,10). In Peru, a country with considerable linguistic and cultural diversity, it is a priority to implement signage systems that ensure equitable access to healthcare services and enable a more efficient response during emergencies (1).

Several national and international regulations mandate the implementation of clear and accessible signage systems in hospitals (11–14). For example, the Sustainable Health Agenda for the Americas 2018–2030 (ASSA 2030) emphasizes the importance of optimizing user experience in health facilities, aligning with the Sustainable Development Goals related to health (15, 16). However, in many public hospitals, deficiencies in signage persist, perpetuating orientation difficulties for users (17).

The Instituto Nacional de Salud del Niño de San Borja (INSN-SB) (18) is a high-complexity pediatric surgical center that serves patients from various regions of Peru. Despite the implementation of multiple signage elements, many companions, parents, and guardians fail to perceive or effectively understand them, resulting in wandering, delays in care, and, in some cases, missed medical appointments. The lack of specific studies on the perception of hospital signage in the Peruvian context underscores the need to investigate the barriers faced by companions when navigating efficiently within such institutions.

In this context, the present study aims to evaluate the perception of pediatric patients' companions regarding signage and their spatial orientation ability in the INSN-SB. The findings of this study may contribute to identifying the main orientation barriers and proposing improvement strategies aligned with international best practices and ASSA 2030 guidelines, ultimately enhancing the user experience.

METHODS

Study design

Observational, analytical, and cross-sectional study.

Population and sample

The study included all parents, legal guardians, and caregivers of pediatric patients who attended INSN-SB at the time of the survey administration during 2025.

Based on the study by Mora *et al.* (19), which reported that 36% of users perceived the facility's infrastructure as hindering their wayfinding, a sample of 354 participants was calculated using Epidat version 4.2 for cross-sectional studies, with a 95% confidence level and a 5% margin of error.

Eligible participants were individuals aged 18 years or older who had visited the institution at least once within the past six months and were able to provide informed consent. Exclusion criteria were users with cognitive or language impairments that prevented them from adequately answering the questionnaire. Sampling was sequential, i.e., non-randomized.

Questionnaire

A structured questionnaire was developed based on the variables assessed by Mora *et al.* (19). The instrument included closed and multiple-choice questions designed to collect sociodemographic information, the frequency of visits to the hospital, users' perceptions of signage (four items), and a self-assessment of spatial orientation ability (two items).

Perceptions of signage and self-assessment of spatial orientation ability were measured using 10-point Likert scales, where 10 indicated a positive perception and zero a negative one. From these responses, the main variables were generated: (1) self-assessment of spatial orientation ability in any environment, (2) self-assessment within the hospital (each scored 0–10), and (3) perception of signage, derived from the sum of four items evaluating the quantity, location, clarity, and ease of orientation provided by signage, with a range of 0–40 points.

A pilot test of the questionnaire was conducted in a group of 15 users not included in the final sample to assess clarity, coherence, and relevance of the items before formal data collection. Additionally, the questionnaire was reviewed by three experts in health services management and quality to ensure its content validity. Reliability was assessed using Cronbach's alpha coefficient, which yielded a value of 0.701, indicating adequate internal consistency.

Procedures

Data were collected in high-traffic areas within the health facility, including the main entrance, waiting rooms, and outpatient corridors. Surveyors informed participants about the study's objectives and obtained their informed consent prior to the interview. A digital form in REDCap (20) was used, which automatically redirected participants to the questionnaire items once the consent was completed.

Data analysis

Data collected in REDCap were exported for analysis in STATA version 17.0 (21) and RStudio (22). Descriptive analyses were performed to characterize the sample and assess variable distributions, using measures of central tendency (mean and median) and dispersion (standard deviation and interquartile range). Since some variables followed a normal distribution and others did not, both statistics were reported regardless of distribution to provide greater detail in the tables. Categorical variables were expressed as absolute and relative frequencies.

For inferential analyses, normality was assessed using the Shapiro-Wilk test. As the assumption of normality was not met, nonparametric tests were used. The Kruskal-Wallis test was applied to compare self-assessed spatial orientation ability by educational level, and the Mann-Whitney U test was used to evaluate differences by sex. Additionally, Pearson's chi-square test was used to analyze the association between educational level and orientation strategies within the facility. The correlation between self-assessed spatial orientation ability and perception of signage was evaluated using Spearman's rank correlation coefficient (rho).

All analyses were conducted at a 95% confidence level, with $p < 0.05$ considered statistically significant.

Ethical considerations

The project was approved by the Institutional Research Ethics Committee of INSN-SB before implementation (Approval No. 05-2025). Participant confidentiality was ensured by creating a virtual form in REDCap separate from the informed consent document, which each participant digitally signed. A copy was provided to those who agreed to participate. All participants were informed that participation was voluntary and that they could withdraw from the study at any time without repercussions.

RESULTS

A total of 369 individuals were surveyed; 15 incomplete responses were excluded, resulting in a final sample of 354 participants, of whom 81.6% were women. The mean age of participants was 37.34 ± 10.47 years. More than half (51.1%) of the population completed secondary education. Regarding their native language, 4.2% reported Quechua, and 0.9% reported another language, including Shipibo and English. Among the 18 participants whose native language was not Spanish, 94.4% indicated that understanding it did not represent a difficulty, whereas 5.6% reported difficulties in comprehension (Table 1).

With respect to the frequency of hospital visits over the past six months, 16.4% of respondents attended for the first time, 19.0% attended two to three times, 26.1% between four and ten times, and 38.5% more than ten times. When assessing the main strategy used to find their way inside the hospital, 88.4% of participants preferred asking staff for directions, while only 11.6% relied on signage, maps, or diagrams (Table 1).

Regarding self-assessment of general wayfinding ability, men reported significantly higher scores (7.77 ± 0.27) compared to women (6.92 ± 0.16). Participants with primary education or no formal education were more likely to ask staff for directions compared to those with higher educational levels ($p = 0.041$). In turn, those with higher educational levels showed a greater preference for using available signage. The mean score for self-assessed wayfinding ability in general settings was 7.07 ± 2.65, whereas the mean within the hospital was 7.38 ± 2.26. Overall perception of signage yielded a mean score of 30.07 ± 6.38. For specific components, the mean scores were 7.63 ± 2.13 for the amount of signage, 7.45 ± 2.21 for the location, 7.22 ± 2.46 for the clarity, and 7.76 ± 2.19 for the ease of orientation provided by the infrastructure (Table 2).

Analysis by educational level revealed significant differences in self-assessed spatial orientation. As shown in Figure 1, participants with primary education or no formal education (12.08 ± 4.46) reported significantly lower scores compared to those with secondary education (14.87 ± 3.84) ($p < 0.001$) or higher education (15.32 ± 3.48) ($p < 0.001$). However, no statistically significant differences were observed between participants with secondary and higher education ($p = 0.730$).

Finally, a moderate positive correlation was identified between self-assessed spatial orientation and perception of signage, with a Spearman correlation coefficient of 0.39 ($p < 0.001$), suggesting that better perception of signage is associated with higher self-assessed wayfinding ability (Figure 2).

DISCUSSION

The present study on spatial orientation in hospital environments is supported by various previous investigations that have addressed this issue from different perspectives, including architectural organization, signage, and psychological factors (23).

The findings reveal that 88.4% of participants preferred to seek assistance from hospital staff rather than use signage, which is consistent with Rodrigues *et al.* (17), who found that although signage is perceived as adequate, its practical use remains limited. This may be related to the perception of clarity of the signage, which in our study had a mean score of 7.22, similar to the values reported by Mora *et al.* (19), who noted that clarity is a determining factor in users' preference for reading instructions. In addition, Sahoo *et al.* (1) emphasized that, in public hospitals, the lack of uniformity in signage contributes to disorientation, a finding reflected in the high preference of our participants for asking staff for directions. Regarding general orientation ability, average or high self-reported scores (approximately 7) were observed,

suggesting a positive self-perception. Moreover, men reported significantly higher scores (7.77) than women (6.92), consistent with the findings of Morag and Parush (24) and with the review by Iftikhar and Luximon (6), who suggested that men tend to rely on map-based spatial orientation strategies, whereas women favor detailed instruction-based strategies. This reinforces the importance of designing wayfinding systems that take these differences into account. It should be noted that in the study setting, signage consisted of signs with the names of each service, complemented by arrows, directional signs, or illustrative figures, rather than maps.

Table 1. Sociodemographic characteristics and frequency of visits to the hospital among participants

Characteristics	n	%
Age (years)		
Young (18–29)	82	23.2
Adult (30–59)	260	73.5
Older adult (60 and over)	12	3.4
M (SD)	37,34 (10,47)	
Sex		
Female	289	81.6
Male	65	18.4
Educational level		
Primary/none	69	19.5
Secondary	181	51.1
Higher education	104	29.4
Mother tongue		
Spanish	336	94.9
Quechua	15	4.2
Shipibo	2	0.6
English	1	0.3
Ease of understanding Spanish	n = 18	
Easy for me	17	94.4
Difficult to understand	1	5.6
How often did you visit the hospital in the last 6 months?		
First time	59	16.4
Few times (2–3)	67	19
Several times (4–10)	92	26.1
Many times (>10)	136	38.5
What do you do first to orient yourself upon entering the hospital?		
Ask staff	313	88.4
Read signs, maps, diagrams	41	11.6
Total	**354**	**100**

M: Mean; SD: Standard deviation

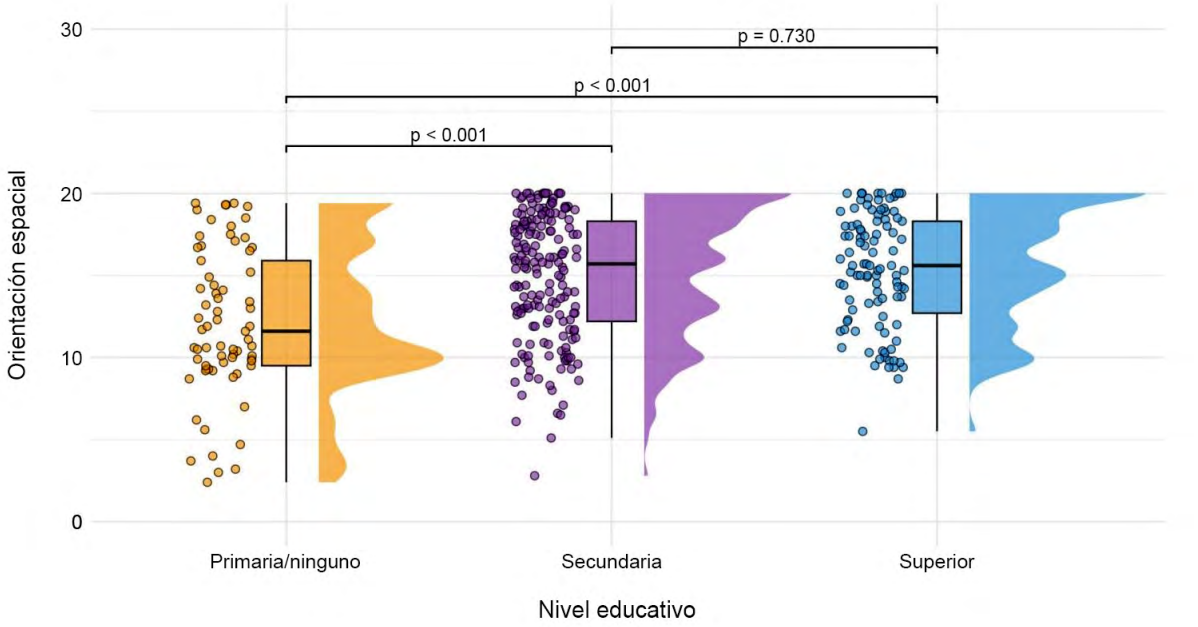

Figure 1. Self-assessment of spatial orientation ability according to educational level.

Table 2. Self-assessment of spatial orientation ability and perception of the hospital's signage

	M (SD)	Median	IQR
Self-assessment of spatial orientation ability			
Self-assessment in any environment	7.07 (2.65)	8	5 - 9.2
Self-assessment within the hospital	7.38 (2.26)	8	6.3 - 9.1
Perception of signage	30.07 (6.38)	31.2	26.1 - 34.8
Quantity	7.63 (2.13)	8.1	6.8 - 9.2
Location	7.45 (2.21)	8.1	6.6 - 9.1
Clarity	7.22 (2.46)	8.1	5.8 - 9.2
Ease of orientation through infrastructure	7.76 (2.19)	8.5	7.5 - 9.2

M: Mean; SD: Standard deviation; IQR: Interquartile range.

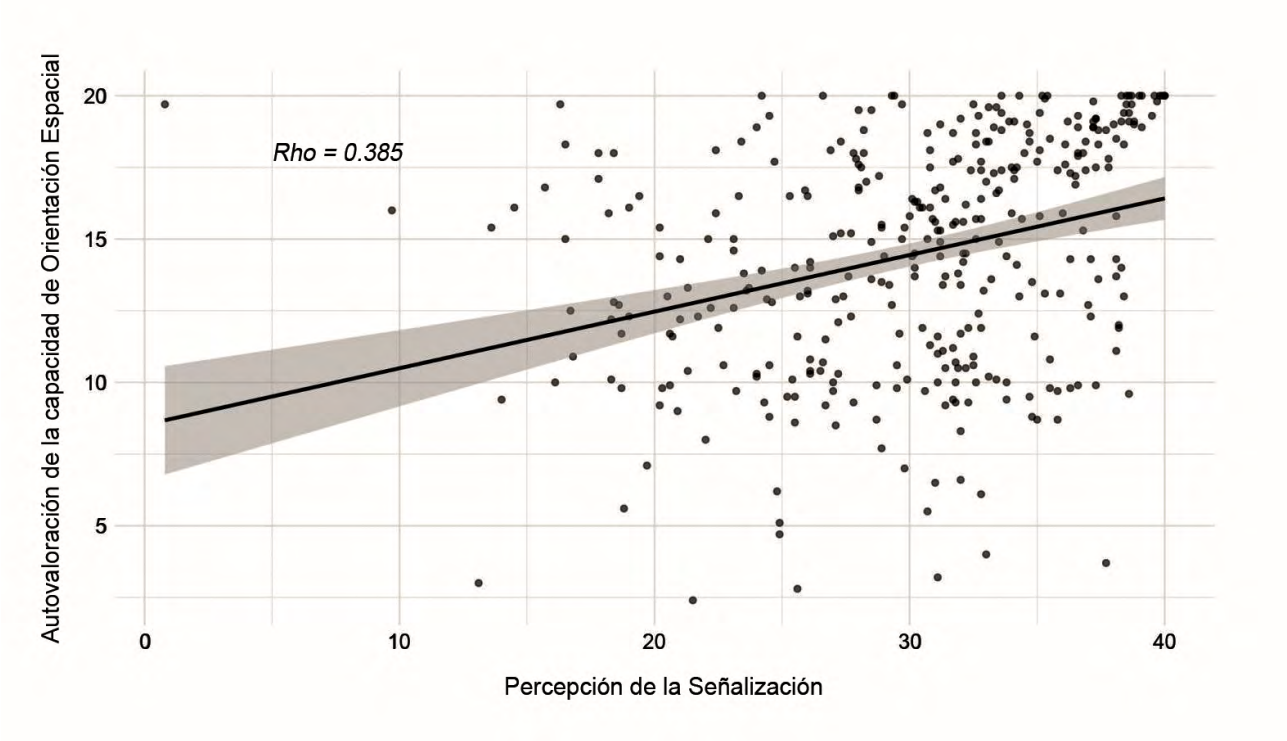

Figure 2. Relationship between self-assessment of spatial orientation ability and perception of signage

Educational level also played an important role in orientation ability. Participants with primary education or no formal education (12.08) reported significantly lower scores compared with those who completed secondary education (14.87) or higher education (15.32) ($p < 0.001$). Nuvolari-Duodo *et al.* (25) highlighted the importance of considering academic background when designing wayfinding systems, as lower educational levels may be associated with reduced ability to interpret complex signage.

Regarding infrastructure perception, the ease of orientation provided by the environment had a mean score of 7.76. Qi *et al.* (26) identified that the use of spatial references, such as windows with exterior views, significantly improves orientation. This suggests that although the infrastructure in this study was perceived positively, it could benefit from more strategic integration of visual references, such as increased exposure to external environments through windows or balconies.

Finally, the positive correlation between self-reported spatial orientation ability and signage perception ($r = 0.39$, $p < 0.001$) supports the findings of Zhu *et al.* (27), who used machine learning models to demonstrate that better environmental perception is associated with superior spatial orientation performance.

Although the present study did not evaluate direct clinical or surgical interventions on pediatric patients, its findings have relevant implications for hospital care in this population. Effective signage can reduce delays in accessing services, decrease caregiver stress, and optimize patient flow, ultimately impacting the timeliness and quality of medical care received by pediatric patients. Thus, improving signage constitutes a complementary intervention that, while not clinical, indirectly contributes to patient well-being and safety.

From an institutional management perspective, the results suggest the need to implement more visible, uniform, and culturally adapted signage systems that incorporate universal pictograms, predominant languages among users, and resources for individuals with visual impairments. Likewise, training staff to provide proactive guidance and complementing it with digital tools, such as interactive maps accessible via mobile devices, could optimize caregivers' experience and reduce staff workload.

Finally, as this research is an observational, analytical, and cross-sectional study, it is subject to selection bias, as data collection took place in high-traffic areas and may not accurately represent all hospital users. Similarly, the use of a self-administered questionnaire may introduce information bias due to social desirability or recall errors. Nevertheless, anonymity of responses was ensured, minimizing the likelihood that responses would be influenced by the presence of interviewers or hospital staff.

In summary, the results reinforce existing literature by demonstrating that architectural design (25), signage, and individual factors such as sex and educational level (24) significantly influence orientation in hospital environments. Implementing strategies that consider these individual

differences, together with the use of emerging technologies, could optimize orientation and improve user experience in these settings (28), thereby reducing problems arising from inadequate wayfinding in healthcare facilities.

For future studies, longitudinal designs are recommended to assess the impact of specific signage interventions on users' orientation and waiting times. Furthermore, including objective measures of orientation (e.g., actual time required to reach a specific service) and expanding the sample to different hospitals would allow comparisons across settings with varying architectural complexities and cultural contexts.

Author contributions

BEGC: Conceptualization, Data curation, and Formal analysis.

GM and IAC: Investigation.

All authors: Supervision, Validation, Writing – original draft, and Writing – review & editing.

Conflicts of interest

The authors declare no relevant financial or non-financial conflicts of interest.

Funding

This research was self-funded.

REFERENCES

1. Sahoo B, Pillai JSK, Md S, Sahoo MC. Implementation of wayfinding signage in public hospitals and its evaluation towards quality improvement. Cureus. 2024 Jul;16(7):e65435. doi:10.7759/cureus.65435
2. Jiang ZM, Zhang PH, Shang RX, Tian XL. Investigation and simulation on human evacuation behaviour in a large hospital building in Shenyang. Procedia Eng. 2014 Jan 1;71:101–6. doi:10.1016/j.proeng.2014.04.015
3. He Y, Bai W, Ye Y, Guo W, Wang X, Zou X. A lean approach to enhance the visual experience during wayfinding in emergency department spaces: a case study of a large-scale general hospital in China. Archit Eng Des Manag. 2025 Jul 4;21(4):642–64. doi:10.1080/17452007.2023.2274103
4. Rodrigues R, Coelho R, Tavares JMRS. Users' perceptions of signage systems at three Portuguese hospitals. HERD. 2020 Jul;13(3):36–53. doi:10.1177/1937586719866577.
5. Rousek JB, Hallbeck MS. The use of simulated visual impairment to identify hospital design elements that contribute to wayfinding difficulties. Int J Ind Ergon. 2011 Sep 1;41(5):447–58. doi:10.1016/j.ergon.2011.03.003
6. Iftikhar H, Luximon Y. Wayfinding information syntheses: a study of wayfinding efficiency and behavior in complex outdoor institutional environments. HERD. 2023 Apr;16(2):250–67. doi:10.1177/19375867221122066
7. Adams A, Theodore D, Goldenberg E, McLaren C, McKeever P. Kids in the atrium: comparing architectural intentions and children's experiences in a pediatric hospital lobby. Soc Sci Med. 2010 Mar;70(5):658–67. doi:10.1016/j.socscimed.2009.10.044
8. Morag I, Sonmez V, Van Puyvelde A, Pintelon L. Improving wayfinding in hospitals for people with diverse needs and abilities: an exploratory approach based on multi-criteria decision making. Appl Ergon. 2024 Jan 1;114:104149. doi:10.1016/j.apergo.2023.104149
9. Lee E, Daugherty J, Selga J, Schmidt U. Enhancing patients' wayfinding and visitation experience improves quality of care. J Perianesth Nurs. 2020 Jun;35(3):250–4. doi:10.1016/j.jopan.2019.07.007
10. Çelebi C, Dündar M. Investigation of circulation areas depending on spatial planning criteria in healthcare facilities [Internet]. In: Scientific Researches in Health Sciences II. 2021 [cited on 2025 Aug 18]. p. 379–401. Available from: https://www.scienceopen.com/book?vid=8945beb7-c3e0-4420-bc0d-f3e7aa61adf5
11. EsSalud. Guía rápida para implementar la señalética de los establecimientos de salud del Seguro Social de Salud – EsSalud [Internet]. 2016 [cited on 2025 Aug 18]. Available from: https://www.essalud.gob.pe/downloads/guia_rapida_implement_senaletica_en_establecim_de_saluda.pdf
12. Ministerio de Salud. Norma técnica de salud para señalización de seguridad en establecimientos de salud, servicios de salud y servicios de apoyo médico [Internet]. 2006 [cited on 2025 Aug 18]. Available from: https://www.gob.pe/institucion/minsa/informes-publicaciones/353455-norma-tecnica-de-salud-para-senalizacion-de-seguridad-de-los-
13. Department of Health. Wayfinding: effective wayfinding and signing systems guidance for healthcare facilities [Internet]. NHS England; 2021 [cited on 2025 Aug 18]. Available from: https://www.england.nhs.uk/publication/wayfinding-effective-wayfinding-and-signing-systems-guidance-for-healthcare-facilities/
14. Pan American Health Organization, World Health Organization. Safe hospitals [Internet]. 2024 [cited on 2025 Aug 18]. Available from: https://www.paho.org/en/health-emergencies/safe-hospitals
15. Pan American Health Organization, World Health Organization. Sustainable health agenda for the Americas 2018–2030 [Internet]. 2017 [cited on 2025 Aug 18]. Available from: https://www.paho.org/en/sustainable-health-agenda-americas-2018-2030
16. Gamez MJ. Sustainable development goals and targets [Internet]. United Nations Sustainable Development. [cited on 2025 Aug 18]. Available from: https://www.un.org/sustainabledevelopment/sustainable-development-goals/
17. Rodrigues R, Coelho R, Tavares JMRS. Healthcare signage design: a review on recommendations for effective signing systems. HERD. 2019 Jul;12(3):45–65. doi:10.1177/1937586719843419
18. Instituto Nacional de Salud del Niño San Borja. Quiénes somos [Internet]. 2024 [cited on 2025 Aug 18]. Available from: https://portal.insnsb.gob.pe/quienes-somos/
19. Mora R, Oats A, Marziano P. Percepción de la señalización y orientación espacial de los usuarios de tres complejos hospitalarios de Santiago, Chile. Rev Med Chil. 2014 Oct;142(10):1291–6. doi:10.4067/S0034-98872014001000005
20. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009 Apr;42(2):377–81. doi:10.1016/j.jbi.2008.08.010.
21. StataCorp. Stata statistical software. College Station, TX: StataCorp LLC; 2021.
22. Posit Software, PBC. RStudio: integrated development for R [Internet]. Boston: Posit Software; 2025 [cited on 2025 Aug 18]. Available from: https://posit.co
23. Hu B. Wayfinding for modern healthcare: a participatory approach to designing a wayfinding system in a Chinese hospital setting. Des J. 2023 Jul 4;26(4):662–72. doi:10.1080/14606925.2023.2217095
24. Morag I, Parush A. The effect of verbal instructions while using digital indoor wayfinding devices on gender, performance, and self-

reported strategies. Appl Ergon. 2024 Jan;114:104160. doi:10.1016/j.apergo.2023.104160

25. Nuvolari-Duodo I, Brambilla A, Ricciardi GE, Dolcini M, Capolongo S. New requirements for post-COVID-19 hospital inpatient wards: evidence, design recommendations and assessment tools. Ann Ig. 2024;36(2):182–93. doi:10.7416/ai.2024.2595
26. Qi F, Lu Z, Chen Y. Investigating the influences of healthcare facility features on wayfinding performance and associated stress using virtual reality. HERD. 2022 Oct;15(4):131–51. doi:10.1177/19375867221078868
27. Zhu B, Cruz-Garza JG, Yang Q, Shoaran M, Kalantari S. Identifying uncertainty states during wayfinding in indoor environments: an EEG classification study. Adv Eng Inform. 2022 Oct 1;54:101718. doi:10.1016/j.aei.2022.101718
28. Daykin N, Byrne E, Soteriou T, O'Connor S. The impact of art, design and environment in mental healthcare: a systematic review of the literature. J R Soc Promot Health. 2008 Mar;128(2):85–94. doi:10.1177/1466424007087806