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Assessing Spatial User Experience for Design Guidelines: A Comparative Study of Outpatient Waiting Rooms With Conventional Versus Modern Features

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Abstract

Objectives: Identify waiting room design features that are most appreciated by outpatients and their companions in conventional and modern waiting rooms. Evaluate if end users evaluate the environment differently from experts and in what aspects. Provide evidence-based design guidelines that orient designers and healthcare managers. **Background**: Built environments are relevant in patients' evaluation of overall healthcare service. For outpatients, waiting frequently consumes the largest amount of time; thus, waiting room interior design has great potential to enhance their experience. **Methods**: This study compares perceptions of two types of waiting rooms—conventional and modern—based on the spatial user experience (SUE) model. In the first stage of the study, we compared user evaluations of conventional waiting rooms ($n = 137$) and modern waiting rooms ($n = 426$) with respect to the eight SUE model dimensions using multigroup structural equation modeling. In the second stage, an expert ergonomist and two professional interior designers assessed both types of waiting rooms. **Results**: Results showed that modern waiting rooms were perceived to be significantly better in all SUE dimensions. We also found experts' evaluations were overall consistent with users' perceptions. Discrepancies were only found in temperature perception, signage evaluation, and spatial appreciation. **Conclusions**: Participants valued modern style waiting room features such as good quality signage, use of armchairs and sofas, a controlled environment, and decoration. We suggest involving end users in the design process to respond to their needs and

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promote a positive experience. Finally, we provide easy-to-adopt design guidelines to improve patients' waiting room experience.

Keywords
outpatient waiting rooms, comparative study, interior design, spatial user experience, evidence-based design, design guidelines, healthcare experience

Tangible elements such as built environments are relevant for the patient's evaluation of overall healthcare service (Han et al., 2018). Consequently, healthcare providers are increasingly interested in improving their facilities to deliver high-quality service and foster positive experiences (Halawa et al., 2020; Jiang et al., 2017; Schweitzer et al., 2004).

In outpatient services, waiting usually consumes the greatest amount of time. The experience of it plays a critical role in outpatient satisfaction and patients' perception of care quality (Becker et al., 2008; Leddy et al., 2003; Spechbach et al., 2019). Although there is vast literature exploring strategies to decrease waiting time, this goal is not always achieved, and outpatients often experience delays to get specialist care (Gijo & Antony, 2014; Harper & Gamlin, 2003; Naiker et al., 2017; Potisek et al., 2007; Zhu et al., 2012). In this scenario, enhancing the physical environment can be a concrete alternative strategy to improve the waiting experience for patients and visitors (Aeschbach et al., 2022; Bazley et al., 2016; Fenko & Look, 2014; Higuera-Trujillo et al., 2020; Lee, 2011; Pruyn & Smidts, 1998; Sahoo & Ghosh, 2016).

In recent decades, practitioners have applied an evidence-based design (EBD) approach to improve healthcare environments (Hamilton, 2003). The Center for Health Design (n.d., para. 1) defines EBD as "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes." Research that shows the effects of waiting room environments on outpatient experience is limited, however, and it can be challenging for designers to define the diverse waiting room features based on evidence.

The latest contributions to this subject mainly address the positive impacts of environmental elements such as daylight (Pouyesh et al., 2018), scents (Fenko & Loock, 2014; Higuera-Trujillo et al., 2020), interactive media and aquarium (Biddiss et al., 2019), vegetation (Blaschke et al., 2017; Higuera-Trujillo et al., 2020), images of natural landscapes (Watts et al., 2016), and music and nature sounds (Fenko & Loock, 2014; Higuera-Trujillo et al., 2020; Pouyesh et al., 2018; Watts et al., 2016) on patients' and visitors' anxiety levels. There are also studies exploring comfort perceptions in the waiting room based on seat features such as stability and capacity to support users of different ages and sizes (Jafarifiroozabadi et al., 2022) and the introduction of Feng Shui principles (Margolies, 2020), which aim to achieve the environment energy balance and users' harmony with their surroundings (Bazley et al., 2016).

While anxiety and comfort are important aspects of the user experience, they are only a part of it. According to the spatial user experience (SUE) model (Juliá Nehme et al., 2020), the user experience in physical settings is a holistic phenomenon influenced by ergonomic and affective dimensions. In turn, the user experience influences behavioral responses (Figure 1). Aiming to provide a comprehensive understanding of the user experience in waiting rooms, in our previous work (Juliá Nehme et al., 2021), we designed a questionnaire based on the SUE model and distributed it in waiting rooms at two medical centers. Structural equation modeling analysis results showed a significant impact of several factors on the user experience dimension: emotional reaction, physical compatibility, spatial appreciation, and spatial cognition. We also found that the user experience strongly influences patients' behavioral intentions, such as willingness to recommend and return.

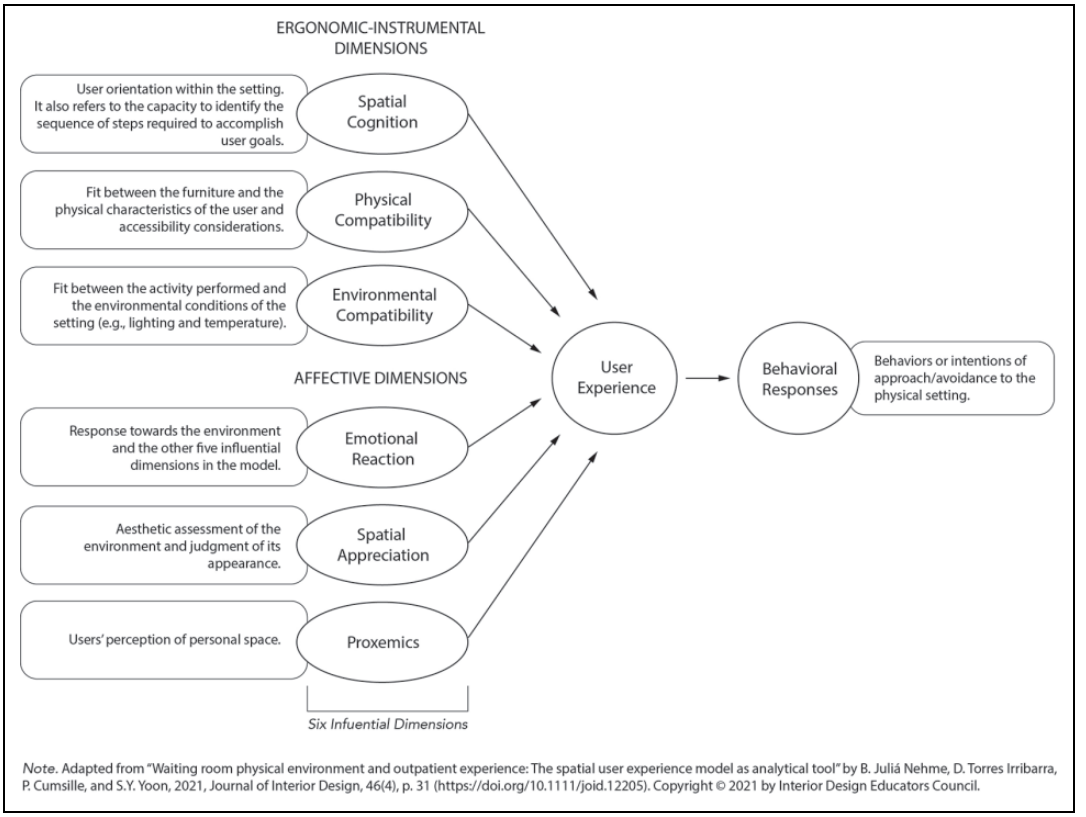

Figure 1. Spatial user experience model structure and main definitions.

The user experience in outpatient waiting rooms is simultaneously influenced by various factors, including emotions, physical comfort, spatial appreciation, and spatial cognition. In turn, the user experience impacts behavioral responses.

Our prior work gathered data from two medical centers with waiting rooms that differ in functional and aesthetic features. However, differences between the participants' SUE perceptions in each scenario were not addressed. There have been previous studies in the literature that compared patient perceptions of interior design features in different types of waiting rooms. Leather et al. (2003) found that "nouveau" waiting areas or those with a user-oriented design, with open-plan reception area, color coordination, fabric-upholstered seats, wall-mounted fixtures, plants, and nature photography were related to better perceptions of the environment, higher satisfaction scores, and lower self-reported stress compared to "traditional" ones (i.e., regular waiting areas of outpatient clinics in UK, with square plan, enclosed reception area, no color coordination, plastic-covered seats, and no music or television). Fornara et al. (2006) identified that patients and visitors evaluated significantly better the most "humanized environments," defined as environments that respond to patients' necessities and promote their wellbeing. These results were mostly congruent with experts' evaluations of spatial humanization in the facilities under study, suggesting that hospital design improvements could potentially promote greater patient satisfaction with the environment. Finally, Andrade et al. (2012) found that outpatients evaluated "newer facilities" (in the sense of recently built or renovated buildings versus buildings from the early 20th century)

significantly higher in terms of environmental quality, which was consistent with the expert evaluation of the settings.

Although these works identified highly valued features, they did not consider all aspects involved in the SUE model or evaluate each dimension thoroughly. Additionally, study results rarely translated into specific design recommendations, which could be an obstacle to their application in practice. Finally, they offered no discussion about the aspects in which experts and visitors agreed and disagreed.

Discovering the SUE dimensions that have higher evaluations in the two types of waiting rooms from our previous study (Juliá Nehme et al., 2021) could contribute interesting insights to waiting room design literature and for design practice. In the present study, we apply the label "conventional waiting rooms" to the waiting areas in the first medical center, whose design type is one frequently implemented in local health centers: it includes plastic chairs, wooden reception desks, and no decorative elements. In turn, we call "modern waiting rooms" the waiting room design found in the second medical center, which has distinctive modern design features, such as overall neutral tone with accent color elements in furniture and art, furniture with clean lines, details of chrome and glass, use of art as decor, and use of decorative wall panels (Fedorovskaya et al., 2021; Interior Design Styles, 2022). Detailed features of each waiting room type are defined in Table 1 and Figures 2–4. Previous literature suggests that modern waiting rooms could have higher user evaluations, given that they are in a recently remodeled building, and they share "nouveau" and "humanized" waiting room features, offering a more user-centered waiting space.

The purpose of the present study is to add the knowledge base on waiting room research by identifying the design features most appreciated in conventional and modern waiting rooms according to the multidimensional SUE model and provide easy-to-apply EBD guidelines. We also aim to explore the congruence between actual users and expert evaluations identifying similarities, discrepancies, and aspects toward which users show greater tolerance in order to better understand their priorities and needs. We expect our study findings can help designers and healthcare facility managers create waiting rooms that promote positive experiences.

Stage 1: Comparing SUE perceptions in Conventional and Modern Waiting Rooms

Method

In the first stage, we compared user perceptions of the SUE model dimensions (Figure 1) in conventional and modern waiting rooms using the database collected in our previous work (Juliá Nehme et al., 2021; Juliá-Nehme et al., 2022). This database does not include any information of participants' identity; thus, the study is exempted from ethics approval (Protection of Human Subjects, 2020).

Settings: Conventional and Modern Waiting Rooms

Conventional and modern style waiting rooms are in two Chilean medical centers located in the same city. Conventional waiting rooms in a government medical center cater to a specific group of government employees and their families during the morning. Modern waiting rooms in a mutual insurance company medical center receive affiliated and nonaffiliated patients throughout the day. Details of conventional and modern features are outlined in Table 1 and displayed in Figures 2–4. In all waiting rooms, patients must pick up a number ticket and wait for their turn to pay at the registration desk to check-in. After checking in, they sit and wait until medical staff calls their name. Waiting times were 25 min in average.

Measures and Data Collection

The SUE questionnaire was created in the Spanish language, including 10 background questions and 51 measurement items representing the eight dimensions in the model. Items were designed to collect perceptions of various waiting room design features, user experience overall ratings, and behavioral intentions (Juliá Nehme et al., 2021). Online Appendix A contains the list of the

Table 1. Description of Main Interior Design Characteristics in Conventional and Modern Waiting Rooms

Features	ConventionalWaiting Rooms	ModernWaiting Rooms
Building state	Old remodel	Recently renovated interior
General layout	Square plan	L-shaped plan
Furniture	Chairs and reception desks	Armchairs, sofas, chairs, side tables, and reception desks
	Color scheme and materials	
Walls	White	White/wooden/color around the doors to help floor identification
Floor	Beige (laboratory) or turquoise (multispecialty unit) vinyl flooring	Wooden/beige vinyl
Doors	Light blue	White
Seats	Plastic/white	Artificial leather White and orange armchairs, black sofas
Reception desk	Wooden dark brown	Wooden dark brown
	Dimensions	
Seat dimensions, cm (seat height/width/depth; back support height)	Chairs: 45/46/44/36	Armchairs: 42/49/46;42 Sofa: 41/58 (per person)/51; 38
Reception desk height, cm	105	117
	Environmental conditions	
Windows	Yes	No
Views to the outside	Yes, buildings	No
Light appearance	Not uniform/cold	Not uniform/cold
Illuminance (lux)	30–196	164–245
Temperature (mean °C taken random days during summer)	26 °C	24 °C
Sound (dB[A] slow taken random days)	57–70 dB(A)	50–58 dB(A)
Air conditioning equipment	Ceiling fan and air conditioner wall-mounted (multispecialty waiting room)	Air conditioning system
Scent	—	Citric artificial scent
Take a number machine	Ticket dispenser	Touchscreen take a number system
Amenities	TV showing open channels	TV showing institutional videos (repetitive background melody or no sound). Water dispenser
Decoration	None	Large size abstract artwork; plants
Graphic information on the walls	Yes	No
Signage	Basic. Some printed indications to help orient patients	Floor number and specialties. Reception desk modules. Doctors' box. Bathroom

**Please add the lines specified in the original table to separate topics.

items corresponding to each SUE dimension and their scales (translation in English is included).

Questionnaires were organized in six forms, each one with different order of the SUE influential dimensions to control data missingness in the last part of the questionnaire. Data collection was performed during 6 weeks in conventional and modern waiting rooms by the principal investigator and six undergraduate research assistants. The research team approached adult patients and their

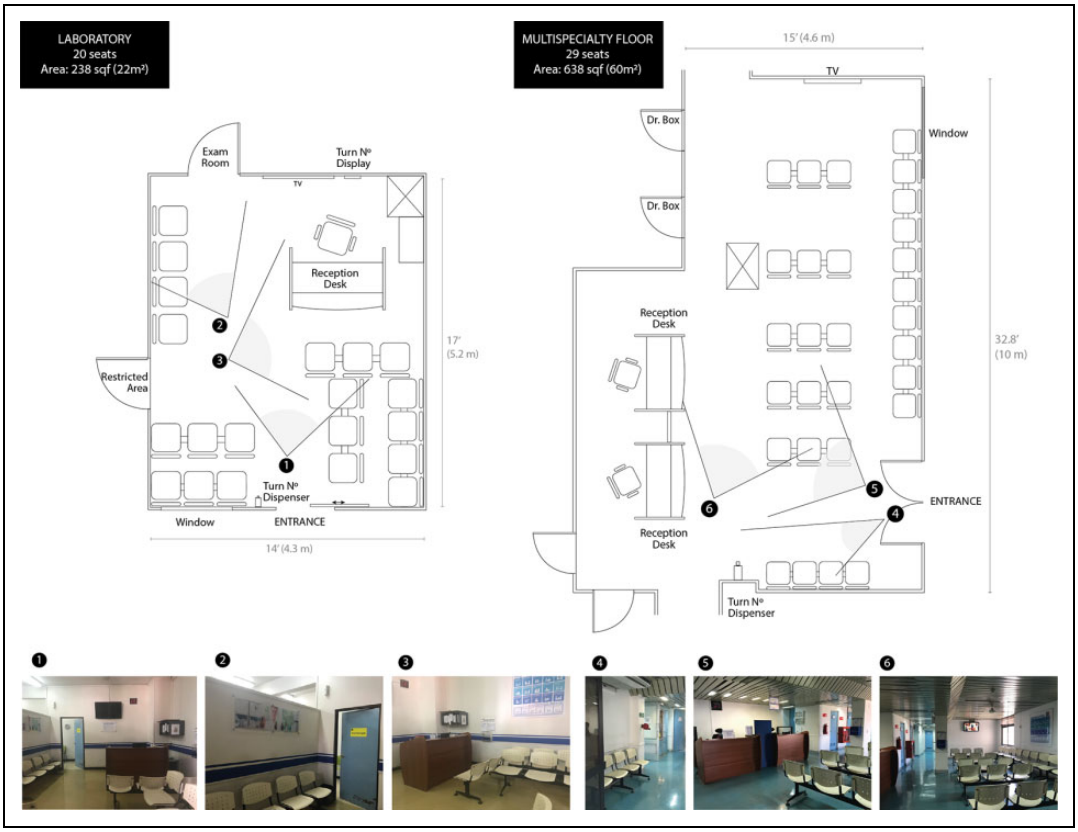

Figure 2. Conventional waiting rooms.

companions in the waiting room, explained the study's objectives and invited them to participate. Visitors who agreed to participate signed a consent form and responded the questionnaire while waiting in their seats. Some patients were interrupted by their medical appointments and resumed after they were finished.

Sample

The database (Juliá-Nehme et al., 2022) comprises a sample of 137 participants in conventional waiting rooms and 426 participants in modern waiting rooms. Participants include patients and their companions. Table 2 summarizes the samples' demographic and background information.

Considering the nature of comparative analysis, we performed Mann–Whitney–Wilcoxon test and χ^2 analysis to explore the samples' differences and similarities based on demographic information and background questions. These tests aim to better understand the samples to perform an appropriate interpretation of our comparative analysis results.

Comparative Data Analysis

We conducted a multigroup structural equation modeling analysis to identify mean differences between participants of conventional and modern waiting room conditions in all latent variables influencing the user experience in the SUE model (i.e., spatial cognition, physical compatibility, environmental compatibility, emotional reaction, spatial appreciation, and proxemics). In addition, we compared means of the user experience dimension and behavioral intentions (i.e., willingness to recommend, return and stay in the

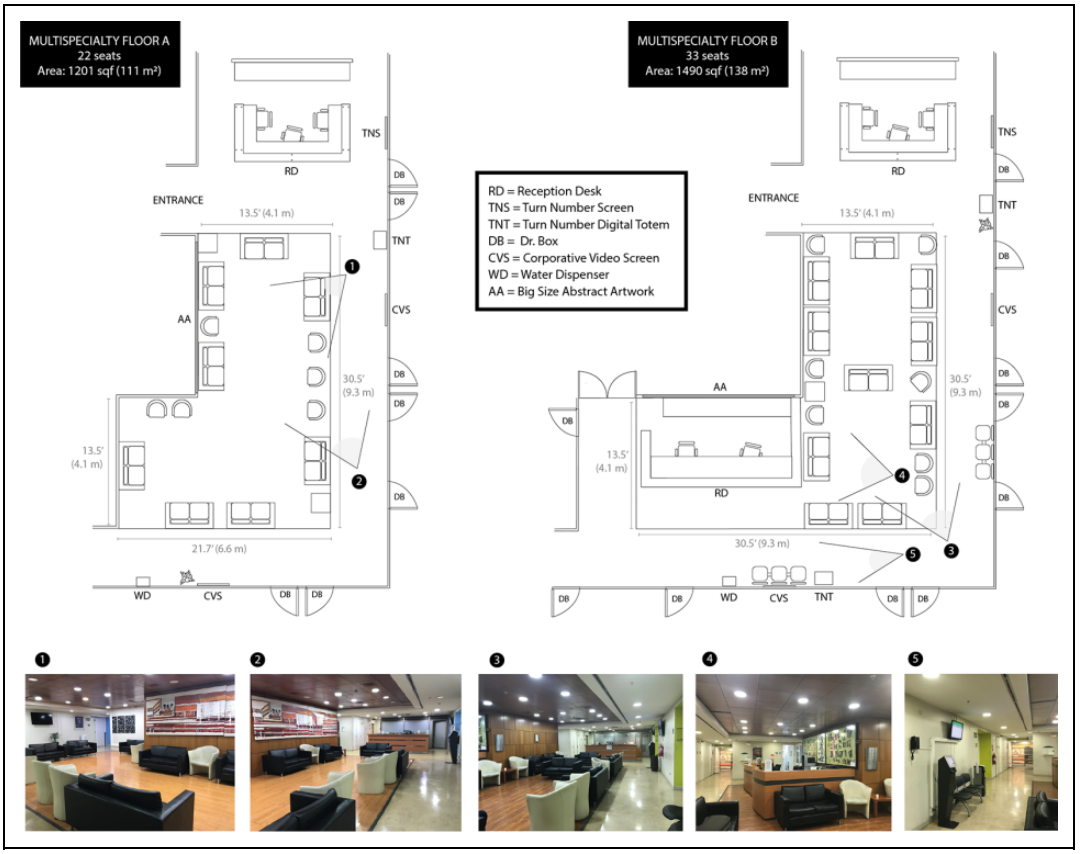

Figure 3. Modern waiting rooms Floor A and B.

place) to explore the impact of conventional and modern waiting room features.

Comparing latent means in structural equation modeling analysis requires measurement invariance between groups to avoid biased estimates (Breitsohl, 2019). Putnick and Bornstein (2016) explain that measurement invariance evaluates a construct's psychometric equality across groups. A strong level of invariance is required to compare latent means (Rensvold & Cheung, 1998).

Model invariance and group differences were evaluated using Mplus Version 8 software (Muthén & Muthén, 1998–2017). Because the questionnaire's items were considered ordinal-level measures, a means comparison was performed using the adjusted estimator weighted least square mean and variance (WLSMV), appropriate for categorical variables. We conducted group comparisons at the center level, restricting factor loadings and thresholds (categorical intercepts).

Results

Samples Similarities and Differences

Regarding the samples' demographic and background similarities, χ^2 analysis revealed no significant difference in gender (male/female) between participants in conventional and modern waiting rooms, $\chi^2(1) = 1.21$, $p = .27$. We also found no significant difference in terms of the proportion of participants visiting as patients or companions, $\chi^2(1) = 0.62$, $p = .43$. Finally, a Mann–Whitney–Wilcoxon test showed no significant difference regarding their nervous state toward medical attention ($W = 26{,}953$, $p = .60$).

On the other hand, a Mann–Whitney–Wilcoxon test showed that participants in conventional waiting rooms were significantly older than in modern waiting rooms ($W = 37{,}678$, $p < .001$). Chi-square analysis showed that there were significantly more participants with tertiary education in modern waiting

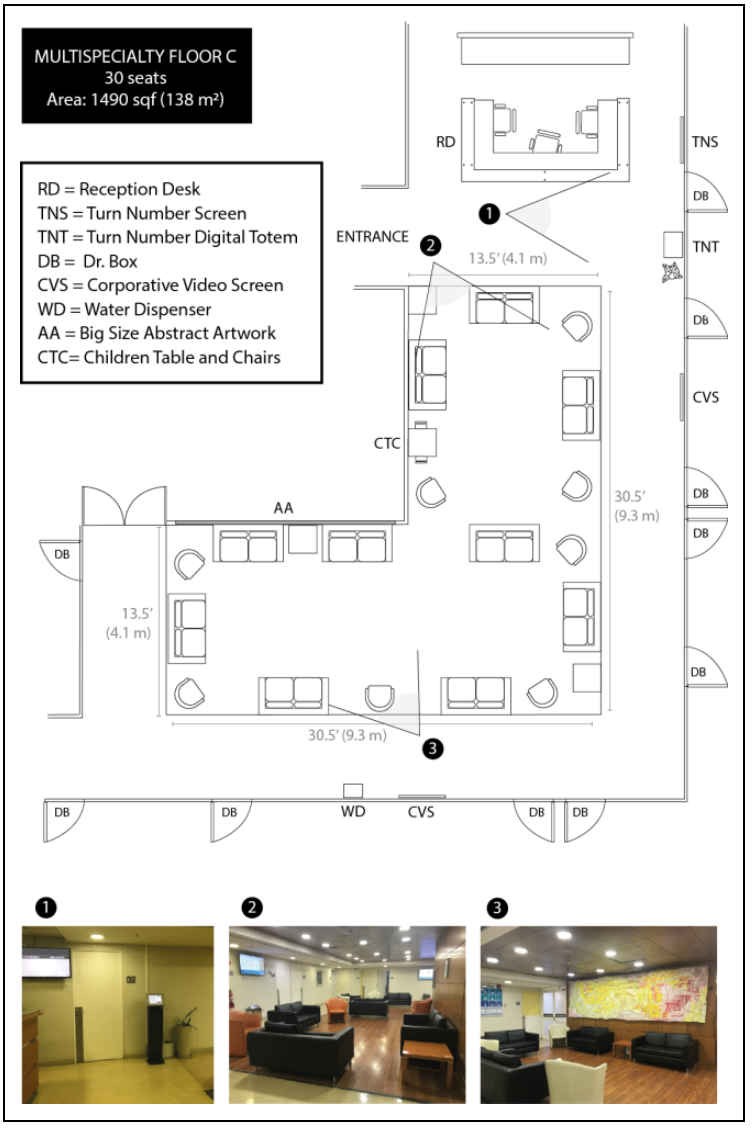

Figure 4. Modern waiting rooms Floor C.

rooms, $\chi^2(1) = 18.70$, $p < .001$. Finally, we found that participants in modern waiting rooms evaluated significantly higher on fulfillment of expectations regarding the physical waiting room environment (W = 24,240, $p < .01$) and the level of satisfaction toward staff service (W = 22,328, $p < .001$).

Comparative Data Analysis Results

Multigroup structural equation modeling analysis with fixed factor loadings and thresholds showed an acceptable fit to the data, $\chi^2 = 4{,}420.02$, $df = 2{,}570$, $p < .001$, comparative fit index (CFI) = 0.96, Tucker -Lewis index (TLI) = 0.96, root mean square error of approximation (RMSEA) = 0.05, and standardized Root Mean Square Residual (SRMR) = 0.07, suggesting a strong level of invariance and allowing for the testing of mean comparisons between the two groups.

Comparison analysis with multigroup structural equation modeling showed that participants in modern waiting rooms rated all SUE

Table 2. Samples Demographics and Background

Demographics and Background	ConventionalWaiting Rooms	ModernWaiting Rooms
Sample size (*n*)	137	426
Age, *M*(*SD*)	54.6 (18.5)	45.6 (14.3)
Reduced mobility, *n*(%)	1 (0.7)	26 (6.1)
First time in the waiting room, *n*(%)	39 (28.5)	121 (28.4)
Gender, *n*(%)		
Male	49 (35.8)	177 (41.5)
Female	87 (63.5)	246 (57.7)
Other	0	1 (0.2)
Nationality *n*(%)		
Chilean	129 (94.2)	404 (94.8)
Foreign	8 (5.8)	19 (4.5)
Education *n*(%)		
Up to high school graduate	65 (47.5)	115 (27.0)
Tertiary education	72 (52.6)	309 (72.6)
Objective of the visit, *n*(%)		
Patient	91 (66.4)	300 (70.4)
Companion	42 (30.7)	114 (26.8)
Nervous state, *M*(*SD*)[a]	0.7 (1.1)	0.7 (1.1)
Satisfaction with staff, *M*(*SD*)[b]	2.8 (1.2)	3.2 (1.2)
Waiting room design meets expectations, *M*(*SD*)[c]	2.7 (1.3)	3.1 (1.1)

Note. $n = 137$ for conventional waiting rooms; $n = 426$ for modern waiting rooms.
[a]Five-point scale: *not nervous* to *very nervous* (0 to 4).
[b]Five-point scale: *very unsatisfied* to *very satisfied* (0 to 4).
[c]Five-point scale: *strongly disagree* to *strongly agree* (0 to 4).

dimensions significantly higher than those in conventional waiting rooms (Table 3). The most considerable group mean differences were found in physical compatibility and spatial appreciation dimensions.

Detailed descriptive statistics for all SUE items/questions are reported in Table 4. Overall, evaluations in modern waiting rooms mostly fluctuated between neutral (two points) and agree (three points), whereas evaluations of conventional waiting rooms tended toward neutral (two points).

Table 3. Spatial User Experience (SUE) Standardized Mean Differences Between Conventional and Modern Waiting Rooms.

Dimensions	Estimate
Spatial cognition	0.627***
Physical compatibility	1.124***
Environmental compatibility	0.672***
Emotional reaction	0.345**
Spatial appreciation	0.885***
Proxemics	0.781***
User experience	0.730***
Behavioral intentions	0.771***

Note. $n = 137$ for conventional waiting rooms; $n = 426$ for modern waiting rooms. SUE mean values in conventional waiting rooms are set to 0, so mean estimates represent differences for modern waiting rooms.
**$p = .008$. ***$p < .001$.

Stage 2: Expert Evaluations of Conventional and Modern Waiting Rooms

In the second stage, an expert ergonomist and two professional interior designers assessed conventional and modern waiting rooms based on the SUE model structure. There was no interaction with patients or visitors during the analysis; thus, the study was also exempted from ethical approval. These results were used to examine the congruence between expert evaluations and users' perceptions and to inform waiting room design guidelines.

Table 4. Descriptive Statistics for Measurement Items in the Spatial User Experience Model Questionnaire

	Conventional Waiting Rooms ($n = 137$)		Modern Waiting Rooms ($n = 426$)	
Label and Item	Mean	*SD*	Mean	*SD*
Spatial cognition (*strongly disagree* to *strongly agree*)				
sc1: I can easily identify where I have to take a number for my appointment	2.68	0.96	3.11	0.81
sc2: Signage is useful, clearly visible and gives me appropriate orientation	2.45	0.93	2.88	0.97
sc3: I am clear on where to go once my turn for attention comes	2.55	0.99	3.17	0.81
sc4: I can easily see/hear how appointment turns progress	2.54	1.04	2.86	1.00
sc5: I can easily tell when my appointment turn comes	2.62	0.95	3.02	0.94
sc6: Overall, it appears easy to me to know what I have to do to get medical attention	2.61	0.94	3.07	0.79
Physical compatibility (*strongly disagree* to *strongly agree*)				
pc1: The halls are wide enough for me to circulate without problems	2.51	0.98	3.18	0.78
pc2: The height of the main desk lets me see and communicate with personnel, exchange documents and pay without problems	2.80	0.79	3.14	0.83
pc3 [a]: I feel physical discomfort from the time I've had to wait	2.07	1.02	2.36	1.07
pc4: There are enough seats for the people waiting	1.89	1.19	2.73	1.05
pc5: The seat back gives me good support	2.34	1.04	3.15	0.84
pc6: My legs have enough free space	2.71	0.86	3.33	0.64
pc7: The seat width gives me enough personal space	2.76	0.82	3.28	0.69
pc8: I think the seat firmness is (too hard—hard—neutral—comfortable—very comfortable)	1.73	1.02	3.01	0.78
pc9: I think the seat material is (too cold—cold—agreeable—warm—too warm; highest score in the center)	1.74	0.73	2.33	0.60
Environmental compatibility				
ec1: I think the temperature is (too cold—cold—pleasant—hot—too hot; highest score in the center)	2.09	0.65	2.01	0.32
ec2: I think the ventilation is (too weak, stale air—weak—adequate—more than desirable—excessive, there is a draft; highest score in the center)	1.77	0.70	1.89	0.43
ec3: The air feels (too dry—dry—pleasant—humid—too humid; highest score in the center)	1.84	0.64	1.92	0.37
ec4: I think the lighting level is (too dim—dim—pleasant—intense—too intense; highest score in the center)	1.62	0.64	1.99	0.37
ec5: I think the ambient sound is pleasant (strongly disagree—strongly agree)	2.11	0.86	2.36	0.83
ec6: I find the ambient aroma pleasant (strongly disagree—strongly agree)	2.31	0.73	2.53	0.91
Emotional reaction (*5-point differential semantic*)				
er1: Annoyed—pleased	2.45	1.10	2.90	0.87
er2: Bored—entertained	1.90	1.33	2.31	1.13
er3: Jittery—calm	2.28	1.55	3.00	1.12
er4: Sleepy—wide awake	2.22	1.46	2.34	1.28
er5: Anxious—calm	2.66	1.43	2.96	1.15
er6: Suspicious—trusting	3.05	1.17	3.33	0.88
er7: Displeased—pleased	2.46	1.20	2.81	0.95
er8: Despairing—hopeful	2.88	1.13	2.98	0.93
Spatial appreciation (*strongly disagree* to *strongly agree*)				
sa1: The waiting room looks clean	3.02	0.74	3.43	0.66
sa2: The waiting room looks welcoming	2.28	1.02	2.98	0.87
sa3: The space seems ample	2.15	1.04	3.12	0.83

(continued)

Table 4. (continued)

	Conventional Waiting Rooms ($n = 137$)		Modern Waiting Rooms ($n = 426$)	
Label and Item	Mean	*SD*	Mean	*SD*
sa4: I like this waiting room's colors	2.05	1.05	2.77	0.94
sa5: The furniture is in good condition	2.66	0.79	3.08	0.79
sa6: I like the furniture's design	2.03	0.89	2.72	0.95
sa7: I like this waiting room's decor	1.86	0.95	2.53	1.00
sa8: Overall, I like this waiting room's design	2.17	0.95	2.71	0.91
Proxemics (*strongly disagree* to *strongly agree*)				
p1 [a]: I think there's too many people waiting in this room	1.45	1.03	1.98	1.06
p2 [a]: I feel like others are too close to me	1.98	0.95	2.45	0.89
p3: Everyone has enough personal space	2.20	0.98	2.85	0.78
p4: The seat arrangement lets me feel I have my own space	2.29	0.98	2.81	0.86
p5: I can easily avoid eye contact with strangers	2.14	0.95	2.43	0.98
User experience (*5-point scale*)				
e1: Considering the characteristics of my waiting room, my experience waiting my turn for attention has been (very satisfactory—very unsatisfactory)	2.45	1.03	2.89	0.90
e2: Characteristics of this space have allowed for a wait that is (very uncomfortable—very comfortable)	2.48	0.90	3.05	0.81
e3: My experience accessing medical attention has been (very difficult—very simple)	2.70	0.84	3.12	0.77
e4: Generally, I can say that the experience of awaiting medical attention in this space has been (very negative—very positive)	2.61	0.79	3.01	0.71
Behavioral intentions (*strongly disagree* to *strongly agree*)				
i1: In spite of the purpose of my visit, I enjoy spending time in this place	1.94	1.04	2.39	0.96
i2: If I needed medical attention again and could choose, I would return to this same place	2.77	0.87	3.16	0.84
i3: I wish all health service waiting rooms were like this one	2.33	1.06	3.01	0.97
i4: I will probably make favorable comments about this waiting room	2.43	0.92	3.02	0.79
i5: Given the characteristics of the waiting room, I would recommend this place to family and friends	2.53	0.89	3.10	0.81

Note. Questionnaire items are from Juliá Nehme et al. (2021). Five-point scales with scores between 0 and 4.
[a]Reversed scores.

Method

To evaluate the waiting rooms' ergonomic conditions, an experienced certified ergonomist of our research team visited the facilities and analyzed their qualities according to the ergonomic-instrumental dimensions in the SUE model. The specialist measured spatial dimensions, furniture dimensions, lighting level, sound level, and temperature in all waiting rooms (details in Table 1). Waiting room features were examined considering the activities performed and according to the existing design guidelines for waiting rooms.

Regarding appearance and aesthetic quality of the waiting rooms, we asked two professional interior designers to look at the photos of conventional and modern waiting rooms without people and to complete a brief questionnaire. The questionnaire included a modified Spatial Appreciation Scale (Online Appendix B) and one modified proxemics question (*I find that everyone can have enough personal space*) from the original SUE questionnaire responded by patients and their companions.

Table 5. Ergonomic Analysis of Conventional and Modern Waiting Rooms.

Feature	Guidelines	Conventional Waiting Rooms	Modern Waiting Rooms
		Spatial cognition	
Signage and wayfinding	– Use of sans serif typefaces with the first letter in upper case (Rodrigues et al., 2019). – Use of high contrast of signs and text with their background (Rodrigues et al., 2019). – Signs should be positioned to be easily seen (Ministry of Health, 2014) – Signage design should be consistent in format and layout within the setting (Ministry of Health, 2014). – Use of symbols, large letters with sans serif or simple serif fonts, and use of braille and raised symbols to help guide people with disabilities and older adults (Rodrigues et al., 2019). – Use of artwork, colors, and materials to help distinguish zones (Ministry of Health, 2014).	– The laboratory has corporative signage at the entrance to help users identify the unit. – The multispecialty floor is not identified by signage at the entrance, which could cause confusion. There is informal signage printed by staff. Doctor's offices are numbered to help patients find them. – Doctor's offices are in two different zones, and there is no signage orienting users about where the offices of certain numbers are located. – Signage fonts are sans serif as recommended, with high contrast between text and background (blue text on white background). Nevertheless, they mostly use upper case only and they do not provide braille or raised symbols for blind users.	– Each floor has visible corporative signage identifying its purpose. – Signage is consistent throughout the setting. Nevertheless, there is some informal signage printed by staff to help users in the process. – Numbers of all doctor's offices are visible from the waiting area. – Bathroom signage is visible only from one part of the waiting area. – There is no signage to identify the purpose of the two reception desks on Floor B. This could cause confusion and unnecessary queries to the staff. – Signage fonts follow most guidelines but they do not provide braille or raised symbols for blind users. – Each floor has a distinctive color applied to walls around the doors and different artwork which can help visitors identify and remember the floor.
Layout	The Ministry of Health (2014) stated that individuals gather information around them to create a mental map of the setting layout and routes. Juliá Nehme et al. (2020) highlighted the importance of orienting users during the interaction process by providing clear cues in the setting through design.	– Laboratory size and layout allow visibility of the reception desk and the exam room from the whole waiting area. The ticket number dispenser is located aside from the entrance door; thus, patients and visitors could not see it immediately. – In the multispecialty room, the ticket number dispenser is visible from the entrance. Patients need to wait to be registered at the reception desk and stand close to track their turn. – Layout from the multispecialty floor presented problems to visually following medical staff actions (e.g., going out of their office to call patients) with most chairs facing the TV and part of the doctors' offices behind the seating area.	– Layout in Floors A and C allows visibility of principal interaction points from the entrance. – There is a second reception desk on Floor B (X rays) that is not visible from the entrance or signaled, which could cause confusion and unnecessary queries to staff. – Reception desk and ticket number dispenser are visible from the entrance allowing patients to easily start the check-in process. – The screen showing the number turns to be registered at the reception desk is not visible from the waiting area. People need to stand close to the reception desk to track their turns. – Patients can be seated close to their doctor's office to visually follow medical staff actions and hear when their name is called.

(continued)

Table 5. (continued)

Feature	Guidelines	Conventional Waiting Rooms	Modern Waiting Rooms
		Physical compatibility	
Anthropometry and posture support	Chilean anthropometric information (Castellucci et al., 2019). Seats with arms provide support for elderly and infirm patients when sitting and standing ("Guide to Choosing Waiting Room Seating," 2021).	– Furniture dimensions (seats and reception desks) mostly fit the anthropometry of Chilean adult population (Castellucci et al., 2019) except for seat height (45 cm) that could cause discomfort to women and men with shorter legs (women popliteal height P5 = 37.0 cm and P95 = 44.0 cm; men popliteal height P5 = 39.9 cm and P95 = 47.4 cm). – Seats have low back support, which could cause discomfort to patients sitting for longer periods. There are no seats with arms which could cause difficulties standing up or seating down for some patients.	– Seat dimensions mostly fit the Chilean anthropometric characteristics (Castellucci et al., 2019), except for a misfit in sofas due to seat depth (51.0 cm) affecting shorter women (buttock-popliteal length P5 = 43.7 and P95 = 52.2 cm). Patients could have problems reaching sofa back supports causing discomfort. – Attention desk height (117.0 cm) allows communication with staff, but it could cause discomfort to patients if they need to read documents or write, considering population elbow height of P5 = 90.2 cm for women and P5 = 95.5 cm for men. – The waiting room includes alternative seats which help accommodate visitors with different anthropometric characteristics and physical needs.
Materials and comfort	Upholstered cushioned seating is recommended to provide comfort while waiting ("Guide to Choosing Waiting Room Seating," 2021). Gaja (2014) found aluminum and polypropylene were evaluated as the least comfortable materials, and synthetic leather as the most comfortable and warmest.	Chairs' plastic material is functional to maintain cleanliness and provide sufficient support to the body. Nevertheless, seats could be perceived as hard and uncomfortable when people seat for long periods of time.	Upholstered sofas and armchairs provide comfort, especially for longer waits. Artificial leather is comfortable but could be perceived as too warm in high ambient temperatures.
Accessibility	– Seating configuration should allow wheelchair visitors to access, transit around the waiting area, and position themselves next to regular seats not to feel excluded ("Guide to Choosing Waiting Room Seating," 2021). – The reception desk (or part of it) should allow communication between staff and short-height individuals, children, and wheelchair users (Baida & Ivanova, 2019). – Signs should provide alternative information formats (e.g., icons, braille, symbols; Baida & Ivanova, 2019).	– Patients with motor limitations can enter the building and use the elevator to get to the medical unit. – The laboratory does not have free space to position the wheelchair next to standard chairs. – Reception desk height is not wheelchair accessible. – There are no accessibility conditions to allow visually impaired people to access the service independently.	– Patients can enter the building and use the elevator to get to the medical unit. Hallways and doors are wide enough to allow displacement and maneuvering of the wheelchair user in the waiting area. There is space to position wheelchairs next to regular seats. – Reception desk's height is not wheelchair accessible. – There are no accessibility conditions to allow visually impaired people to access the service independently.

(continued)

Table 5. (continued)

Feature	Guidelines	Conventional Waiting Rooms	Modern Waiting Rooms
		Environmental compatibility	
Lighting	The Society of Light and Lighting and CIBSE recommends 200-lux for the waiting area (Bukorovic et al., 2008).	Despite daylight, lighting is insufficient in some areas of the laboratory and multispecialty unit.	Lighting is mostly acceptable according to recommendations. There is no daylight in the waiting rooms.
Temperature	The Centers for Disease Control and Prevention (CDC) recommends a temperature range between 21 °C and 24 °C for healthcare facilities (What Is the Ideal Hospital Temperature, 2021).	Temperature measured during the summer is over the recommended range, with a mean value of 26 °C, which could cause discomfort.	Temperature is regulated by an air conditioner system in a comfortable range, according to CDC recommendations.
Sound	Speech intelligibility and audibility are relevant for communication in healthcare facilities (Angeli & Ulrich, 2007). Music and natural sounds have positive effects on patients in the waiting room (e.g., Fenko & Loock, 2014; Pouyesh et al., 2018). Recommended waiting room design maximum sound level is LAeq 50 dB-A (Standards Australia & Standards New Zealand, 2000).	Sound levels measured on random days and moments in the laboratory and multispecialty unit suggested that noise exceeds recommended LAeq levels. Acoustics are especially problematic in the multispecialty unit where it was difficult to hear doctors calling patients' names.	Sound levels measured on random days and moments on Floors A, B, and C suggested that noise exceeds recommended levels. There is repetitive instrumental music associated with the corporative videos on wall screens. Although music has proven to impact patients waiting positively, repetition of the same melody for long periods could have a different effect on patients and staff.

Note. Report provided by a certified ergonomist based on the three Ergonomic–Instrumental dimensions in the Spatial User Experience model (Juliá Nehme et al., 2020), including spatial cognition, physical compatibility, and environmental compatibility.

Results

Ergonomic analysis results of spatial cognition, physical compatibility, and environmental compatibility are summarized in Table 5.

Regarding spatial appearance, evaluations from interior designer professionals revealed differences between conventional and modern waiting rooms (Table 6). Using a scale from *strongly disagree* (Score 0) to *strongly agree* (Score 4), in conventional waiting rooms, the highest mean score was 2 (neutral) in items/questions referring to the state of cleanliness and maintenance, while the lowest mean value was 0, showing negative responses to the waiting rooms' aesthetic value and proxemics. Regarding modern waiting rooms, the highest mean score was 3.5 (*agree* to *strongly agree*), addressing spatial breadth and proxemics. The lowest mean score was 2.5 (between *neutral* and *agree*) regarding the aesthetic quality of furniture and decor.

Discussion and Conclusions

Previous studies show that patients and visitors rate waiting rooms environmental quality more positively when these areas are in a new, or recently remodeled, building (Andrade et al., 2012); when they are more "humanized" to respond to patients' necessities (Fornara et al., 2006); and when they have a "nouveau" style with open layout, coordinated colors, upholstered seats, nature pictures, and indoor plants (Leather et al., 2003). Our study supports these results and adds evidence identifying that patients and visitors prefer modern waiting room features over conventional ones in terms of SUE. Multigroup structural equation modeling analysis showed that all SUE dimensions were evaluated as significantly higher in modern waiting rooms. In other words, users valued these waiting rooms' ease of orientation, including layout and signage; they perceived upholstered seats were more

Table 6. Interior Designers' Evaluations of Spatial Appearance.

	Conventional Waiting Rooms			Modern Waiting Rooms		
Label	Expert 1	Expert 2	Mean	Expert 1	Expert 2	Mean
id1. The waiting room looks clean	3	1	2	3	3	3
id2. The waiting room looks welcoming	0	0	0	3	3	3
id3. The space seems ample	2	0	1	4	3	3.5
id4. Color selection looks harmonic	0	0	0	3	3	3
id5. The furniture is in good condition	2	2	2	3	3	3
id6. I find furniture design attractive	0	0	0	2	3	2.5
id7. I find waiting room decor attractive	0	0	0	2	3	2.5
id8. I find that everyone can have enough personal space	0	0	0	4	3	3.5
id9. Overall, I find this waiting room design attractive	0	0	0	2	3	2.5

Note. Five-point scale, *strongly disagree* to *strongly agree* (0 to 4).

comfortable; environmental conditions more agreeable; personal space more adequate; they had more positive evaluations toward the setting's appearance; and their emotions were significantly more positive compared to participants in conventional waiting rooms. Accordingly, modern waiting rooms obtained significantly better overall user experience evaluations than conventional waiting rooms. The same occurred with behavioral intentions such as willingness to return and recommend.

Patients and their companions prefer modern waiting room features over conventional ones in terms of SUE.

It is important to note that, even though user perceptions in modern waiting rooms were significantly more positive than in conventional ones, there are still opportunities for improvement in both scenarios. For ergonomic and affective dimensions, the participant response was mostly between neutral to agree in modern waiting rooms, while it was more neutral in conventional waiting rooms. An EBD approach could help enhance both types of waiting rooms to improve patient experience during the wait, selecting elements and features that have been explored in the literature with positive results. For instance, introducing images of natural landscapes to decorate the room (Watts et al., 2016) or applying Feng Shui, an ancient Chinese philosophy and practice of using design to enhance healthy and prosperous environments (Margolies, 2020) by integrating its basic elements (i.e., wood, earth, fire, metal, and water) and their related features (e.g., color and compass direction) properly to achieve energy balance in the environment (Bazley et al., 2016).

Most participants in our study did not report feeling jittery or anxious, they mostly felt between neutral and calm (see Table 4). This suggests that outpatient emotional state may vary depending on the context of their visit, which does not have to be anxiety producing. Taking into consideration the holistic user experience perspective allows for a more comprehensive analysis that may provide new insights.

Regarding congruence between waiting room user perceptions and expert evaluations, results showed that they are overall in agreement as expected from previous literature. For instance, the ergonomic evaluation identified more comfort issues in conventional waiting rooms, and its participants reported more negative responses to seat firmness (hard), seat material (cold), and availability of seats. In turn, participants in modern waiting rooms rated the seats being more comfortable, agreeing with the expert ergonomic evaluation. Participants had positive evaluations of seat characteristics such as back support, width, material quality, and seat firmness.

On the other hand, we observed some disagreements between participants and experts in conventional waiting rooms. The participants

perceived temperatures as agreeable, even when the temperatures were out of the recommended range. The experts criticized signage, but the participants did not show dissatisfaction. Finally, the experts' appearance evaluations were more critical than those by the end users. These differences suggest that experts may have more critical views and higher standards for spatial components than certain groups of users that express higher tolerance toward these features. Understanding the end users' preferences and involving them in the design process can help in aligning values and priorities in order to properly design waiting rooms that respond to their needs.

Involving end users in the design process can help in aligning values and priorities in order to properly design waiting rooms that respond to their needs and foster a positive experience.

Limitations and Projections

Groups sample size can affect the power of invariance analysis (Putnick & Bornstein, 2016). The small sample size in conventional waiting rooms led to identification problems in the first stage, limiting our analysis. Although we were able to prove the strong level of invariance, we suggest that researchers work with larger samples for all implicated groups.

We found that samples in conventional and modern waiting rooms differed in various aspects. Although any interference of the samples' characteristics was not identified, future studies assuring demographic and background equivalence could support our results.

We expect that our findings will help interior designers, architects, and facility managers, to design outpatient waiting rooms that work better for users and promote positive experiences. Our results can be especially relevant in developing countries where the quality of healthcare facilities is often neglected, and there are limited budgets to improve their interior design.

Guidelines for Waiting Room Design

The SUE model can be used as a guide to establish the necessary spatial design requirements. It is important that designers and managers consider all six dimensions that influence the user experience in the SUE model in order to define the characteristics of healthcare waiting rooms: spatial cognition, physical compatibility, environmental compatibility, spatial appreciation, emotional reaction, and proxemics. Below, we draw recommendations to design waiting rooms that foster a more positive SUE based on participant perceptions (Stage 1) and expert evaluations (Stage 2).

It is important that designers and managers consider all six dimensions that influence the user experience in the SUE model in order to define the characteristics of healthcare waiting rooms: spatial cognition, physical compatibility, environmental compatibility, spatial appreciation, emotional reaction, and proxemics.

Spatial Cognition

To improve spatial cognition, "take a number" machines should be located at a clearly visible spot from the entrance to direct patients to start the process of getting their medical appointments. Screens showing the progress of number turns to check-in at the reception desk should be facing the seats in the waiting area to avoid patients gathering close to the reception desk.

We recommend locating signage within the user's visual field and identifying all critical areas. Visible signage identifying doctor's offices can help patients figure out where to go when they are called by the medical staff (e.g., use of office numbers). Placing seats to face the doctor's office door, or to be in their vicinity, help patients easily see medical staff and hear when their name is called.

Our results showed that blue or back text on a white background and sans serif fonts in signage was considered acceptable. Using only capital letters in the text did not lead to a negative

signage perception by the users in conventional waiting rooms.

Physical Compatibility

Suggestions to improve physical compatibility include planning wide hallways to allow patients to circulate without difficulties (reference 6 ft wide). Distributing seats along the perimeter of the waiting area can also provide enough space for patients to move their legs while seated. Chairs distributed in rows do not lead to a negative perception of leg space or personal space.

We suggest placing reception desks that allow eye contact and easy interaction between visitors and staff, defining their height according to the anthropometric characteristics of the user population. For instance, reception desks in modern waiting rooms (3.8 ft high) were considered acceptable for interaction between Chilean patients and staff, including conversations and the exchange of documents. If visitors need to fill out documents with information, it could be appropriate to set the reception desk height closer to users' elbow height in order to allow a comfortable posture.

We recommend selecting armchairs and sofas that fit the users' anthropometric characteristics and provide lumbar and dorsal back support as well as sufficient personal space. Providing seating options can allow users to choose where to sit according to their needs and can improve the chances of feeling comfortable (e.g., seats with armrests for older adults or people with injuries and sofas for patients with their companions). Regarding seat material, plastic may feel cold or hard for some patients, while artificial leather is perceived as mostly agreeable.

Environmental Compatibility

To promote the patients' and visitors' positive environmental compatibility, our results showed that artificial lighting around 250 lux is evaluated as pleasant. Lighting around 150 lux is mostly evaluated as dim, even in the presence of daylight. A temperature of around 24 °C is perceived as agreeable during summer. Humidity level may be perceived as low and airflow insufficient in enclosed spaces without open windows; managers and designers should therefore seek to counteract these effects. According to our study, artificial citric environmental scent contributes to a better evaluation of environmental compatibility, but we found it also can be extremely unpleasant to some patients that expressed us their discomfort verbally. Finally, regarding the acoustic environment, participants felt mostly neutral toward ambient sounds and TV. Repetitive music from corporate videos was evaluated as slightly more favorable.

Spatial Appreciation

Interior design can help patients and visitors have a long, often stressful time to be more positive during the wait and inspire positive emotional valence. In this study, we found that the absence of ornaments and decor received lower scores. Space amplitude, overall cleanliness, and furniture maintenance are also relevant for a positive spatial appreciation of the waiting room. We found that TV open channels and corporate videos do not ensure patients' entertainment during the wait. Finally, in this study, we found that participants did not rate the interior design appearance of modern and conventional waiting rooms with the highest score. Thus, we recommend that interior designers not only respond to the organization's corporate guidelines (e.g., use of corporate colors) or interior design tendencies but also explore patients' preferences and needs. Including "user personas" in the design process (Nielsen, 2019) and using the SUE questionnaire as postoccupancy survey can help create waiting environments that are welcoming and attractive to its users.

Implications for Practice

- Results showed patients' and visitors' preference for modern style waiting room features versus conventional ones, which supports investment in user-centered waiting areas.
- Higher user evaluations of the dimensions that impact the user experience (spatial cognition, physical compatibility, environmental compatibility, emotional reaction, spatial

appreciation, and proxemics) are congruent with higher evaluations of overall user experience and behavioral intentions. Thus, investing holistically in all aspects influencing the user experience in the waiting room may lead to positive results for the healthcare industry.
- Expert evaluations were overall consistent with user perceptions. Nevertheless, we found discrepancies in temperature perception, signage evaluation, and spatial appreciation. We suggest involving end users in the design process to understand their priorities and respond to their needs.
- The article provides design guidelines regarding waiting room orientation features, physical comfort, environmental conditions, aesthetics, and personal space that can be used as design considerations for waiting room projects or implementing improvements.

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Supplemental Material

The supplemental material for this article is available online.

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