Therapeutic Environment Design for Hospitalised Children: A Systematic Review with Implications for Resource-Constrained Settings in the Arab Context

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ABSTRACT

Therapeutic environment design is an important dimension of paediatric healthcare, with physical conditions associated with children's stress, comfort, well-being and behaviour during hospitalisation. Yet evidence remains concentrated in high-income Western countries, with limited research in Arab settings. This review examines these relationships and how the evidence can inform resource-constrained paediatric healthcare, with particular consideration of Syria within the wider Arab context. Following PRISMA 2020, Scopus and Web of Science were searched for studies published in 2000–2025. Twenty-five publications were included: 23 empirical studies with MMAT 2018 appraisal records and two reviews providing context. Four themes were identified: sensory and atmospheric environment; nature and biophilic design; spatial configuration, layout and privacy; and child-centred experiential and family-supportive design. Daylight was linked to satisfaction, blue and green walls were preferred to white, and poor acoustics and limited thermal control were sources of dissatisfaction. Nature-access studies reported mood, distress and satisfaction outcomes. Spatial legibility, privacy and parent accommodation were relevant to orientation and well-being. Positive distraction was associated with calmer behaviour, and families valued home-like accommodation. Evidence mainly comprised associations, preferences and perceptions. Only three Arab-context studies were identified, and none was from Syria. The review draws on international evidence and the limited research from Arab contexts to develop design considerations for architects, hospital administrators and policymakers in resource-constrained paediatric healthcare settings.

Keywords: Therapeutic environment, Paediatric healthcare design, Evidence-based design, Arab context, Systematic review

INTRODUCTION

In January 2025, UNICEF reported that an estimated 7.5 million children in Syria required humanitarian assistance and that almost 40% of hospitals and health facilities operated only partially or were no longer operational (UNICEF, 2025). This infrastructural collapse is an acute form of a broader problem that also affects paediatric healthcare facilities outside conflict-affected health systems. Even where hospitals remain operational, environmental factors have been shown to influence children's adjustment to the ward, a process that can affect their well-being and recovery (Demetriou et al., 2024). As children are more sensitive than adults and have distinct needs when ill (Babbu & Haque, 2021), poorly designed ward spaces may add to the distress associated with illness rather than relieve it. The physical design of paediatric healthcare facilities is therefore a clinical concern as well as an aesthetic one.

Several theoretical frameworks offer explanations of how the built environment shapes patient well-being. Stress Recovery Theory (SRT), proposed by Ulrich (1983), holds that exposure to natural environments can produce rapid psychophysiological stress reduction through affective responses that are consistent with evolutionary

predispositions. Attention Restoration Theory (ART), developed by Kaplan and Kaplan (1989), argues that environments characterised by soft fascination replenish directed attention and reduce mental fatigue, a process relevant to individuals whose cognitive capacity has been reduced by illness. Whereas SRT addresses emotional recovery, ART addresses cognitive recovery; together, they provide a therapeutic rationale for biophilic and sensory design in clinical settings. Ulrich's (2000) Supportive Design Theory (SDT) extends this stress-reduction perspective to healthcare environments, proposing that they support psychological recovery when they give patients a sense of control over their immediate surroundings, access to social support and exposure to positive distractions. As hospitalisation can reduce children's autonomy and social contact, these conditions are likely to be especially relevant in paediatric care.

At the empirical level, evidence-based design features have been associated with better hospitalisation experiences for patients and families in intensive care settings, including paediatric and neonatal units, although findings for clinical outcomes are mixed (Verderber et al., 2021). Design variables, including natural light, colour, acoustic conditions, spatial legibility, nature access, and child-centred experiential features, have been linked to children's well-being, satisfaction or stated preferences across diverse paediatric settings (Babbu & Haque, 2021; Park, 2009; Whitehouse et al., 2001).

The international evidence on therapeutic design in paediatric healthcare remains geographically limited. Most studies originate from developed countries, and physical-environment studies in developing countries are lacking (Babbu & Haque, 2021). Arab-context evidence is correspondingly limited. The available studies from Palestine, Jordan and Qatar use different designs: participatory workshops on artwork preferences (Abulawi, 2023), a quasi-experimental study of positive distraction in a children's cancer centre (Alhsainat & Günçe, 2024), and a survey of children's satisfaction and preferences (Pattabi et al., 2024). None of these studies addresses Syria. Two questions remain unresolved: how therapeutic environment design influences children’s well-being in paediatric healthcare settings across Arab contexts, and how the available evidence can inform design in resource-constrained settings. Babbu and Haque (2021) note that guidelines derived from studies in developed countries may not be feasible in low-income countries. Applying this evidence to paediatric facilities in Syria and other low-resource contexts requires attention to differences in cultural, economic and infrastructural conditions.

This systematic review synthesises international evidence on how therapeutic environment design influences children’s well-being in paediatric healthcare settings. It uses that evidence to develop design considerations for resource-constrained Arab contexts where context-specific evidence is limited.

METHOD

Search strategy

This review adhered to the PRISMA 2020 guidelines for transparent and standardised reporting (Page et al., 2021). Two research questions guided the review: (i) How does therapeutic environment design influence children’s well-being in paediatric healthcare settings? (ii) How can evidence on therapeutic environment design inform paediatric healthcare settings in resource-constrained Arab contexts?

Scopus and Web of Science were searched systematically on 10 June 2026. Six Boolean searches were performed, three per database, using the following search strings: ("therapeutic environment" OR "healing environment" OR "evidence-based design") AND ("paediatric" OR "pediatric" OR "child*") AND ("hospital" OR "healthcare"); ("therapeutic environment" OR "healing environment" OR "evidence-based design") AND ("developing country" OR "resource-constrained" OR "low-income" OR "Arab" OR "Middle East"); and ("healing environment" OR "therapeutic design") AND ("hospital" OR "healthcare") AND ("Arab" OR "Middle East" OR "Syria" OR "Iraq" OR "Jordan" OR "Egypt").

Inclusion and exclusion criteria

Eligibility was restricted to peer-reviewed journal articles published in English from 2000 to 2025. Publications from 2026 and grey literature were excluded (Table 1).

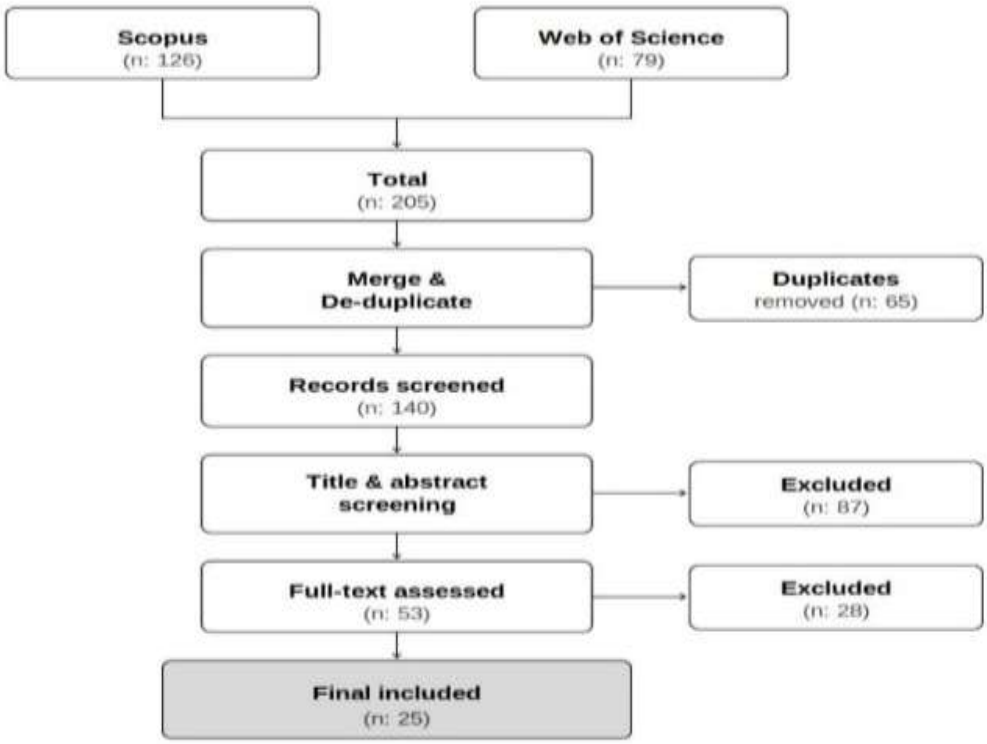
Table 1. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Empirical studies using quantitative, qualitative, or mixed methods; Systematic or narrative reviews	Conceptual or theoretical articles without primary data or methodological structure
Studies focused on physical design elements of paediatric healthcare facilities as the primary variable	Studies where physical design is not the primary variable
Setting is a paediatric healthcare facility: hospital, clinic, ward, or rehabilitation unit	Non-healthcare settings: schools, offices, or residential buildings
Population is children aged 0–18, or findings explicitly transferable to paediatric settings	Adult-only population with no stated relevance to children
Outcome related to comfort, well-being, stress, anxiety, behaviour, or satisfaction	Non-physical interventions: therapy programs, drug treatments, nursing protocols

Study selection process

Searches across both databases returned 205 records (Scopus: 126; Web of Science: 79). After 65 duplicates were removed, the remaining 140 records were independently screened by two reviewers based on titles, abstracts, and keywords using Rayyan (Ouzzani et al., 2016). Of these, 53 articles proceeded to full-text review and were independently assessed by the same two reviewers against the predefined inclusion and exclusion criteria (Table 1). Discrepancies at both stages were discussed and resolved by consensus. 25 articles met all inclusion requirements and were included in the final synthesis (Figure 1; Table 2).

Figure 1. PRISMA 2020 flow diagram of the study selection process. Source: Authors



Quality appraisal

The Mixed Methods Appraisal Tool (MMAT) Version 2018 was applied to evaluate the quality of the included studies (Hong et al., 2018). The MMAT applies five methodological criteria tailored to each study design category. The methodological appraisal was independently undertaken by each reviewer using the MMAT, with any differences resolved through discussion. In line with the guidance of Hong et al. (2018), no study was excluded on the basis of its MMAT score alone.

Data synthesis

Design-relevant data were extracted by the reviewers from the 25 included publications, comprising 23 empirical studies and two reviews that provided context. Findings were organised into inductively derived themes and synthesised narratively to bring together studies using different methods and outcome measures (Popay et al., 2006).

RESULTS

Characteristics of included studies

The included studies varied in methodological approach, geographic setting and participant group, but most were conducted in high-income Western countries, particularly the United States (Table 2). Of the 23 empirical studies, 11 used quantitative, seven mixed and five qualitative approaches (Table 2), whereas longitudinal and experimental designs were rare. In nine of the 23 empirical studies, data were gathered from parents or healthcare staff rather than directly from hospitalised children.

Table 2. General Overview of the 25 Included Studies

#	Author & Year	Country	Setting	Approach	Method	Population
S01	Norouzi et al. (2023)	USA	Adolescent psychiatric hospital	Qualitative	Semi-structured interviews + literature synthesis	Staff (n=30)
S02	Gola et al. (2016)	Italy	Paediatric hospice	Quantitative	Interviews and survey	Professionals, families; absolute sample count not reported
S03	Pattabi et al. (2024)	Qatar ★	Paediatric departments	Mixed	Survey and open-ended questions	Children aged 6–14 (n = 398)
S04	Pasha (2013)	USA	Healing gardens at paediatric hospitals	Quantitative	Self-administered surveys	Staff (n=70); family (n=76)
S05	Ozturk & Merter (2024)	Turkey	Paediatric emergency department	Qualitative	Semi-structured interviews	Nurses (n=17)
S06	Park & Park (2013)	USA / South Korea	Simulated patient rooms	Quantitative	Model simulation and survey	Inpatients aged 7-11 (n=92: USA n=42; South Korea n=50)
S07	Park (2009)	USA	Simulated patient rooms	Quantitative	Model simulation and survey	Children aged 7–11 (n = 153)
S08	Goel et al. (2024)	USA	Procedure centre	Mixed	Observation, physiological measures and survey	Child-parent dyads (n=16)
S09	Babbu & Haque (2021)	International	Paediatric wards, clinics, ICUs and NICUs	Systematic review	PRISMA review	Paediatric patients; families; staff

S10	Whitehouse et al. (2001)	USA	Children's hospital healing garden	Mixed	Observation, surveys and interviews (POE)	Garden users (>200); adults (n = 83); children (n = 22)
S11	Varni et al. (2004)	USA	Children's convalescent hospital	Mixed	Focus groups and PedsQL survey	Parents (n = 40); staff (n = 72)
S12	Kotzer et al. (2011)	USA	Children's hospital ward (pre/post relocation to new facility)	Quantitative	Before–after survey	Staff (N=812 pre; N=890 post); families (n=60 pre; n=67 post)
S13	Qi et al. (2021)	China	Paediatric clinic waiting areas	Mixed	Observation, questionnaire and interviews	Parents and accompanying persons (n=195)
S14	Canakcioglu & Unlu (2025)	Turkey	Paediatric oncology and haematology unit	Quantitative	Cognitive mapping and space-syntax analysis	Inpatients aged 7–18 (n = 30)
S15	Alhsainat & Günçe (2024)	Jordan ★	Paediatric cancer centre	Mixed	Questionnaire and quasi-experiment	Patients aged 8-18 (n=20); parents (n=20); doctors (n=40)
S16	Pati & Nanda (2011)	USA	Paediatric dental and cardiac clinic waiting areas	Quantitative	Within-subject behavioural observation	Paediatric patients (n = 158)
S17	Verderber et al. (2021)	Canada / International	Paediatric and neonatal ICUs	Literature review	Review of 135 sources	Patients, families and staff
S18	Adams et al. (2010)	Canada	Children's hospital atrium	Qualitative	Archival analysis, child-led tours and interviews	Children aged 5–18 (n = 80); professionals (n = 4)
S19	Woo & Lin (2016)	Taiwan	Paediatric hospital ward	Mixed	Grounded-theory interviews and validated survey	Children aged 7–18 (n = 401); experts (n = 6)
S20	Sherman et al. (2005)	USA	Healing gardens in a paediatric cancer centre	Quantitative	Observation and PedsQL pilot (POE)	1,400 observations; child pilot (n = 22)
S21	Sherman-Bien et al. (2011)	USA	Paediatric haematology–oncology unit	Quantitative	Cross-sectional correlation and SEM	Inpatients aged 8-18 (n=90); parents (n=149)
S22	Abulawi (2023)	Palestine ★	Children's hospital public spaces	Qualitative	Participatory workshops, drawings, models and interviews	Children (n=18); parents (n=8); medical staff (n=9); designers (n=12)
S23	Litkouhi et al. (2012)	Iran / Germany	Children's hospital wards	Quantitative	Graphic self-report questionnaire	Hospitalised children aged 6–16 (n = 224)
S24	Dyekjær & Dreyer (2019)	Denmark	Family house adjacent to a paediatric hospital	Qualitative	Phenomenological interviews	Family members (n = 33 from 15 families)
S25	Vollmer & Koppen (2021)	Netherlands / Germany	Paediatric oncology patient rooms	Quantitative	Video observation and validated questionnaires	Co-admitted families (n = 22)

Note. ★ denotes a study conducted in an Arab country. ICU = intensive care unit; NICU = neonatal intensive care unit; POE = post-occupancy evaluation; PedsQL = Paediatric Quality of Life Inventory; PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; SEM = structural equation modelling.

Table 3 shows considerable variation in sample size across the included studies. Two studies involved 25 or fewer direct participants. Four studies exceeded 300 participants, although one of these (S20) was classified by behavioural observation records. Studies classified as systematic or literature reviews were not included in this distribution.

Table 3. Distribution of Included Studies by Sample Size Band

Sample size band	Study ID (Table 2)
≤25	S05, S08
26–100	S01, S06, S14, S15, S18, S22, S24, S25
101–300	S02, S04, S07, S10, S11, S13, S16, S21, S23
>300	S03, S12, S19, S20*
N/A	S09, S17

*Note. N/A = not applicable; studies S09 and S17 are systematic and literature reviews respectively. * Study S20 classified by behavioural observation records.

Methodological quality of included studies

As detailed in Table 4, this dataset is marked by several recurring methodological limitations. Most studies relied on single-site recruitment and lacked control groups.

Table 4. Common Methodological Limitations Across Included Studies

Limitation theme	Frequency (out of 23 studies)	Illustrative examples
Single-site recruitment	16	Observed effects may reflect local architecture or organisational culture rather than design variables
No control group	17	Limits causal attribution of outcomes to specific design elements
Cultural and geographic specificity	15	Findings tied to Western contexts may not transfer to Arab or Syrian settings
Proxy or staff-only perspectives	9	Excludes the lived experience of the hospitalised child
Age-mixed samples without stratification	11	School-aged children aged 6–12 rarely analysed as a distinct subgroup

Note. Frequency refers to the number of studies in which each limitation was identified.

The full appraisal results are presented in Table 5. One study scored 1/5 and was retained as it provided direct Arab child-voice data. MMAT scoring was not applicable to two review studies, which were retained as contextual sources.

Table 5. Critical Appraisal Results Using MMAT Version 2018

Score	Study count	Study ID (Table 2)
100 (5/5)	1 study	S05
80 (4/5)	13 studies	S01, S08, S10, S12, S14, S16, S18, S20, S21, S22, S23, S24, S25
60 (3/5)	8 studies	S02, S04, S06, S07, S11, S13, S15, S19
20 (1/5)	1 study	S03

N/A	2 studies	S09, S17

Note. N/A = not applicable; MMAT = Mixed Methods Appraisal Tool.

Thematic synthesis

The thematic synthesis of the 25 studies identified four themes: sensory and atmospheric environment, nature and biophilic design, spatial configuration, layout and privacy, and child-centred experiential and family-supportive design. Several studies addressed more than one theme.

Sensory and Atmospheric Environment

The sensory studies examined natural light, colour, acoustic comfort and thermal control in relation to child well-being across different study populations. The reported findings included preferences, satisfaction and dissatisfaction, alongside physiological and psychological responses.

Natural Light and Thermal Comfort

Improvements in family and staff satisfaction followed a hospital's relocation to a purpose-built facility, where floor-to-ceiling, south-facing windows replaced the small, north-facing openings of the previous building (Kotzer et al., 2011). Families living alongside hospitalised children in long-term paediatric facilities also reported unmet daylight needs, with only moderate satisfaction scores (Varni et al., 2004). Among parents surveyed in Chinese paediatric clinic waiting areas, 65.1% preferred brightly lit environments (Qi et al., 2021).

Temperature control was among the weakest-rated environmental attributes in the pre-relocation facility (Kotzer et al., 2011). Dissatisfaction was attributed directly to the absence of individualised adjustment.

A structural equation modelling study of a paediatric haematology-oncology unit found that parental satisfaction with the built environment mediated better present functioning, less negative affect, and greater health care satisfaction. A separate, non-mediated path linked more 'beneficial' features to lower parental positive affect, the opposite of what was hypothesised, and no significant effects were found for children (Sherman-Bien et al., 2011).

Colour and Acoustic Environment

Wall colour emerged as a substantive and modifiable design variable. Blue and green were the most preferred colours across paediatric inpatients, outpatients, and healthy children aged 7–11, whereas white was consistently the least preferred (Park, 2009). A cross-cultural replication involving American and Korean patients confirmed this pattern, with both groups preferring blue and green to white, and with female patients showing stronger preferences for warm hues (Park & Park, 2013).

In adolescent psychiatric hospital settings, noise was flagged by staff as a major environmental stressor, and decentralised nurse stations and acoustic ceiling materials were proposed as mitigation strategies (Norouzi et al., 2023). Acoustic comfort was also one of only two environmental subscales that failed to meet family expectations following hospital relocation, remaining below satisfaction thresholds despite statistically significant overall improvement (Kotzer et al., 2011).

Nature and Biophilic Design

Several included studies examined gardens and other forms of nature access in paediatric settings (Pasha, 2013; Sherman et al., 2005; Whitehouse et al., 2001). Their findings concern reported mood and satisfaction, observed distress and garden use, rather than a single measured restorative outcome. In Palestine, participating stakeholders preferred nature-themed artwork (Abulawi, 2023). The Jordanian study evaluated an environment combining natural elements with other design features (Alhsainat & Günçe, 2024).

Healing Gardens and Outdoor Access

A post-occupancy evaluation of a dedicated healing garden at a San Diego children's hospital found that garden use was linked to improved mood, increased satisfaction, and emotional respite for families (Whitehouse et al., 2001). Eighty per cent of the children and adolescents interviewed did not know that the garden existed. Sherman et al. (2005) observed 1,400 garden users across three gardens at a paediatric cancer centre. A separate pilot compared 11 people in the gardens with 11 inside the hospital, including patients, visitors and staff. Distress and pain scores were lower in the gardens, but the differences were not statistically significant. Across three Texas paediatric hospitals, poor shade was negatively correlated with garden use for all user groups, and inadequate seating significantly reduced use specifically among staff (Pasha, 2013).

Nature Views and Arab-Context Evidence

Pleasant natural surroundings are among the environmental attributes associated with child satisfaction in a Taiwanese paediatric ward (Woo & Lin, 2016). A high-intervention environment at the King Hussein Cancer Center in Amman incorporated natural elements alongside other positive design features. Patients in that environment scored significantly higher than a control group across all five KIDSCREEN-27 dimensions, with large effect sizes throughout (Alhsainat & Günçe, 2024). In Nablus, Palestine, photo analysis of two paediatric facilities informed participatory workshops with school-age children and other stakeholders. Nature-themed artwork was the most strongly preferred design option across all groups, and water features and culturally resonant imagery were secondary preferences (Abulawi, 2023).

Spatial Configuration, Layout and Privacy

Studies in this theme examined how children navigate, understand and experience clinical settings under different spatial arrangements. Across multiple national contexts, floor plan legibility, room size, privacy provision and the availability of withdrawal spaces were reported as factors associated with psychological well-being.

Floor Plan Intelligibility and Wayfinding

In a space syntax analysis of a paediatric oncology and haematology unit in Istanbul, children perceived spaces with high circularity, low occlusivity and shallow mean depth values most readily. The corridor appeared most frequently in their cognitive maps. These syntactic properties, rather than integration values, corresponded to the mapping; integration values were not statistically significant predictors (Canakcioglu & Unlu, 2025). In paediatric clinic waiting areas, overall satisfaction correlated with both the distance between waiting areas and consulting rooms and the number of circulation intersections (Qi et al., 2021). Children used the eight-storey atrium at SickKids Hospital in Toronto as a spatial anchor for wayfinding, social engagement and respite from adjacent clinical zones (Adams et al., 2010).

Privacy, Room Size and Withdrawal Spaces

Most hospitalised children preferred spaces without barriers between beds, favouring social interaction over enforced separation. Iranian children showed a significantly stronger preference for open configurations than German children. In both groups, curtain-based separation was the least preferred barrier type (Litkouhi et al., 2012). Across two paediatric oncology hospitals in the Netherlands, lower parental anxiety and better parent-rated child well-being were associated with greater parent–child distance, greater use of interaction space and greater use of withdrawal opportunities (Vollmer & Koppen, 2021). In a Danish family house adjacent to a paediatric hospital, families described private rooms, treatment-free zones, shared kitchens and living spaces, and a home-like atmosphere as essential to sustaining well-being during prolonged hospitalisation (Dyekjær & Dreyer, 2019).

Child-Centred Experiential and Family-Supportive Design

The studies in this theme addressed artwork, play provision, positive distraction, family accommodation, and culturally resonant design.

Artwork, Play and Positive Distraction

Systematic behavioural observation of 158 paediatric patients in dental and cardiac clinic waiting areas found that plasma-screen distraction corresponded with calmer behaviour and reduced movement compared with a no-distraction control, with all distraction conditions producing significant calming effects, and the television monitor attracting the highest proportion of children's attention (Pati & Nanda, 2011). Children and parents preferred comfortable design features that offered distraction, but heart-rate variability and skin-conductance responses did not differ significantly across the four procedure-related spaces (Goel et al., 2024). Nursing staff identified play areas and child-appropriate equipment as essential. Their absence, staff reported, heightened child distress and complicated care delivery (Sarı Öztürk & Merter, 2024).

Family Accommodation and Arab-Context Evidence

Families described home-like accommodation as a quiet place where they could stay together and maintain everyday life during their child's hospitalisation. The study emphasised the importance of keeping family houses free from treatment (Dyekjær & Dreyer, 2019). The paediatric hospice design favoured small units with few beds, rooms for overnight family stays and in-room meals, and green space for viewing and outdoor activity (Gola et al., 2016). In a Taiwanese paediatric ward, child satisfaction was driven most strongly by child-friendly spatial features, whereas interpersonal interaction spaces underperformed relative to their perceived importance (Woo & Lin, 2016). In Qatar, 398 children aged 6–14 years completed a satisfaction survey, with average satisfaction the most frequent response across the environmental items. The qualitative expectations questionnaire had 30 respondents, who described a preference for colourful, spacious and attractive environments with toys and cartoon imagery (Pattabi et al., 2024).

DISCUSSION

Across 25 studies, therapeutic environment design was associated with multiple aspects of children's well-being in paediatric healthcare settings, although the strength and nature of the evidence varied across design features. Four themes were derived inductively: sensory and atmospheric environment; nature and biophilic design; spatial configuration, layout and privacy; and child-centred experiential and family-supportive design. Stress Recovery Theory (Ulrich, 1983), Attention Restoration Theory (Kaplan & Kaplan, 1989) and Supportive Design Theory (Ulrich, 2000) inform the interpretation of these themes.

The sensory findings concern physiological and psychological responses, but most of the evidence comes from satisfaction ratings and stated preferences. A single Chinese study also reported a preference for brightly lit environments, extending this finding beyond Western hospital settings (Qi et al., 2021). Under Ulrich's supportive design theory (Ulrich, 2000), perceived control over the immediate environment is treated as a core mechanism of patient stress reduction, and the thermal finding, in which dissatisfaction was attributed to the absence of individualised adjustment (Kotzer et al., 2011), is consistent with that mechanism. Wall-colour choices in resource-constrained settings can take account of the reported preference for blue and green over white. The evidence concerns stated preferences among children aged 7–11, including two culturally distinct samples assessed using comparable methods, and comes from two studies by the same first author (Park, 2009; Park & Park, 2013). Acoustic comfort is a persistent challenge. Similar findings from inpatient families and psychiatric staff suggest that acoustic performance needs targeted architectural changes rather than incidental redesign (Kotzer et al., 2011; Norouzi et al., 2023).

Most children and adolescents interviewed were unaware of a hospital garden, suggesting that visibility and wayfinding may be as important as design quality for access to nature (Whitehouse et al., 2001). However, access alone may not ensure use: poor shade and inadequate seating were associated with reduced garden use (Pasha, 2013). Woo and Lin (2016) extend the nature-access finding beyond dedicated gardens to pleasant natural surroundings more broadly. Ulrich's stress recovery theory (Ulrich, 1983) offers a plausible mechanism: nature

exposure is understood to trigger physiological stress reduction and support emotional recovery in hospitalised children, although the garden outcome data remain preliminary (Sherman et al., 2005).

Canakcioglu and Unlu (2025), Qi et al. (2021) and Adams et al. (2010) examined space syntax, waiting-area satisfaction and use of a large atrium, respectively. Together, these studies indicate that spatial legibility is relevant to how children orient themselves in unfamiliar clinical settings. This interpretation is limited because the waiting-area evidence reflects parents' satisfaction rather than children's orientation, and the space syntax study involved 30 children. Vollmer and Koppen (2021) reported associations between parent–child spatial provision and both child well-being and parental anxiety. These findings indicate that decisions about privacy and room configuration matter beyond functional efficiency.

Artwork, play provision, positive distraction, family accommodation and culturally resonant design were reported as ways in which paediatric healthcare environments may address children's psychological needs. Pati and Nanda (2011) reported calmer behaviour with distraction, while Sarı Öztürk and Merter (2024) reported that staff considered play provision important to care delivery. Goel et al. (2024) found that 16 child–parent dyads preferred comfortable, distracting features, although physiological measures did not differ significantly across spaces. The findings reflect positive distraction and social support, two of the three mechanisms central to environmental recovery in Ulrich's supportive design theory (Ulrich, 2000).

Variation in methodological approaches, settings and participant groups broadens the scope of the evidence but limits direct comparisons across contexts and the strength of interpretation (Table 2). The reliance of most studies on single-site recruitment and the absence of control groups limit causal inference (Table 4). Small samples, proxy perspectives and cultural specificity further limit how fully the findings can be analysed. In nine of the 23 empirical studies, parents or staff supplied the data, providing an indirect account of children's experiences. These limitations mean that the findings are interpreted as associations, preferences and perceptions rather than demonstrated effects. The search was limited to Scopus and Web of Science. Relevant studies available through other databases or regional sources may therefore not have been captured.

Most of the 25 included studies came from high-income Western countries; only three were from Arab contexts, and none was from Syria. This critical gap leaves uncertainty about whether the findings apply to settings with different cultural, economic and infrastructural conditions. The available Arab-context evidence from Palestine (Abulawi, 2023), Jordan (Alhsainat & Günçe, 2024), and Qatar (Pattabi et al., 2024) suggests that children in these settings respond to similar broad categories of design features to those documented in the Western literature. The types of evidence differed: the Jordanian study measured quality-of-life outcomes in an environment combining natural elements with other design features. In Palestine, the study recorded the preferences of children and other stakeholders. The Qatari study surveyed children's preferences and satisfaction. Nature-themed artwork, natural elements and colourful environments appear, based on this limited evidence, to be shared priorities, although the Palestinian preference for culturally resonant imagery indicates that some preferences are context-specific (Abulawi, 2023). Although no Syrian study was included, Arab-context evidence is the closest available reference for the Syrian setting. However, this should be read as an indication of transferability in principle rather than confirmation, given the small number of Arab-context studies available. Table 6 translates the empirical findings into evidence-informed design considerations rather than validated requirements, particularly given the limited Arab-context evidence and the absence of studies from Syria.

Table 6. Evidence-Informed Design Considerations Derived from the Review

Theme	Sub-area	Evidence-Informed Design Considerations
Sensory and Atmospheric Environment	Natural light	Consider providing daylight in patient rooms, with window orientation adapted to local context (Kotzer et al., 2011). Consider prioritising daylight access in new and renovated rooms (Varni et al., 2004). Consider brightly lit waiting and clinic areas, which 65.1% of surveyed parents preferred (Qi et al., 2021).

	Thermal comfort	Consider providing individualised temperature adjustment at room level (Kotzer et al., 2011).
	Wall colour	Consider using blue or green rather than white wall finishes, which children preferred (Park, 2009; Park & Park, 2013). Consider warm hues where female patients' stronger preference for them is relevant (Park & Park, 2013).
	Acoustic control	Consider decentralised nurse stations and acoustic ceiling materials in high-noise zones, as proposed by staff (Norouzi et al., 2023). Consider addressing acoustic performance directly, as it did not meet family expectations after hospital relocation (Kotzer et al., 2011).
Nature and Biophilic Design	Healing gardens and outdoor access	Consider providing adequate shade and seating in hospital gardens (Pasha, 2013). Consider locating gardens where they are visible from ward circulation routes (Whitehouse et al., 2001). Consider including garden access in paediatric ward planning (Sherman et al., 2005).
	Interior biophilic elements	Consider incorporating nature-themed artwork in corridors and waiting areas (Abulawi, 2023). Where feasible, consider incorporating water features (Abulawi, 2023).
Spatial Configuration, Layout and Privacy	Wayfinding and legibility	Consider circulation routes with high visual continuity and shallow depth (Canakcioglu & Unlu, 2025). Consider the distance and number of intersections between waiting areas and consulting rooms when planning waiting areas (Qi et al., 2021).
	Privacy and room configuration	Consider alternatives to curtain-only bed separation, the least preferred barrier type (Litkouhi et al., 2012). Consider bed layouts that preserve opportunities for social interaction (Litkouhi et al., 2012).
	Room size and family accommodation	Consider providing space that allows parents and children to adjust proximity, interact and withdraw when needed (Vollmer & Koppen, 2021). Consider providing treatment-free space for families during prolonged hospitalisation (Dyekjær & Dreyer, 2019).
Child-Centred Experiential and Family-Supportive Design	Positive distraction	Consider screen-based distraction in waiting areas (Pati & Nanda, 2011). Consider comfortable features that provide distraction, reflecting reported preferences in outpatient procedure settings (Goel et al., 2024).
	Play and child-scale design	Consider designating a play zone furnished with age-appropriate toys (Sarı Öztürk & Merter, 2024). Consider colourful, spacious environments with toys and cartoon imagery, which children preferred (Pattabi et al., 2024).
	Culturally resonant design	Consider reflecting local cultural imagery in artwork and colour schemes (Abulawi, 2023).
	Family accommodation	Consider shared family spaces, including a kitchen area, communal living zone, and private rooms separate from clinical treatment areas (Dyekjær & Dreyer, 2019).

		Consider prioritising child-friendly spatial features in ward design (Woo & Lin, 2016).

CONCLUSION

This systematic review examined how therapeutic environment design influences children's well-being in paediatric healthcare settings and how this evidence can inform design in resource-constrained Arab contexts. The 25 studies were organised into four themes covering sensory conditions, nature access, spatial layout and privacy, and child-centred experiential and family-supportive design. Reported outcomes ranged from preferences and satisfaction to mood, emotional distress and pain, observed behaviour and anxiety, indicating that the physical environment is associated with multiple aspects of children's well-being in paediatric healthcare settings.

Research remains concentrated in high-income Western countries, leaving a critical geographic gap in the reviewed evidence. The three studies from Palestine, Jordan and Qatar suggest, but do not confirm, that children in Arab settings respond to similar broad categories of therapeutic design features to those reported in the international literature. No included study was from Syria, where targeted primary research is needed. Future studies should prioritise empirical investigations in Arab and conflict-affected paediatric settings, particularly in Syria, with direct child-voice data collection, age-stratified analyses of school-aged children, rigorous confounder control, and assessment of the feasibility and resource requirements of design interventions. The evidence-informed design considerations derived from these four themes offer a starting point for architects, hospital administrators, and policymakers designing paediatric healthcare facilities in settings where context-specific evidence is limited, provided they are adapted to the context of each setting.

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