

Healing Built Environment for Children Cancer Patient a Systematic Review

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Abstract

A systematic review to find evidence base about the healing environment for pediatric cancer patients: the healing process is a process that connects physiological conditions and psychological conditions. Children with cancer must undergo long-term treatment to improve the quality of life, prolong life expectancy, and aim to cure. A systematic review study examined 1148 papers, read the abstracts, and then selected 27 papers, of which 5 were review papers. This research complements environmental behavior study and healing built environment. Where research on exceptional cases is still rarely done, especially in pediatric patients with chronic cancer. This study found the built environment needed by pediatric cancer patients through an in-depth study of writing. This section discusses theoretical propositions that are refined following the interpretation and synthesis of the literature findings. The findings from this systematic review are that the built environment related to improving children's quality of life is in palliative care, health infrastructure, facilities, environment, social demographics, illness variables, child depression level, self-healing, and quality of life.

Keywords: healing environment; children cancer; health care facility; environment behavior studies; pediatric cancer

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Introduction

Roger Ulrich wrote the term psychological wellbeing in 1979. Until now, Sadek and Willis (2019), who wrote about the influence of the built environment for cancer patients, concluded that the environment in health facilities has a critical role in patients and supports the healing process. In the last 30 years, research on the healing environment, its determinants, and their impact on health has been carried out (Alhorr, et al., (2015); Ulrich, et al., (2008); Zhang et al., (2019); Sadek et al., (2019)). A healing-built environment is defined as a health building that reduces stress levels for all users and improves user-health (Zhang, Tzortzopoulos, & Kagioglou, 2019). The study has been carried out several times on adults, but there is a severe lack of studies on patients other than adults. There is an urgent need of continuing the study on patients other than adults, Rodriguez et al. (2013) support this urgency by stating that reducing the number of children deaths is one of the Millennium Development goals for low- and middle-income countries, prioritizing reducing non-communicable diseases, including childhood cancer. One of the chronic diseases in children is cancer. As in Patenaude and Kupst (2005) cancer in children describes the emergence of pediatric psycho-oncology and summarizes research on psychosocial aspects of cancer and childhood survivorship.

As with other major stressors, the way a child with cancer responds to stress varies with age. In the end, some pediatric cancer patients will have problems with mood and anxiety (Kurtz & Abrams, 2010). Kurtz & Abrams from Bloom, Markovitz, Silverman, & Yost, (2015); Groff, Carison, Tsang, & Potter, (2008); Mehnert, et al., (2012), mentioned the use of the drug during outpatients encourage healing. There is little research that examines the needs of patients in detail in the physical environment and their relationship to recovery.

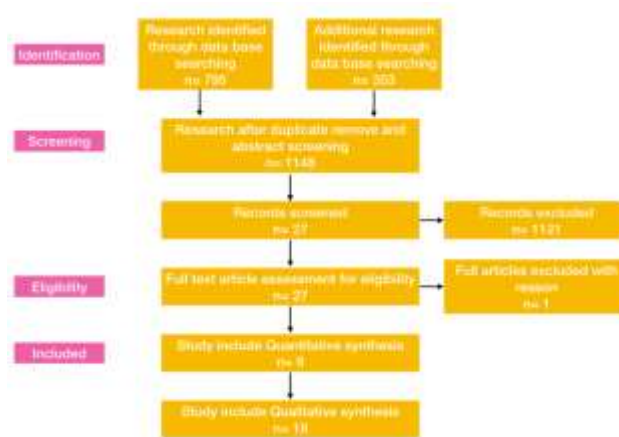


Figure 1. Systematic review flow diagram adapted from Prisma

Cancer patients in outpatient care will get several treatments, namely infusion, radio-therapy, rehabilitation, and outpatient consultation (Bredart, et al., 2015). Which also mentions that outpatients will last for an extended period. Research is needed on the psychological condition of cancer patients when receiving outpatients, how they respond to various actions (Wang & Puksza, 2017), how they spend long-term care (Shepley, Rybkowski, Aliber, & Lange, 2012) and how their conditions are particularly vulnerable. Chemotherapy and cancer patients’ reliance on it present a unique set of challenges and consequences of (Farrugia, Ingledeu, Dawes, & Moss, 2006), as it leads to patients experiencing many psychological disorders.

This study will explore the relationship between the built environment on mood and anxiety in pediatric cancer patients. Many studies discuss the influence of the environment on human health. However, it is still rare to discuss specifically cancer in children. This systematic review compiled and synthesized 27 papers regarding the relationship between pediatric cancer patients and their environment. It aims to cover how far pediatric cancer patients and the environment has been carried out to this date.

Research Method

Systematic literature review (SLR) is a type of research synthesis that can be used to create an overview of the state of the art of research on a specific topic (Burgers, Brugman, & Boeynaems, 2019). With a continuously expanding library of studies discussing physical design’s influence on clinical, behavioral, operational and business processes outcomes, there is a significant increase of demand for SLRs on healthcare design topics (Pati & Larusso, (2017); Currie, et al., (2020)). When examining such studies through SLRs, there are key supporting factors such as clarity, validity, and audibility (Booth, 2016). A systematic review approach to study at hand with standardized methodologies, namely systematic searching, filtering, reviewing, critiquing, interpreting, synthesizing and reporting findings from various publications (Pati & Larusso, 2017). Preferred reporting items for systematic reviews and meta-analysis (PRISMA) is the evidence-based guide in the form of checklist and flowchart, designed to be used by authors serving as the framework and tools in writing SLR and meta-analyses (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

The purpose of this research design is to identify the relationship between the built environment and the psychology of pediatric cancer patients and their relationship to improving their quality of life and health. The systematics of the research will be described in figure 1. Some of the research steps will be explained in the following.

A. Step 1

This study begins by identifying the literature reviews that have been published, primarily using Pub Med as the data source. The research was conducted with the keywords "interior and children oncology", "multisensory environment for cancer", "children oncology healing environment", "multisensory environment for cancer".

P	Patient, Population or Problem	Cancer, oncology, paediatric, anxiety, psychology
I	Intervention	Multisensory environment, interior
C	Comparison of intervention (if appropriate)	NA
O	Outcome to Measure or Achieve	Patient behavior, health outcome

Figure 2. Explanation of PICO search model adapted from center for evidence based medicine (Pati & Larusso)

The research was conducted in June 2021. These keywords were obtained with the use of PICO and interventional studies; made up of concepts of interest, which are participants, interventions, comparisons and outcomes (PICO), and study design (Figure 2).

Table 1. Primary Literature Searching Template (Pati & Larusso)

		<i>Population Concept</i>	<i>Intervention Concept</i>	<i>Outcome Concept</i>
<i>Medical Headings</i>	<i>Sub</i>	Paediatric	Healing environment	Patient behaviour
		Oncology	Health care facility	Health outcome
		Children	Interior	
		Cancer	Multisensory environment	
		Psychology	Wellbeing	
		Anxiety Cemotherapy		

The PICO process is evidence-based medicine studies to address a healthcare-based question, to narrow down search terms and keywords to the specific topic (Centre for Evidence-Based Medicine, (2014); Centre for Reviews and Dissemination, (2009); Lorusso & Bosch, (2016)).

B. Step 2

The screening process is carried out by reviewing the paper title, abstract, and year of publication. The only integrated paper will be reviewed, published after 2000, written in English. The other criteria are as follows:

“Focus on how to most effectively improve the quality of life of pediatric cancer patients”

A total of 1148 papers were found. This number has exceeded expectations because all abstracts from the 1148 papers will be read. Of these, 1121 were excluded because they did not fit the scope, the majority of whom did not discuss the physical environment but the medical approach—a total of 27 papers that meet the requirements. The PICO indicator is also used in screening the obtained papers.

Results

The results of the search for keywords in PubMed are as follows, mentioned in table 2. With the limitations of 2011-2021, available in the abstract and full paper, the range of articles are narrowed down to clinical trials, journal articles, meta-analysis, randomized control trials, reviews, and systematic reviews.

Table 2. Mesh keywords and the results

MeSh	PubMed		
	Results	Eligible	NA
Children oncology healing environment	10	NA	10
Paediatric cancer patient health care facility	795	18	777
Anxiety children cancer patients	343	9	334

A total of 1148 initial papers were obtained, their abstracts were read and then eliminated if they were not appropriate. Because all data comes from PubMed, the results obtained focus on research in the health sector. Initially, this research will also try to use Google Scholar, but because the results are biased and too broad, it is not used. In line with the gray literature writing (Pati & Larusso, 2017). An experiment on Google Scholar with one of the MedSh, namely "interior and children oncology," resulted in 19300 papers, and after being limited for ten years, the search became 12,500 papers. Called gray literature because the filter has not been done, so the results are very broad. This research finally refers to a more specific source in the health sector, namely PubMed.

The difficulty in reading 1148 papers is that none of the papers specifically refers to the physical environment and its relation to specific healing. 1148 were evaluated through abstracts and formulated 27 selected papers which were read in their entirety.

A. Analysis

The results were synthesized using meta-analysis or narrative techniques (Sadek & Willis, 2019) using narrative strategies to collect evidence and explain the reviewed articles found. The narrative is the method used in synthesizing this research by grouping the extracted data. At this stage, the important data obtained from the research article is grouped so that further conclusions can be drawn that can answer the objectives (Georgakakou-Koutsonikou & Williams, 2017).

The 27 full papers found were extracted by grouping the study results, then supplemented with narratives obtained from supporting studies. Data extraction used referred to the method found in (Sadek & Willis, 2019), carried out using the following steps: (i) conceptualizing the main parameters of cancer patients' healing environment through the extraction and combination of themes developed across the main studies; (ii) drawing on and synthesizing narratives presented by patients to inform and illustrate the key parameters; (iii) "secondary sources" (Table 4) are used to support the themes found, where appropriate. It provides seven philosophical dimensions or main themes, which become the parameters of the supporting environment that influence the healing and psychology of pediatric cancer patients. The results obtained are data with the following parameters in Table 3.

B. Discussion

To identify the main constituents of the environment that support or promote healing, a narrative synthesis strategy (Rasmussen & Edvarsson, 2007); (Saunders, et al., 2016) systematically gathers evidence and explains the findings of the articles reviewed. This section discusses theoretical propositions that are refined following the interpretation and synthesis of the literature findings.

Table 3. A supportive environment to paediatric cancer patients

Paliative Care	Social support	Family inclusion	Spruit & Paul, (2018), Mojen, et all, (2018), Levine, et al, (2017), Doherty,Power & Thabet, (2020)
		Social interaction with others (community)	Zebrack,st al, (2010)
		Social Attention	Al-Gharib, Abu-Saad Huijjer, & Darwish (2017)
		Staff support (nurse, doctor)	Zebrack,st al, (2010)
	Communication and Information	Patient, family, community and staf	Walubita,et al, (2018), Esmaili, et al, (2018)
		Paliative care since at early stages	Symzacak, et al, (2018), Levine, et al, (2017)
Information to family		Koohkan, et al, (2019)	
Infrastructure and Facility	Integrative Acute Care and ICU		Esmaili, et al, (2018), Wang, et al., (2011)
	Family shelter		Mojen, et all, (2018), Doherty,Power & Thabet, (2020)
	Patient centered facilities		Mojen, et all, (2018), Huidobro, et al, (2016)
	Easy access to service		Doherty,Power & Thabet, (2020)
Environment	Sleep Quality		Linder & Christian, (2012)
	EBD		Brambila, et al (2019)
	New Technology	Video Game Internet Digital Intervention	Zebrack,st al, (2013), Rodrigues, et al, (2013), Sassevile, et al,2021
	Distraction	Pet-Therapy	Chubak et al (2016)
Socio Demographic and illness variables	Financial		Mojen, et all, (2018), Esmaili, et al, (2018)
	Family and Patient perception		Tremolada, et al, (Tremolada, et al., 2020)
Levels of depression and anxiety			Mahakwe, et al, (2021), Engval, et al, (2018), Ander, et al (2017)
Self -healing	Self- Report		Philips, (2015), Mahakwe, et al, (2021), Engval, et al, (2018), Ander, et al 2017
	Self Help		Philips, (2015), Mahakwe, et al, (2021), Engval, et al, (2018), Ander, et al (2017)
QOL	Assessment		Batra et, al, (2014), Michel, et all, (2020)

1. Palliative care

Palliative care, according to the World Health Organization (2021), is the approach that aims to better the quality of life of patients and families facing a life-limiting disease. This may be achieved through effective symptom management as well as spiritual and psychological support from diagnosis until their passing. Palliative care is defined as "the complete care of the child's body, mind, and spirit, including support for the family. It begins when illness is diagnosed and continues regardless of whether or not a child receives treatment for their disease" (Al-Gharib, Abu-Saad Huijjer, & Darwish, 2017).

In the field of pediatric diseases, cancer overall survival rate has come leaps and bounds over the past several decades. Although, in terms of disease beyond infancy in children, it still remains as the leading cause of death (Spruit & Prince-Paul, 2018) with most pediatric cancer deaths occurring in low and middle-income countries (LMICs). Pediatric palliative care focuses on relieving all forms of suffering, physical, psychosocial, and spiritual; throughout the treatment of cancer, thus considered essential to pediatric cancer care with no exception (Doherty, Power, & Thabet, 2020). This is due to the significant symptom burden and toxicities of therapy that are often experienced among the children and adolescents that survive their cancer diagnosis. The evidence presented paints a picture of the current, firsthand support for pediatric palliative care, implementation of palliative care in the pediatric cancer care including their families, and the kinds of barriers that has been found to date (Spruit & Prince-Paul, 2018).

a. Social Support

There are several forms of social support that effect to palliative care:

Family inclusion

Pediatric patients experience significant symptoms throughout their cancer therapy, from the early phases up to their passing. Spruit & Paul (2018) investigated the evidence of pediatric palliative care involvement in children with cancer and their families. Their research shows an increasing trend of appropriate palliative care services in caring for pediatric cancer patients and their families (Spruit & Prince-Paul, 2018). These benefits include commitments to the patient and family-centered care, respect through cooperation with families, increased high-quality services accessibility, and consistent care. The active involvement of palliative care teams also took care of family members and healthcare staff whose needs usually go unrecognized or are not unmet otherwise (Spruit & Prince-Paul, 2018)

Social Interaction

There is limited evidence in terms of the characteristics, symptoms, and outcomes of palliative care in pediatric cancer patients, which is needed to identify and guide the improvements that could be done for the service. The most common palliative care services implemented to children with cancer were physical symptom management (31%) and psychosocial support (53%), taking the form of group counseling or play therapy. Pain was the most commonly identified physical symptom, thus leading to morphine and paracetamol becoming medications that are prescribed the most to pediatric cancer patients (Doherty, Power, & Thabet, 2020).

Palliative care should be readily available in health care facilities for pediatric cancer patients to alleviate the stress experienced by the children and their families. Intensive, medical-directed care needed for terminal conditions, such as the care for cancer, has been associated with significant suffering. Mechanical ventilation and invasive medical interventions, along with the environment of the intensive care unit, can be physical and psychosocial taxing for children with cancer and their families (Spruit & Prince-Paul, 2018).

Social attention

According to Esmaili et al. (2018), most caregivers reported that they have learned and are aware of palliative care principles, including the physical and psych spiritual needs of dying children. A few staff reported to have learned through training lead by visiting specialists, although most reported to have gained the knowledge through the clinical routine they experienced. Despite this reported awareness, stigma against dying patients was still rampant, as through observation, it is apparent that the practice of segregating and neglecting pediatric patients with severe illnesses were often found.

People believe that if [patients] will soon die, they have a stigma, and people don't want to go near them. When

they are sent, home...no one will feed them or even clean them. Their bedsheets will get wet, and they get bedsores. There is this problem with stigma.

(Oncology nurse, Esmaili et al., 2018)

Staff support

Esmaili et al., (2018) recognized and seek out not only patients and their families' first-hand accounts, but also those of hospital staff through a series of interviews. They conducted interviews with randomly selected chaplains, doctors, nurses, and social workers across various hospital departments involved in the care of children with a terminal illness, such as oncology, HIV, and intensive care. The semi-structured interviews addressed several key issues: staff and caregiver views on end-of-life needs, financial barriers and resource needs, infrastructure challenges, views on pain and its management, and their motivation in delivering end-of-life care, including faith background. An analysis of the coded interviews brought forth five key barriers that hinder pediatric end-of-life care: financial barriers, infrastructure barriers, knowledge and cultural barriers, communication: barriers, and the unique advantages presented by the care in this particular situation.

Because we are poor sometimes we have to borrow money. Up to now, we have not paid our house rent. Sometimes it is difficult to bring the child to hospital for treatment

(Mother of 6 year- old with Wilms tumor, Esmaili, (2018))

Financial issues were the most frequently reported barrier as staff reported that patients were most times unable to afford prescribed medicines, hospital supplies, laboratory tests, or even food, clothes, soap, and hospitalization fees; thus hindering the most children patients from receiving end-of-life care.

b. Communication and Information

There are many kinds of strategies to build communication and information, creating an effective strategy is a way to ensure a response from the patient.

Patient, family, community and staff

Adopting such an approach from Walubita et al. (2018), the issues related to child cancer diagnosis may require strategies that addresses these issues simultaneously at multiple layers (individual, community, systems, and cultural levels), as they are deeply intertwined with one another. At health systems and societal levels, health education policy on pediatric cancer diagnosis needs to be enforced and factors such as supplies, financial support, interventions, and lastly, accessibility to and the attitude of health workers that support the overall health system. Grootenhuis and Las found that personal interaction with health workers helped the families/parents to develop a deeper relationship with staff which then improved the level of satisfaction of the treatment given.

Gharib et al. (2017) mentioned that parents of patients who are children have reported that their child spend more time with people as compared to parents of adolescent patients. The cancer center has a psychotherapist, social worker, play therapist, teachers, and several volunteers who could be spending more time with children than with adolescents. Therefore, health care providers, need to be more aware of the care that they give to adolescent patients and how to care for their special needs during this period, similarly as to how they care for children patients.

A palliative care team that adequately responds to patients' concerns and educates healthcare providers directly involved in caring for pediatric cancer patients is something that needs to be focused on. Education will focus on both emotional support, physical pain management, and communication with both children and their family members. It highlights how important patients' and parents' participation are in the care during this period. The education that is given by medical professionals are in line with the issues brought up by Gharib (2017) as he has shown the disparity in social attention given to children and adolescents. This issue should be further addressed with psychiatrist and volunteers who provide and psychological aid to parents and patients.

Palliative care at an early stage

Evidence show that a greater comprehension of how pediatric oncology clinicians' emotional

management skills impacts the speed of booking palliative care consultations needs to be further studied upon (Szymczak, et al., 2018). Findings imply that early palliative care integration in oncology could benefit pediatric cancer patients and their respective families as very few patients or parents in this study expressed negative attitudes toward early palliative care Levine, Mandrell, & Sykes (2017) and Spruit & Prince-Paul (2018). This could be attributed to the number of pediatric oncology patients that experience a high degree of symptom-related suffering early in cancer therapy. Therefore, palliative care should not be resorted to the end-of-life period for children with cancer and should start early in the process of treating the illness, as evidence has shown that early implementation of palliative care resulted to an improved symptom management and quality of life. (Doherty, Power, & Thabet, 2020).

Information to family

Saad et al. (2008) mentioned 93% of pediatric nurses and 92.6% of pediatricians believed that the patient should know the details of their diagnosis, yet only a fraction of these pediatric nurses (6.3%) and pediatricians (23.5%) relay the diagnosis to these patients. These findings are further corroborated by Esmaili et al., (2018) who observed lacking communication between staff and terminally ill patients. One social explained that mentions of death has become a cultural taboo that no one will say (Esmaili, Stewart, Masalu, & Schroeder, 2018). Meanwhile, other caregivers reported feeling ignored, avoided, or under informed:

After we reached here I heard nurses discussing themselves that my child is suffering from kidney cancer but they are not open with me.

(Mother of 4-year-old with Wilms tumor, Esmaili et al., 2018)

The parents' low participation in decision making could also be the cause, as mentioned by Saad *et al.* (2011), where only one third of bereaved parents reported discussing resuscitation interventions and home care options with physicians. Patients' reports also show correlation between a low level of satisfaction with poor participation in decision making, though adolescents expressed more participation than children, children and parents seem to desire more active involvement in decision making.

A deeper communication barrier was found in caregivers' understanding their child's prognosis and its gravity. All caregivers believed they were receiving treatment to cure the disease even though the medical team had clearly identified these children as having terminal cancers. The team believed it would be culturally inappropriate to directly deliver the hopeless prognosis and thus, such communication barriers left many patients that has been on the oncology ward for extended periods with a vague comprehension of the fatality rates and the most likely poor outcomes (Esmaili, Stewart, Masalu, & Schroeder, 2018).

2. Infrastructure and Facility

The completeness of hospital infrastructure and facilities affects the hospital's ability to care for patients (Esmaili, Stewart, Masalu, & Schroeder, 2018). This fact highlights the urgent need for better methods of treating terminally ill cancer patients in hospitals. An example is creating interventions between facilities and cancer patients who need treatment, especially those already very severe (Wang, et al., 2011). In palliative care, (Earle, Park, & Lai, 2003) have explained some errors in the treatment of cancer patients indicating palliative care facilities:

1. Excessive use of chemotherapy
2. Improper care resulting in multiple visits to the emergency room (ER), hospital admission, 14 days and more hospitalization, ICU admission, or death
3. The use of hospice services showed a lack of associated referral (3 days before death) in the last year of life.

a. Integrative Acute Care and ICU

Acute care hospitals are not preferred in terms of death for most oncology patients, but for most worldwide, there are no other choices (Wang, et al., 2011). Having a hospice unit within an acute care hospital could help in furthering terminally ill cancer patients' understanding and affirming the conditional benefits of both acute and palliative care, through direct consultations with experts in the field and indirect influence of hospice philosophy and practices.

The recommendations from Davidson, et al. (2017) identified and summarized the best approach based on existing evidence to form internal hospital policies related to aid for families in the ICU. The researched support clinicians with evidence-based strategies to better support the family of terminally ill patients in the ICU. Most literature examining family participation in consultation are qualitative in nature and highlights the needs, perceptions and preferences of caregivers and healthcare workers. Studies have been done with subjects residing in the adult ICU, PICU or neonatal ICU, and generally, family members are more assured when they do participate in consultation and tend to prefer them over the traditional rounds format. Family members who participate in consultation report a better comprehension and communication with healthcare workers thus could make informed decision and are more satisfied across the board.

b. Family Shelter

Mojen, et al, (2018) conducted research. on a group of parents and health policy makers. To explore the two main pillars in children's palliative care, specified as: "empowerment" and "family support seeking". Participants in the research also referred to the crisis of disease and its consequences as a reason for the family's need of support, mentioning the necessity of family members supporting each other, the treatment team and other people involved in the procedure to keep the integrity of the family intact. Family member roles as parents, spouses or members of the community change with the progress and severity of the child's illness and as this could hinder family members from performing their duties. Support such as family shelters in palliative care are one of the ways to help families face these challenges.

Doherty, et al, (2020) concludes based on the available evidence of the activities that a hospital based palliative cares may provide to support for pediatric cancer patients with limited resources. Support come in the form of alleviating symptoms, providing psychological and social aid for patients and immediate family, and ease the process of discharge from the hospital as part of end-of-life care. (Doherty, Power, & Thabet, 2020).

c. Patient centered facilities

The solutions provided by palliative care in the world is carried out in a variety of ways. Designing it as a health care model that can be used as a guide is essential for the development of related activities (Bacon & Adams, 2005). Although, considering the variety of palliative care models for children, it is important for the model to be flexible and not set to a list of fixed and predetermined goals (Cancer Research Center, 2012). Furthermore, the identification and implementation of the appropriate model requires consideration for the specific conditions of each society and consequently, the health care system policies of that society (Rassouli & Sajjadi, 2014).

Doherty, et al (2020) believed that to have easy access to services, the existence of the care provision settings in which specialists are available 24 hours a day is a must. Providing care at home, at the clinic and at the hospital were approved by the participants respectively, whose realization, as they believe, depends on how the services will be implement into the health care system. Integration of services is one of the key principles in health management, thus these services should be expected of the palliative care model and not separate from it. This integration would reduce problems that the patient and caregiver encounters, such as getting confused in various care fields, delays in the treatment process, spending too much time to access services, etc. Doherty, et al (2020) noted the importance of coordination between different treatment levels in order to present families with 24-hour care, from determining where and when the patient goes after diagnosis, to referring the family to other sectors according to their needs.

3. Environment

Research show that the physical conditions of a health facility is an essential element that accounts for the quality of healthcare services (Henriksen, Isaacson, Sadler, & Zimring, 2007); (Eisen, Ulrich, Shepley, Varni, & Sherman, 2008); (Zhao & Mourshed, 2012); (Buffoli, Capolongo, di Noia, Gherardi, & Gola, 2015). Giving more thought into the physical environment of healthcare facilities would therefore address an important aspect of quality of life for children undergoing treatment for cancer, which is attention to symptoms management (Hinds, et al., 2004). Hospital environmental stimuli, particularly the amounts of sound and light, and programs utilized by caregivers; could

negatively impact sleep quantity and quality among pediatric intensive care unit patients (PICU) ((Al-Samsam & Cullen, 2005); (Carno, Hoffman, Henker, Carcillo, & Sanders, 2004); (Corser, 1996); (Cureton-Lane & Fontaine, 1997)).

a. Sleep quality

Children and adolescents receiving chemotherapy in inpatient and ambulatory settings have reported a decrease in sleep quality, indicating conditions that inhabit the ability to sleep continues in various treatment facilities. The environment, especially sound and light, is the most impactful on the length of sleep. These findings highlight how significant hospital care environments impact nighttime sleep quantity and quality (Linder & Christian, 2012).

b. Evidence based design

Indeed, architecture is considered an important aspect that contributes to the creation of a high quality service that promotes health and well-being (Clancy, 2008); (Sadler, Blair, & Berry, 2011), (Capolongo, 2016) and there are certain standards that dictate decisions about healthcare facilities design, which are to be based on state of the art available information from solid research and evaluations (Ulrich, Berry, Quan, & Parish, 2010).

Since Ulrich's first empirical studies, found that evidence-based design approach has shown significant relevance between specific design solutions in health facilities and alleviating symptoms such as: anxiety reduction, blood pressure decrease, postoperative course improvement, pain medication needs reduction and shortening of the hospital stay (Ulrich, Berry, Quan, & Parish, 2010).

According to Ulrich's evidence-based design there are several environmental variables that have an impact on users or organizational-related outcomes, as shown in Figure 3. Brambilia, et al, (2019) combined the built environment variables and user's outcome.

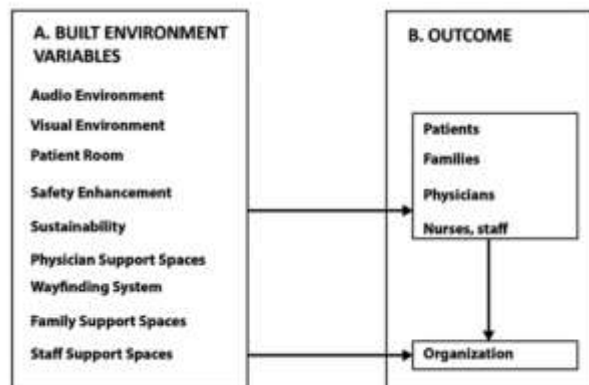


FIGURE 3. ULRICH'S AND BRAMBILIA, ET AL THEORETICAL FRAMEWORK.

Brambilia, et al (2019) assumed that this model is able to catch all the possible EBD implications and relationships between built environment and patients or structural outcome in the hospitals. The conceptual framework that is previously shown in Fig. 3 and the results indicate that visual environment still ranked at the top in recent reports. About one third of the studies mentioned some form of benefits that visual environment can give to users. Followed by audio environment (20%), patients room (20%), safety enhancement (17%), way finding (17%), family support space (17%), staff support space (14%), and sustainability (9%).

The evidence indicated that environmental design does have a role in patients' outcomes, and ignoring such evidence can no longer be accepted, as there is a growing list of evidence throughout the literature from many disciplines about the need to create a healing environment within hospital facilities (Nejati, Rodiek, & Shepley, 2016). Brambilia, et al. (2019) found 26 instances from systematic review user outcomes that can be considered evidence to indicate a correlation between

built environment characteristics and user outcomes. As shown in Fig. 3. Patients' fall reduction (6 papers), patients' stress reduction (9 papers), patients' satisfaction (6 papers), sleep quality (3 papers), social support and family presence (1 paper), and sense of privacy (1 paper) emerged to be the most significant outcomes.

c. New technology

Digital technologies could be used as a preventive and protective measure against mental health problems that persist in chronically ill patients, with adjustments made according to the age group and appropriate approach, including technology used. When children are diagnosed with cancer, issues like dealing with the concept of mortality, changes in physical appearance, disruptions to their everyday social lives, loss of agency, financial barriers, loss of reproductive capacity, and health-related concerns about the future could lead to their distress (Roberts, Turney, & Knowles, 1998); (Evan & Zeltzer, 2006), (Shama & Lucchetta, 2007); (Eiser & Kuperberg, 2007).

For recently diagnosed cancer patients, the need for information and outpatient aid services is significant and varies significantly, depending on the patients' age group and cognitive abilities during diagnosis. It is consistent with findings that suggest the use and desire for services vary, depending on the patient's socio demographic characteristics and clinical conditions, but rarely according to the type or severity of cancer (Zebrack, Matthews-Bradshaw, & Siegel, 2010). The relatively low use of internet-based resources, which are more fitting for teenagers in the current study (15.5%), implies that, although teens are at the forefront of computers and social media use in general, perhaps only a few patients use them the Internet for cancer-related information and support. Indeed, cancer information can exacerbate anxiety and distress, particularly for young people.

d. Digital Intervention

In their systematic review, Sasseville et al. (2021) targeted to examine the effectiveness of digital mental health interventions in preventing, detecting, or managing mental health problems in individuals with a preexisting chronic condition. This rapid review highlights the currently available studies about using digital treatments for people with stable chronic diseases. The review indicates that for individuals with a terminal illness such as cancer, healthcare professional-directed digital interventions, like teleconsultations, are can effectively and safely accompany outpatient treatments. Nonetheless, further studies on this are still required to provide precise recommendations regarding specific demography like children and adolescents, modes of delivery, and type of intervention.

Digital technologies could be used as a preventive and protective measure for people living with chronic conditions and dealing with the mental health side effects of it, considering the age group and type of technology used in response, but also facilitating post and future crises. The types of digital technology that had the most reports of improvements were web-based interventions, followed by email. Although, reportedly, the use of virtual reality and community forums had no significant improvements on outcomes (Sasseville, et al., 2021).

Research showed that digital health interventions effectively improve depression, anxiety, distress, quality of life, and mood regulation. Also, teleconsultation and web-based interventions were the most effective modes of delivery for the general population. Web-based interventions are indeed effective; regarding the pediatric population, a meta-review targeting digital mental health interventions reported that only in children and adolescents with anxiety and depression with no other concurring conditions (Hollis, Falconer, Martin, & et al, 2017). Meanwhile, studies reporting improvements classified by the type of digital technology used reported web-based interventions, patient portals, smartphone applications, virtual reality, email, text message, online chat, and telemedicine (Sasseville, et al., 2021).

Another research mentioned new technologies could provide a new way to treat physical pain, anxiousness, and depression as the common symptoms found in pediatric oncology patients. In addition to pharmacological therapy, the development of mobile applications, video games and virtual reality have the possibility to be beneficial as alternative therapies in alleviating pain and handling

mental health problems (Lopez-Rodriguez, Fernández-Millan, Ruiz-Fernández, Dobarrio-Sanz, & Fernández-Medina, 2020).

Studies in digital technology interventions also imply the need to assess symptoms reflecting cognitive decline as a result of chemo-brain in future research ((Tauty, et al., 2019); (Nguyen & Ehrlich, 2020)) and consider its moderating variables. Moreover, the utilization of developing technologies as new programs in pediatric oncology nursing are included in the implications for nursing practice. Thus, there would be a decrease in burden for nurses to look after basic activities such as pain management, addressing the patient's holistic perspective could occur in the future (Lopez-Rodriguez, Fernández-Millan, Ruiz-Fernández, Dobarrio-Sanz, & Fernández-Medina, 2020).

e. Distraction

The environment of the health care facility has the greatest influence on patients' outcome, particularly audio and visual environment, as it is the first concern for evidence-based design scholars. As mentioned before digital intervention are also effective improving depression, anxiety, distress, quality of life and mood regulation.

Chubak & Hawkes, (2016) mentioned that animal interaction as stress relief is a developing area of research in health care. Service animals have the potential to calm and help pediatric cancer patients deal with stress caused by physical interventions, venipuncture, chemotherapy, spinal procedure, surgery, hospitalization, fear of procedures, unpleasant physical symptoms, uncertainty, and death anxiety.

Psychological and social aid were offered individually or in group settings to children and their families. Facilities host weekly group support that discusses topics commonly a concern for parents, including the child's cancer diagnosis, prognosis, and treatment; understanding pain management; and how to care for a child with cancer (nutrition, hygiene, infection prevention). Play sessions with art, music, and theatre are hosted in groups for children, while individual psychosocial supportive counseling which also provided by a team of physicians (Doherty, Power, & Thabet, 2020).

4. Socio-Demographic and illness Variables

Palliative care remains an urgent yet overlooked necessity in the developing world. Global inequality in end-of-life care for pediatric patients, such as those with complex and terminal cancers, results from unstudied barriers that keep them from getting the aid they need. Palliative care for pediatric patients in 3rd world countries remains obsolete, with approximately 1.2 million children in need of palliative care globally. Most pediatric cancer patients (98%) are in low-medium income countries ((Kikule, 2003); (Harding, Powell, Downing, & et al, 2008)) and often face complex obstacles and barriers to receiving pediatric palliative care (Esmaili, Stewart, Masalu, & Schroeder, 2018).

Research to evaluate the cost of pediatric palliative care programs found that pediatric palliative care programs may cause a shift in the implementation of care beyond the hospital setting (Conte, Mitton, Trenaman, Chavoshi, & Siden, 2015). Financial barriers often caused families to request premature discharge to save costs. Thus, unstable, severely ill children would be let out of the hospital before they are ready for outpatient treatment. The threat of being charged for postmortem care (if a child died during hospitalization) could be particularly distressing for families as well (Esmaili, Stewart, Masalu, & Schroeder, 2018).

Esmaili et al. (2018) researched two months from May to July 2016, with a total of 34 respondents to an in-depth interview, 20 of them being caregivers while 14 of their health care staff. Analysis of these interviews and participant observation exposed five key barriers in palliative care revolving around financial, infrastructure knowledge and cultural, communication, and recognition of the unique benefits of end-of-life care could provide. Due to the lack of knowledge in palliative care and the lack of pediatric palliative experts, participants felt that a professional provision of services to children should be a priority and would be highly effective in developing these services.

Levine et al. (2017) researched 129 patients in the dyads on their experiences with cancer therapy and perspectives on early palliative care. Out of the 129 participants, 68 were identified as boys, 61 were girls; and 129 parents, 15 were men, and 114 were women. Patients reported these symptoms in the first month of

cancer therapy:

1. nausea (n = 109; 84.5%)
2. loss of appetite (n = 97; 75.2%)
3. pain (n = 96; 74.4%)
4. anxiety (n = 77; 59.7%)
5. constipation (n = 69; 53.5%)
6. depression (n = 64; 49.6%)
7. diarrhea (n = 52; 40.3%).

The results from Levine also mention that few children and parents expressed opposition to early palliative care involvement, perceived any detrimental effects on their relationship with their oncologist, loss of hope, or therapy interference (Levine, Mandrell, & Sykes, 2017). Another research found that pain, skin disease, and low physical capacity were the most commonly cited symptoms in children who have cancer (Doherty, Power, & Thabet, 2020).

5. Levels of Depression and Anxiety

Children and adolescents have a spectrum of actualization and perspectives regarding depression. There is various age, gender and experiential factors that contribute into an adolescent's comprehension of depression. For example, older participants and girls have a more comprehensive understanding of depression (Georgakakou-Koutsonikou & Williams, 2017). Some cancer survivors experience known as late effects, which find after a certain period following the conclusion of treatment. Due to expectations of long-term aftercare for pediatric cancer patients, belated side effects include physical symptoms and psychological and social ones (Iwai, et al., 2017).

In summary, the findings reported here suggest a strong case that a majority of adolescents and children are not getting their psychological and social needs met. Factors such as time pressures, excessive caseloads, and lack of accessibility to psychological and social support aids for patients, particularly for those in adult care, could be hindering trained psychosocial health care professionals (eg, social workers, psychologists) from adequately assessing and offering developmentally appropriate psychosocial care services (Institute of Medicine (IOM), 2008).

As with any intense stress factors, children's response to cancer psychologically varies with their age. It is wise to view changes to a cancer diagnosis through a developmental lens, being mindful of key characteristics in each age group (Abrams & Rauch, 2008). Ultimately, some pediatric oncology patients may become temperamental or anxious (Kurtz & Abrams, 2010). Kurtz developed psychological adjustment based on activity, age group (such as pre-school, school adolescence), and mood and anxiety to further assess this.

During the preschool years (ages 2–6 years), children tend to be egocentric (a perspective of being at the center of everything) and use the rule of associations, which could justify causality in two unrelated things when it is not the case. The combination of egocentricity and associative logic results in overly active imagination and the blurring of what is reality and what is made up. The tendency for overactive imagination may lead a child to associate his cancer with punishment for bad thoughts or actions. A good example is a 4 years old boy who is led to believe he has leukemia because he took a toy from his sister or he ate too many cookies.

Therefore, procedures and treatment side effects could also be perceived as punishments, especially if the patient could not contain the feeling of pain associated with medical illness to a particular body part, as is with most cases of leukemia. These feelings are related to a perception called a whole-body vulnerability, equating a disease in one part of the body. Whole-body vulnerability makes more accurate for children with cancer who endure extreme side effects, such as lines between veins, loss of hair, and nausea. For leukemia patients, they could be more vulnerable to this misconception, as it is challenging to grasp the dangers of hematologic malignancy (Kurtz & Abrams, 2010).

Not only are pediatric cancer patients impacted psychologically, but research has also shown that the area most affected by the illness for a preschool child is their dominant social sphere, which is family life. 3- to 6-year-old children have their immediate family as a primary social group, and they barely have any social

contact outside of them, except for preschool and day care. Being separated from family members and care providers can cause anxiety and lead to a more challenging course of treatment (Kurtz & Abrams, 2010).

School-aged children, different from their preschool counterparts, are characterized by fully developed skills, logical thinking (causal logic), and empathy of other's points of view. Children with cancer at the school-aged can directly disrupt school performance and social skills. Accompany children patient cancer for school assignments and give them age-appropriate activities such as games, board games, puzzles, art, and crafts, or video games can help children assimilate with their peer group and alleviate the regressive pull of reliance on parents and loss of self-agency the children feel while on intensive medical treatment (Kurtz & Abrams, 2010).

When school aged children receive cancer diagnosis, they a simplified and general understanding of their illness and often pride themselves in recalling the names of procedures and treatments they have received. During normal adolescence, they are expected to develop their sense of identity and independence, sexual development, and peer group involvement. Adolescents are able to consciously comprehend abstract concepts and the complexity of terminal illness in the way adults comprehend them. They understand the urgency behind a life-threatening or chronic illness diagnosis, but are often ill-prepared to deal with the drastic changes in their lifestyle and activities that the treatment entails (Abrams & Rauch, 2008)

Logistical and emotional reasons disrupt the normal development of individuality in adolescent patients; as parents may need to chauffeur them to outpatient meetings, accompany them during a hospital stay or may experience longing for closeness with their peer group when faced with the impending sense of doom raised by cancer. In the case of such emotionally complex dilemma, some teens become sullen, aggressive, non-adherent, or withdrawn, whereas others are able to cope with the inconvenience of becoming more dependent on a supportive relationship with parents (Kurtz & Abrams, 2010)

A recent study examined this dilemma further, by looking at the rates and types of distress teenagers 4 to 8 weeks go through after their cancer diagnosis. Their main concerns revolve around physical symptoms (eg, mucositis), personal side effects (eg, hair loss, fatigue, and weight changes) and disturbance to their daily routines (eg, missing school and missing leisure activities) (Hedstorm, Ljungman, & von Essen, 2005)

6. Self-Healing

As adolescents with chronic health conditions usually become more responsible for their care. With proper preparation for the transition period from pediatric to adult health care through self-management skills, youths have better health and face fewer adverse health outcomes ((Harvey, et al., 2008); (Sevick, et al., 2007)). Phillips et al. (2015) researched self-management programs and health care practices targeted at adolescents and young adult patients with chronic illnesses. Results indicate that patients who have a high self-sufficiency rate had a higher rate of emergency visits and hospitalizations with a longer length of stay than those with a low rate. Phillips' examined the association between disease self-management and health care use and its contradiction. Better self-management leads to better self-care and fewer adverse health outcomes, which reduces hospitalizations. A contributing factor to Phillips' findings could be that the young patient population is shifting their reliance on the caregivers themselves to the health care system as they slowly transition to self-care. It could explain the significant negative relationship between health care use and clinic where participants received health care, showing that younger patients spend more days in the hospital. Ander et al. developed research about guided internet self-help programs (YoungCan), primarily aimed to alleviate anxiety and depression among adolescent cancer patients with planned study procedures for a future controlled trial in mind (Ander, et al., 2017).

However, evidence indicates that internet-based programs may need to confront various backgrounds and symptoms of people with physical health conditions and comorbid anxiety and depression (Hind, O'Cathain, Cooper, & et al, 2010). Adolescents and young adults diagnosed with cancer are a relatively small and geographically dispersed group with unique individual experiences, and internet-based program may have the potential to help deal with the many barriers to psychological support outside of the health care system that have been reported by this population (Gardner, Barnes, Bopanna, & et al, 2014). Ander, et al (2017), If the internet program (YoungCan) proves effective, they aim to make the program part of the routine outpatient care for adolescent cancer patients. Guided internet administered self-help designed for adolescent patients diagnosed with cancer has the potential to alleviate suffering and costs for the individual as well as costs for

society as a whole.

7. Quality of life

The quality of life experienced by patients in the above-mentioned study was also described by Rosenberg, et al (2016). Of the 920 surveys completed and submitted, 38% of them revealed scores deemed “fair” and “poor” for health-related quality of life. Quality of life sub scores relating to physical aspects and education ranked the lowest, while emotional and social sub scores did not decrease as much in comparison. Through the study, they were able to identify thirteen symptoms that are inherently tied to poor quality of life; ten of those consistent with crucial decrease in the final index. These symptoms include Difficulty concentrating, anxiety, dry mouth, physical pain, sorrow, easily irritable, lack of sleep, fatigue, vomiting, and lack of appetite leading to anorexia, many of which can be treated and dealt with through high-quality palliative care.

Quality of life for adolescents experiencing cancer are determined by an overall sense of wellbeing, with parameters such as the ability to carry out normal activities, to socialize with peers and feel cared about, to withstand uncomfortable physical, emotional, and cognitive stress, and to find meaning in the illness experience (Hind, O’Cathain, Cooper, & et al, 2010). Based on this definition, it is clear that an adolescents’ quality of life could widely vary while going through treatment for cancer as it is a subjective experience for each patient. Ultimately, quality of life is an intensely personal phenomenon and one that can change throughout the cancer experience (Hinds P. S., *Quality of Life in Children and Adolescents With Cancer*, 1990).

Several instruments have been developed to evaluate and determine the quality of life for adolescents living the cancer experience. These instruments use various methods to report and assess QOL, such as: self-report, parent report, and proxy report (Varni, et al (1998); Ward-Smith, et al (2007); Wu, et al., (2007)). While each tool looks at several important areas related to QOL, it is difficult to draw a complete assessment from one measure alone (Hinds P. S., 2010).

Research suggests that both resilience in development, identification of strengths or resources for the best outcomes from a given experience, and ultimately, hope have been shown to have a positive effect on an adolescent’s quality of life during cancer (Cantrell & Conte, (2008); Nelson, Haase, Kupst, Clarke-Steffen, & Brace-O’Neill, (2004)). Meanwhile, a study by Bitsko, Stern, Dillon, Russell, & Laver, (2008), has found other indicators for an adolescent’s quality of life in relation to cancer, such as increased happiness and time perspective (the way an individual perceives their past, present, and future). The integration of the kinds of interventions referenced in the studies above could be a cost-effective method for enhancing the QOL for adolescents throughout the cancer experience (Bitsko, Stern, Dillon, Russell, & Laver, 2008).

Conclusion

From this systematic review, it is known that seven main things affect the healing of pediatric patients concerning the environment.

1. Palliative care

It is an integrated child care concept that focuses on social support for all parties, including families, hospital staff, doctors, and the community. Based on family data is the most important thing to accompany the patient. Palliative care must also be carried out from an early age to be handled immediately; children and families feel accepted and receive support from the disease they receive. Palliative care is also a good communication system between the environment, in this case, humans who interact with patients and family.

2. Health Infrastructure and Facilities

The concept of infrastructure and health facilities can be narrowed down to the main thing, namely, patient-centered care, where the patient’s needs come first. The systematic review also found family shelter and integrative acute care and ICU. From patient-centered care, we can match space and facility to the patients and families’ needs, although combining both parties’ needs with the standard rules of health facilities will be a new challenge. However, according to palliative care, the patient’s needs only felt close to the family and cared for, which can be overcome by the location of the nurse’s room and room for the patient’s caregiver/parents.

3. Environment

Research show that the physical surroundings of a facility is an important factor in determining the quality of healthcare (Henriksen, Isaacson, Sadler, & Zimring, 2007); (Eisen, Ulrich, Shepley, Varni, & Sherman, 2008); (Zhao & Mourshed, 2012); (Buffoli, Capolongo, di Noia, Gherardi, & Gola, 2015). The physical environment promotes patient comfort as the conceptual framework in Fig. 3, and the results are Visual environment is still top-ranked in today's studies. About 30% of the papers mentioned some benefits that a visual environment can give to users. Followed by audio environment 20%, patients room 20%, safety enhancement 17%, wayfinding 17%, family support space 17%, staff support space 14%, and sustainability 9%.

The idea that environmental design does not take part in patients' outcomes are outdated and not acceptable, there is growing evidence throughout the literature from many disciplines that indicates the need to form a healing environment within hospital facilities (Nejati, Rodiek, & Shepley, 2016). Distraction to avoid pain is part of a healing environment in audio, visual, or physical activities such as playing or pet therapy.

Studies reporting improvements are divided by the form of digital technology utilized, as mentioned, web-based interventions, patient portals, smartphone applications, virtual reality, email, text message, online chat, and telemedicine (Sasseville, et al., 2021). Another study mentions that new technologies can bring forth new and innovative ways to deal with pain, both physical and psychological, as symptoms of pediatric cancer. Besides drug-based therapy, the development of technology more in line with children's activities today such as mobile applications, video games and VR could be presented as alternative programs in treating these kinds of symptoms (Lopez-Rodriguez, Fernández-Millan, Ruiz-Fernández, Dobarrio-Sanz, & Fernández-Medina, 2020)

4. Socio Demographic and Illness Variables

The study proves that the patient's social demographics also affect the cure rate—for example, financial factors. The average patient from the lower middle class cannot buy medicine and other costs incurred. Its affects the patient's recovery and the type of disease and complaints that each patient has.

5. Levels of Depression and Anxiety

Children and adolescents have a similar yet different conceptualizations of depression that are based on their age, gender, and lived experiences with the idea of depression. For example, adolescents and girls are proven to have a fuller, more extensive understanding of depression (Georgakakou-Koutsonikou & Williams, 2017). Some cancer survivors experience so-called late effects, which manifest after a certain period following the conclusion of treatment. Due to expectations of uncertain prospect even after treatment for pediatric cancer has concluded, not only does physical symptoms manifest as late effects but also psychological and social states can be affected by these effects (Iwai, et al., 2017). Kurtz developed psychological adjustment based on activity and ages as pre-school, school adolescence and also, separated by mood and anxiety. As with any severe stressor, a child's age heavily determines how they are affected by cancer and respond psychologically. It is useful to anticipate adjustments to a cancer diagnosis and the subsequent treatments along the way, taking note of key markers for each age group (Abrams & Rauch, 2008).

6. Self-Healing

It is an effort to do therapy that can calm themselves, with the help of internet media to find out their health condition. The coincides with the findings of distraction and new technology for online consultations and recording health progress. Additional supporting data regarding self-healing also means self-control over the illness in positive suggestions for healing.

7. Quality of Life

Quality of life is something to be achieved in the healing process of patients with childhood cancer, with metrics aiming to measure the positive development in the patient's quality of life. Several parameters and supporting studies are utilized to measure the health of pediatric patients. Quality of

life for adolescents experiencing cancer is determined by an overall sense of wellbeing, with parameters such as the ability to carry out everyday activities, to socialize with the community, feel cared for and loved, to stand up to the uncomfortable physical environment, psychological condition, and to find meaning in the illness experience (Hind, O’Cathain, Cooper, & et al, 2010). It concluded that quality of life is the impact felt by patients from palliative care.

COMPETING INTERESTS

The authors have no competing interests to declare.

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