

Designing Hospital Environments to Improve the Psychological Wellbeing of Pediatric Patients

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Abstract

The hospital environment may either positively or negatively affect patient experience. The potential of the hospital environment to stimulate children's psychological wellbeing (PWB) is yet to be fully understood. This paper aims to describe how interventions in the hospital may improve the PWB of pediatric patients (including self-acceptance, positive relations, autonomy, environmental mastery, life purpose, and personal growth). We conducted interviews with healthcare experts to identify possible interventions that would respond to children's needs, and architecture and mental health experts assessed the proposals' potential to improve children's PWB. Results indicate that it is possible for the hospital environment to stimulate all components of children's PWB, especially environmental mastery, personal growth, and self-acceptance.

Keywords: healthcare design, hospitals, wellbeing, psychological wellbeing, pediatrics

Introduction

Many components of healthcare environments have the potential to positively affect patient wellbeing (Diener et al., 2018). Healthcare environments that meet users' needs can improve not only their physical but also psychological health (Bosch & Lorusso, 2019; Carrus & Pirchio, 2019; Felipe et al., 2017).

There is an increasing interest in understanding the impact of healthcare environments on patients' emotional responses in order to better align design strategies with users' needs (Capolongo, 2016; Gharipour & Trout, 2020). Healthcare facilities can meet pediatric patients' needs for autonomy (e.g., Lambert et al., 2013; Peditto et al., 2020), reduce their feelings of isolation (e.g., Bosch & Lorusso, 2019; Lambert et al., 2013), and create a more positive hospital experience by stimulating social engagement, interaction, entertainment, and learning (Lambert et al., 2013). Such environments are commonly referred to as "child-friendly." They may help lessen the patients' suffering (Hamdan et al., 2016) and support children's wellbeing (Ford, 2011).

Healthcare providers are commonly invited to be part of the process to design hospital environments since their opinions are based on observations and daily interaction with the patients (Mourshed & Zhao, 2012). Following this approach, we propose the following research question: based on experts' assessments, how may interventions in the built environment improve the wellbeing of pediatric patients during hospitalization?

This paper contributes to the state-of-the-art in healthcare design by understanding how the built environment may impact the psychological wellbeing (PWB) of hospitalized children. Our perspective targets specific components of PWB: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth (Ryff's model of psychological wellbeing; Ryff, 1989; Ryff & Keyes, 1995). The novelty of our study relies on discussing how specific interventions in the built environment may stimulate each component of PWB. The interventions proposed in this paper were directed to the Brazilian Universal Healthcare System, which means that they are context-specific, although hopefully they can inspire similar work in other countries.

Our study was divided into two stages. In the first, we conducted in-depth interviews with seven volunteers with experience in pediatric inpatient care who shared their proposals to stimulate children's wellbeing. In the second stage, eight mental health and architecture professionals linked the proposed interventions to the six components of PWB described in the following section.

Designing Hospitals to Improve Children's Wellbeing

Subjective wellbeing is a broad concept that includes a person's "emotional responses, domain satisfactions, and global judgments of life satisfaction" (Diener et al., 1999, p. 277). It relies on individuals' subjective appraisals of their own lives (Keinonen et al., 2013) based on two sources of information: cognitive evaluations and emotional assessments (Veenhoven, 2010). Such evaluations refer to several life domains, including one's health.

Psychological wellbeing (PWB) is a construct that entails more than emotion and life satisfaction. Ryff (1989) describes six core dimensions of PWB:

- self-acceptance (thinking positively about oneself)
- positive relations with others (loving others, being empathic, having affection for others)
- autonomy
- purpose in life (feeling that there is purpose in and meaning to life)
- personal growth (development of one's potential, growing and expanding as a person)
- environmental mastery (participating in and mastering the environment, being able to choose or create settings suitable to their psychic conditions)

In healthcare settings, the physical environment may have an impact on patient wellbeing and psychological health (Alzoubi & Al-Rqaibat, 2015; Bosch & Lorusso, 2019; Carrus & Pirchio, 2019; Water et al., 2017; Shepley et al., 2012). Hospital environments can promote patient engagement in their treatment by providing "physical comfort, sense of control, access to social support, and access to positive distractions" (Bosch & Lorusso, 2019, p. 82). Such distractions have the power to enhance positive feelings and to hold a person's attention (Ulrich, 1991).

Distractions may help hospitalized children stay occupied and positively engaged, reducing their risk of becoming bored and experiencing negative feelings about their situation (Bishop, 2017). Hospital environments that do not have the capacity of igniting children's imagination and help them deal with being in the hospital can lead to absenteeism from outpatient appointments. Adding positive distractions and features to the environment may not only help with absenteeism but also benefit pediatric patients' wellbeing and help reduce their resistance to treatments (McLaughlan et al., 2019). Overall, the hospital environment directly affects patients' health and recovery, with a healing environment helping reduce their stress while hospitalized (Douglas & Douglas, 2014).

Pediatric patients also desire to control their surroundings to have a greater sense of autonomy (Peditto et al., 2020; Sherman et al., 2005). Built environment features that may improve the experiences of hospitalized children include: spaces that facilitate patient interaction (Asfour, 2019; Peditto et al., 2020; McLaughlan, 2017; Nasab et al., 2020); cheerful colors (e.g., light blue, light green, and light yellow) that help diminish the clinical and scary character of the built environment (Water et al., 2017; Nasab et al., 2020); colorful decor and furniture; natural light, green spaces, and water features (Nasab et al., 2020); pictorial interventions (Monti et al., 2012); temperature control; personalizable rooms; and kitchen access (Peditto et al., 2020).

The built environment is crucial to achieving successful treatment outcomes; healthcare based solely on a biomedical perspective does not lead to satisfactory care from the patient's perspective (Edvardsson et al., 2006). Thus, to design hospitals to enhance children's wellbeing, it may be valuable to bring a wide variety

of experts' ideas and perceptions into the design process. Our methods, presented in the following session, include data collection and analysis based on the opinions of experts including physicians, nurses, child life specialists, mental health professionals, and architects.

Method

This study used a qualitative research design divided into two stages to identify the potential of interventions in hospital environments to improve the psychological wellbeing (PWB) of pediatric patients.¹

First Stage

In the first stage of the study, the researchers conducted individual in-depth interviews, in a semi-structured format, with seven healthcare professionals during the participants' working hours. The interviews took place at Hospital de Clínicas de Porto Alegre, in the pediatric unit where patients aged 0-17 years old are treated. The authors invited the interviewees in person or via email to take part in the study. In case of an agreement to participate, interviews were booked according to the participants' schedules. Interviewees signed an informed consent form, which was followed by the interview.

The researchers presented participants with three open-ended questions investigating their ideas for interventions in the built environment to stimulate the wellbeing of hospitalized children:

1. What could be improved in the hospital rooms? (For example, colors, stickers, and the like)
2. What could be improved in the children's experience when they are submitted to radiology exams? (For example, the temperature of the gel used during exams, or equipment sounds)
3. What could be improved in the children's experience when they are submitted to laboratory exams? (For example, they may feel uncomfortable with intravenous (IV) lines or the mobility of IV poles)

The interviews were audio-recorded and transcribed. We analyzed the interview contents using Thematic Analysis, with responses grouped by similarity into categories (e.g., design, co-creation, and play). When data saturation was achieved (i.e., additional interviews stopped bringing new content), the interviewer stopped inviting experts to participate. To preserve participants' anonymity, they are presented in the results section as HC1 to HC7 (HC indicating healthcare professional).

Second Stage

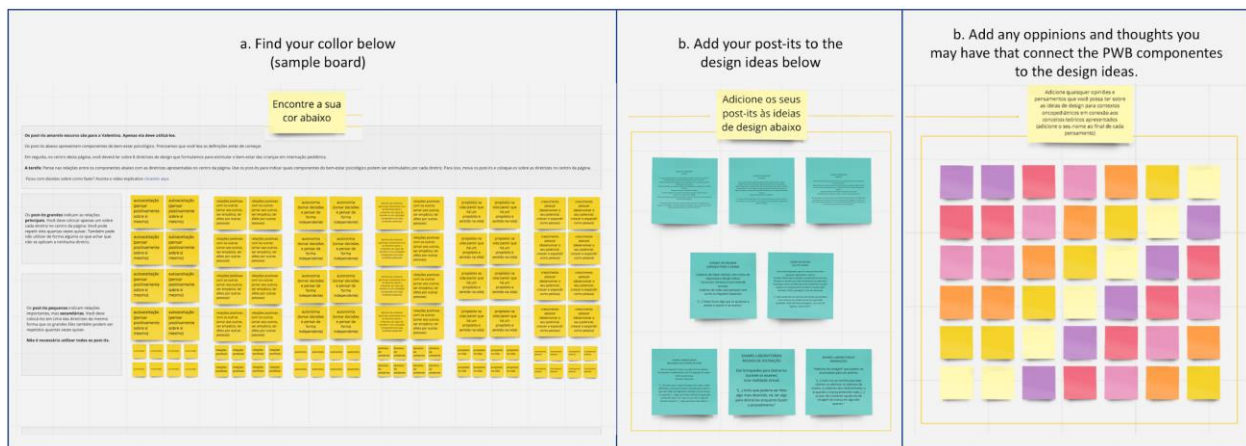
In the second stage of the study, we engaged with four mental health professionals and four architects. Participants were approached by email. Similar to the first stage of this study, research aims were explained, and informed consent forms

¹ This study was approved by the Institutional Review Board of the Clinical Hospital of Porto Alegre (CAAE # 94028918.5.0000.5327).

were collected prior to data collection. Using an online platform, the eight participants reviewed the interventions proposed by the healthcare professionals in the first stage of the study and evaluated their potential to stimulate children's PWB during hospitalization.

Logging in to the online platform at a time of their preference, participants first watched a 5-minute video recorded by the researchers explaining the task and related contents: (i) The participants were expected to connect the six components of PWB, which were explained in the video, to the categories of design interventions to stimulate the PWB of pediatric patients during hospitalization that were put forward in the first stage of the study (Table 1). (ii) Each participant had a color assigned to them, displayed on the left of the page, and several sticky-backed notes identifying the components of PWB in their color. They were instructed to use only the sticky notes of the color assigned to them. The large sticky notes indicated primary (more substantial) connections, and small sticky notes meant secondary connections (i.e., relevant but less meaningful than the primary one) (Figure 1a). (iii) They were instructed to place their sticky notes on the top of the categories of design interventions presented in green in the center of the page (Figure 1b). They were asked only to connect the PWB components they felt were relevant to the categories of design interventions. They were asked to connect only one primary component of PWB to each category, but they could also link secondary components to the categories. (iv) They should provide explanations to each connection made, using the sticky notes available on the right of the page (Figure 1c). Even though the task was performed asynchronously by the participants, they were each stimulated to log in many times to the online platform, see what other participants had responded to, and complement their responses. In some cases, when researchers were unclear about the explanations provided on the right-hand sticky notes, participants were asked to log in and provide further information.

Figure 1. Task displayed in the online platform



Participants' responses were organized in a spreadsheet indicating the frequency in which each PWB component was connected to each category, as primary or secondary connection, as seen in the following section. To preserve participants'

anonymity, they are presented in the results section as MH1 to MH4 (MH indicating mental health professional) and A1 to A4 (A indicating architect).

Results

The seven healthcare professionals (three physicians, two nurses, and two child life specialists² who are physical educators), four mental health professionals, and four architects had, respectively, mean ages of 42, 47, and 40 years old and 14, 22, and 19 years of experience.

Using thematic analysis, we clustered the responses to each of the open-ended interview questions into themes. Within each theme, we grouped all professionals' responses by similarity, forming a total of eight categories of interventions in the built environment to promote the PWB of hospitalized children.

In response to the first interview question regarding possible interventions in the hospital rooms, all participants stated that they perceived the current rooms as ordinary and plain, with no fun elements such as color. The lack of photographs, toys, and colorful walls was deemed unsuitable given the age of patients usually occupying the rooms. Some interviewees said that there should be enough space to play in (HC1 and HC6) and that the rooms should be customizable (HC1, 3, 4, 5, 6, 7). On the other hand, all participants followed up these negative comments justifying that rooms were configured to be easily sanitized and non-customizable due to the high turnover of patients and the possibility of spreading diseases.

Even though participants were not asked about sound, one of them (HC6) brought attention to the matter. "If you have a small baby and you play a soothing song, like one of those baby CD's, you know, like Bach for children... I think that it would help them calm down even when going through something, like when they have to fast, it may bring them peace."

Our thematic analysis of participants' responses revealed three categories of interventions related to hospital rooms: design, co-creation, and play. Answers given by participants are summarized in Table 1, organized into these three categories.

² Child Life Specialists are educated and trained to deal with the impacts of illness and injury on patients. Certified Child Life Specialists provide evidence-based interventions to infants, children, youth, and families, such as therapeutic play, preparation for procedures, and education to reduce distress.

Table 1. Theme: Hospital rooms and corridors

Categories	Suggested interventions	Quotes
Design	<ul style="list-style-type: none"> • More attractive accessory table to make the food look more appealing • Fun decoration of the room • Stickers on walls that could be transferred with patients when moved to another room • Colorful rooms with painted walls or decorated with stickers and bright closets • White walls with colorful details • Images projected on the ceiling for children to look at while in bed • More joyful corridors • Plants projected on the walls, showing the process of life and death through the changing of seasons 	<p>“It is such a sad room. A child's room is not a sad room, right? Children's rooms at home have their toys, there are the things they like, things that their parents make for them, so I just miss that. I think it could be a little more [joyful].” (HC7)</p> <p>“Some children have to be isolated, they cannot leave the room, and having a more colorful room, with more engravings, would be even better for them, they would feel cozier.” (HC2)</p>
Co-creation	<ul style="list-style-type: none"> • Common areas where patients could display drawings, pictures, and writings • Displays on each hospital room door for children to hang their drawings • Virtual panels for each child, which they could bring to the hospital with them • Pictures of something children like to look at to be projected on the walls, with images changing every day (e.g., a place, an object, the sun) • Customizable hospital rooms. 	<p>“[Having their pictures and drawings may] even facilitate conversation, you know? Then we would say ‘cool pictures, who are these people? Don't you want to introduce them to me?’ So, it even would be a way for us to interact better with them.” (HC3)</p> <p>“They could bring photos to be projected on a wall in the unit. These photos could change every day, like one day it would be someone's photo, the next day another's, creating an expectation, with people leaving their rooms and going there to look at what it will be that day.” (HC6)</p>
Play	<ul style="list-style-type: none"> • Hard-shell accessory boards for children to put toys on top while playing in bed • Mobile whiteboards they could draw on while in bed • More suitable play-on boards to be used in bed while keeping the bed's hygiene • Spaces to play on for those who cannot leave their beds • Colorful tatami mats on the floor by the bed to play on 	<p>“This is a pediatric unit. There should be things that stimulate these children. Things for them to play in the rooms and corridors.” (HC3)</p> <p>“Maybe create something that has a board for them to write on, these whiteboards, a movable board, like a tray, that you put on the table, that way you have some playful structures for them so that they can play in a interesting way while in bed.” (HC1)</p>

The interview question concerning children’s experiences when submitted to radiology exams brought a variety of answers. Some professionals (HC1, 5, 6, 7) argued that, since the entire hospital uses the same radiology unit, innovations to make it more child-friendly could not be implemented. However, one of the participants (HC6) said that it is always possible to plan interventions in the environment and take them to the management to check whether they agree to implement the ideas. Table 2 presents the two categories of ideas generated by participants: the patient journey to the exam and the exam room itself.

Table 2. Theme: Radiology exams

Categories	Suggested interventions	Quotes
Patient journey to the exam	<ul style="list-style-type: none"> • Child-sized wheelchairs, with safety belts and fun design • Remote-controlled miniature cars • Wheelchairs that resemble cars or space rockets 	<p>“Maybe it would be something that would help them accept and want to go to the exam.” (HC5)</p> <p>“Going to the supermarket is an extremely boring thing, but sometimes they have a miniature car for the children to sit in the shopping cart. The child wants to go in; time flies for them while you shop.” (HC1)</p>
Exam room	<ul style="list-style-type: none"> • Box of toys for children to play with while waiting for the exam • Fun walls (e.g., turn them into a forest or aquarium through painting or stickers) • Virtual reality or DVDs for them to watch on the equipment’s top shell during the exams (e.g., movies, landscapes, nature sounds) 	<p>“They could get a headphone, which could play songs or the soundtrack for the thing they are watching. There can even be landscapes, with sounds of places, things like that.” (HC6)</p> <p>“There could be some toys so that they can be entertained while waiting for the exam.” (HC2)</p>

In response to the third interview question, ideas to improve children's experiences with laboratory exams, participants concentrated their responses around improvements to IV poles and ways to distract children during the exams (HC2 and 4). Our thematic analysis classified their answers into three categories: improvements to the IV poles, ways of distraction, and rewards (Table 3).

Table 3. Theme: Laboratory exams

Categories	Suggested interventions	Quotes
Improvements to the IV poles	<ul style="list-style-type: none"> • IV poles with animals faces and paws • Medication encapsulated in a superhero or princess logo • IV poles lighter in weight 	<p>"I think that the pole could have covers, things that were colored to cover what they are carrying [the IV attached to the pole]. They could say: 'Today I'm going to go with the Spiderman cover'." (HC7)</p> <p>"The pole could be different. Something to do with the fact that the nurses started calling it "puppy," because it has a collar and all, so I don't know, making a pole in the shape of a dog or something." (HC4)</p>
Ways of distraction	<ul style="list-style-type: none"> • Toys to distract them during the exams • Virtual reality for them to visualize something more pleasant than the exam 	<p>"I think that something more entertaining could be done, you know, having something to distract them while they underwent the procedure." (HC2)</p> <p>"So, these virtual reality glasses are things that can be interesting when taking the child to another place, for them to stay put." (HC6)</p>
Rewards	<ul style="list-style-type: none"> • "Courage badge" stickers that could be accumulated towards a prize 	<p>"You create a little book for them to glue their stickers on... the exam stickers, the medication stickers, and then when the child fills it all, the parents convert that act of courage of the child to something they want." (HC1)</p>

In the second stage of the research, mental health professionals and architects with experience in healthcare design classified how each one of the eight categories of interventions might stimulate children's psychological wellbeing (PWB) during hospitalization (Table 4). The values displayed in Table 4 are the number of connections made by participants. We weighted primary connections as 1 and secondary connections as 0.5 and calculated how much all interventions may stimulate each component of PWB (total score by column), as well as how much each intervention may stimulate PWB overall (total score by row). Table 4 presents the eight categories of intervention in descending order according to their total scores.

Table 4. Connections made between categories of design interventions and PWB components

PWB Components	Number of connections (primary and secondary)												Total score for each category	Quotes
	Environmental Mastery		Personal Growth		Self-acceptance		Autonomy		Positive relationships		Purpose			
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary		
Categories of interventions														
Hospital rooms and corridors: co-creation	7		1	1			1		2		2		11	<p>"I like the idea of bringing something of theirs to the hospital. Also, in the common areas, present drawings or writings of those who recovered, who've been there and overcome it." (MH1)</p> <p>"The mastery of the environment (...) encourages the child to feel at home in a space that they helped to design, leaving their mark and identity on it, making them part of the environment and the environment part of them." (A3)</p>
Laboratory exams: rewards			6			2			1	2	1		10	<p>"Not only they will be rewarded for putting together an 'X' number of stickers, but they will also, above all, show how brave they were to complete this journey." (MH2)</p> <p>"The award, although symbolic, stimulates self-esteem, promotes individual growth and gives the feeling of victory. 'I did it. I won. I did the exam.'" (A3)</p>
Hospital rooms and corridors: play	1		4			3	1	2	1				9.5	<p>"Playing is a form of expression of not only of the conscious but also of the unconscious mind (...). This would allow the understanding of the hardships that the child goes through at that moment." (MH3)</p> <p>"I believe that play is a part of human development. Many toys stimulate the child and should not be left aside due to hospitalization. The proposed intervention brings children closer to this activity and empowers them as human beings." (A4)</p>
Laboratory exams: improvements to the IV pole	2	2			3	1	1	1		1	1		9.5	<p>"In this moment of so few choices in life, even small opportunities to choose [such as personalizing the IV poles] are meaningful." (MH3)</p>

Discussion

There are three different ways to interpret the results reported in Table 4. It seems that mental health professionals and architects assessed all of the proposed interventions as beneficial to promote the PWB of hospitalized children, aligned with many previous studies on the topic (e.g., Bosch & Lorusso, 2019; Carrus & Pirchio, 2019; Water et al., 2017; Alzoubi & Al-Rqaibat, 2015; Edvardsson et al., 2006).

Observing results by column in Table 4, it is noticeable that the proposed interventions stimulate the components of PWB in different ways and to different degrees. Environmental mastery had the highest score, followed by personal growth and self-acceptance—meaning interventions to hospital processes and environment are able to have the greatest impact on these aspects of PWB. Interviewers affirmed that, due to the high number of patients to which healthcare professionals must attend, the staff might merely go through the motions and not explain directly to patients where, how, and what is going to happen in the exams they will experience, negatively affecting the patients' ability to master the environment (i.e., choosing and creating settings suitable to their needs). Similarly, procedures are often explained to parents while in the children's presence, but without explicitly addressing the children, making it challenging for them to grow personally (i.e., have positive feelings about themselves). Patients, who should be active in their treatment since their bodies are the ones being treated, sometimes are just spectators, watching while their bodies are poked, moved around, and touched daily by several people, making it hard for the children to understand their diseases and accept themselves and their life as it is (i.e., think positively about themselves); (definitions of PWB components in parentheses by Ryff (1989) and Ryff and Keyes (1995)).

Observing the total scores in Table 4 by row, the results indicate that most categories of intervention have similar potential to stimulate children's PWB (scores range from 9 to 11), except for "laboratory exams: ways of distraction." These scores suggest that the proposals to stimulate children's PWB put forward by healthcare professionals in the first stage of the research were accurate, according to the mental health professionals and healthcare architects that assessed such ideas in stage 2. Moreover, their responses were aligned with results from previous relevant studies: (Peditto et al., 2020; Asfour, 2019; McLaughlan, 2017; Nasab et al., 2020; Water et al., 2017; Monti et al., 2012). The proposal regarding distraction during laboratory exams was the lowest ranked by mental health professionals and architects; the literature reviewed in this paper also did not provide strong evidence to support the assumption that ignoring any negative impact of the medical treatment would be beneficial to the PWB of children.

Considering individual scores for all categories in Table 4 (column "total score"), those with the most potential to stimulate PWB were "hospital rooms and corridors" both "co-creation" and "design" to stimulate environmental mastery, and "Laboratory exams: rewards" to stimulate personal growth. Also, interventions can be tailored to target specific aims by observing how each category impacts the different PWB components separately (e.g., "Laboratory exams: improvements to the IV pole" as the most adequate intervention to stimulate self-acceptance).

The participants pointed out several features that may make the hospital a more child-friendly environment and enhance children's PWB. Cues that may help distract children, such as adding color to the walls, can positively impact their experience as inpatients. Displayed artwork may help them stay occupied and not feel bored while appreciating decor on the walls (Bishop, 2017; Mari Ruberg Ekra & Gjengedal, 2012). As proposed by Bishop (2017), children enjoy being distracted to avoid thinking about their situation and feeling uncomfortable with the hospitalization. As found by Mari Ruberg Ekra and Gjengedal (2012), children might want to go home while hospitalized because they see the hospital as boring and too different from their daily lives, even feeling like time slows down there. Thus, the scores assigned by the professionals in stage 2 to the proposed interventions indicate that such changes to the hospital environment may stimulate children's PWB. The reduction of stress may consequently speed patients' health and recovery (Douglas & Douglas, 2014).

It should be noted that a friendly pediatric environment embraces not only children's but also adolescents' needs. The interventions proposed by our study participants were focused on young children and thus may not be suitable for adolescents. According to Bishop (2017), both children and youth enjoy having varied artwork as part of the aesthetics of the hospital environment, helping them feel that it is appropriate for them. Thus, corridors and walls may present ever-changing art stimuli, appropriate for different demographics. Having age-appropriate activities and feeling welcomed by the staff are also central to child-friendliness for both hospitalized children and youth (Bishop, 2017), as all patients expect to feel that there is something appropriate for them.

Conclusions

This research aimed to identify the potential of the built environment to enhance the psychological wellbeing (PWB) of pediatric patients during hospitalization. Toward that end, we carried out interviews with healthcare experts to collect their ideas on interventions in the built environment that would meet patients' needs. In the experts' view, the hospital room environments in which patients sleep and spend most of their days do not resemble children's bedrooms and should be made more fun and child-friendly to improve children's PWB. Even small interventions in their hospital rooms could bring more joy to them, enhancing the patients' wellbeing.

When the healthcare professionals' ideas for interventions were submitted to the evaluation of mental health professionals and healthcare architects, it became evident how influential healthcare environments can be on children's PWB. More specifically, our research advances the state-of-the-art by addressing specific PWB components and indicating design interventions that can target each of them.

In total, 36 different ideas for intervention in the environment of pediatric hospital units were brought to light in the interviews with the group of experts. Some of the suggested interventions may lead to design solutions that enhance children's wellbeing. However, other ideas may not be feasible due to context, for example,

having something for children to watch while being submitted to radiology exams. Even though this might have the potential to keep them still and make them feel less anxious about the exam, it may also affect their brain activity while in the MRI scan, leading to changes in the results. Thus, a thorough analysis of such interventions is required to identify viable ideas.

All ideas should be adapted to local needs and contingencies. For example, hospitals with limited funding may explore the aesthetics of the ward, possibly engaging patients themselves in the process of creating their environments. Adding children's artwork to walls and corridors or even asking them to develop specific work to display is a low-cost, high-involvement alternative. Cultural preferences should also be taken into consideration in tailoring child-friendly environments. Thus, even though the suggestions might be universal (e.g., playing soothing music), they should be tailored to specific pediatric populations (e.g., playing distinct music genres to children from different cultural backgrounds).

It is important to highlight that all professionals seemed worried about maintaining a sterile environment and ways that innovations could be implemented without exposing children to infection. Proposed interventions using technology and virtual reality could be a feasible solution to the sanitization problem. Similarly, ideas such as projections on the walls could bring life to corridor walls, hospital rooms, and ceilings without harming patients.

There were limitations to this study. First, it focused on professionals recruited in a single hospital. Their broad understanding of pediatric environments, denoted by their average time of experience, suggests that their responses were not limited to that specific institution. Nevertheless, their current work environment may have created a bias by focusing their attention on current issues they observe in the hospital where they currently work. Second, we limited the interviews to three specific topics (i.e., ideas of interventions in hospital rooms and corridors, radiology exams, and laboratory exams). Although our choice of having them focus on particular issues could help direct their attention toward a specific topic for innovation, that may have limited their answers and ideas, and not given them space to come up with their own scenarios. Third, this study is focused on adults' perspectives and we did not explore children's perspectives on patient friendliness. Further exploration of the topic may assist academics and practitioners in understanding how to help children master settings by making them more suitable to their needs. Fourth, discussions on gender, accessibility, and inclusion were not addressed in this paper but would potentially contribute to understanding pediatric patients' psychological wellbeing in further research.

We would also like to note that the participants in stage 2 of our study were able to see each other's replies on the online platform. On one hand, this may have had a positive impact since it added a sense of co-creation to the process, as if they were all part of a design workshop, discussing opinions. On the other hand, it may also be seen as a limitation of the research because participants may have influenced one another.

The design process will continue in the next steps of this study when experts from both inside and outside of the hospital will be invited to participate in a two-day workshop with architects and healthcare professionals. Together, they will detail and develop the ideas explored in this paper into actual interventions in the built environment.

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