

Nudge design to increase physical activities for hospitalized children

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1. Introduction

Exercise positively impacts the emotional and physical development of children. Hormones released during physical activity help alleviate depression, anxiety, and stress. Sufficient exercise also provides appropriate stimulation to the body, promoting recovery (Trevor, 2014). For healthy children, ample exercise is naturally achieved through various forms of play, making external intervention unnecessary (Ministry of Education, 2016). However, hospitalized children are often isolated from their usual daily routines and favorite activities, resulting in a significant reduction in physical activity.

This study aims to identify the current state of physical activities for hospitalized children through empirical research, interviews, and observations. Based on these findings, it will propose behavioral design interventions that encourage physical activity in children. The ultimate goal is to aid in the progression of recovery and improve the quality of life for children in hospital settings.

2. Identifying Issues and Causes Through Empirical Research

To identify the specific causes of insufficient physical activity, observational studies and user

interviews were conducted at six hospitals, including Seoul Samsung Hospital, Yonsei Severance Hospital, and Asan Medical Center. Additionally, expert interviews were conducted with two members of the Asan Medical Center Design Innovation Team and one ward nurse from Severance Hospital.

Expert interviews revealed that the recommended daily exercise time for children is at least 60 minutes (Cameron C., et al., 2005). However, hospitalized children are unable to meet this recommendation. Investigations into the causes revealed that spaces for physical activity are largely divided into outdoor walking paths and indoor areas.

This study will describe the limitations of each space and propose solutions to overcome these challenges.



< Figure 1 > Seoul Samsung Hospital Walking Path

2-1. Outdoor Walking Paths

Inconvenience Due to Medical Equipment:

Patients using medical devices such as IV drips or electrocardiography machines experienced difficulties navigating uneven paths and obstacles, limiting their mobility.

Weather Constraints: Adverse weather conditions, such as rain, poor weather, or fine dust pollution, significantly reduced the number

of days hospitalized children could utilize outdoor walking paths.



<Figure > Floor of the Pediatric Ward Hallway at Yonsei Severance Hospital

At Yonsei Severance Hospital, indoor spaces have been repurposed for walking exercises. Stickers on the pediatric ward hallway floors mark starting points and display distances from these points. However, physical activity among children in the hallways was rarely observed. Similarly, a playroom equipped with toys and books was also underutilized.

Interviews with nurses revealed that while medical staff encouraged exercise, most children found it uninteresting and instead spent their time watching videos or playing games. Interviews with caregivers highlighted additional concerns. Caregivers expressed reluctance to use the playroom due to fears of secondary infections through interaction with other patients and the potential for accidents, such as IV needle dislodgement during play.

In conclusion, despite the availability of exercise facilities, limitations such as low accessibility, lack of engaging stimuli, and safety concerns hinder their use. To address these issues, the study proposes the design of a service that is highly accessible, engaging for children, and minimizes risks of secondary infections and accidents, encouraging active participation in physical activity.

3. Service Design

3-1. Nudge Design

The concept of nudge refers to achieving positive behavioral changes by subtly encouraging natural participation without imposing strict regulations or surveillance. Nudge design leverages behavioral cues to guide individuals toward desired actions unconsciously.

An example of nudge design can be seen in Amsterdam, where musical stairs were installed to promote energy-saving behaviors. The playful design encouraged people to unconsciously choose stairs over elevators, demonstrating how small design interventions can lead to significant behavioral shifts.

This approach will be explored and applied to create engaging and accessible environments for hospitalized children to promote physical activity.



< Figure 3 > Prototype Development (Left)

< Figure 4 > Walking Path Prototype (Right)

3-2. Prototyping

Based on empirical research, a nudge design was created to encourage physical activity among children. As illustrated in <Figure 4>, the design includes devices that prompt simple movements suitable even for children using medical equipment like IV drips. These activities include leg stretching exercises, sit-to-stand exercises, and rotational movements guided by arrows.

The design focuses on creating engaging, accessible activities that integrate seamlessly into the hospital environment, encouraging children to participate in physical activities without significant barriers.



< Figure 5 > User Testing at Kyungdong Elementary School (Left)

< Figure 6 > User Feedback (Right)

3-3. Usability Test Results and Improvement Directions

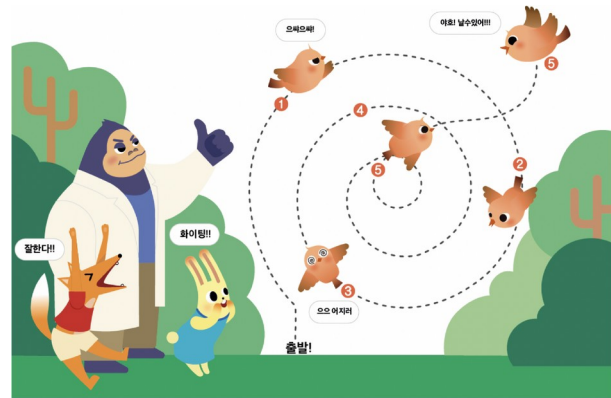
A usability test was conducted with 25 second-grade students at Kyungdong Elementary School. Despite restrictions requiring the use of only one hand due to considerations for medical device use, children responded to all the behavior-inducing elements and performed physical activities successfully.

Feedback received after the test included requests for more diverse activity prompts, higher-difficulty obstacles, and the inclusion of cute characters.

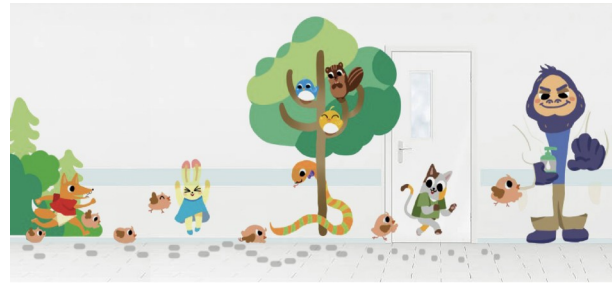
Based on this feedback, improvements were made by incorporating more varied and challenging devices. Additionally, activities were expanded beyond the hospital floors to include the walls, allowing for a wider range of engaging physical activities.

4. Design suggestions

Based on empirical research and usability tests, nudge designs utilizing hospital corridors and walls are proposed for pediatric wards, as illustrated in < Figure 7 >, < Figure 8 >, and < Figure 9 >.



< Figure 7 > Design Proposal 1: Neck Stretching for Children



< Figure 8 > Design Proposal 2: Leg Stretching for Children



< Figure 9 > Model of Footprint Stickers Installed in the Hallway

4-1. High Accessibility

To maximize accessibility, the service was designed for indoor hospital spaces. By utilizing pediatric ward corridors, the activity areas are close to patient rooms, making it convenient for children to participate even while carrying medical devices like IV drips. This effectively enhances patient accessibility and mobility.

4-2. Behavior-Inducing Elements

The design incorporates storytelling by transforming hospital walls and floors into a cohesive fairy tale. Stickers narrate the story of an injured bird being treated by a kind gorilla doctor, turning the ward corridor into a "storybook."

Through storytelling, children naturally engage in physical activity while reading the narrative. Curiosity about the next scene encourages them to continue participating. The fairy tale elements were carefully designed by referencing research on children's character preferences and incorporating varied animal protagonists, simple shapes, and pastel-toned colors to capture children's interest.

To ensure enjoyable and beneficial movement, activities were structured using references from early childhood physical education textbooks. Examples include neck stretches while following the bird's movement <Figure 7>, leg stretches as children walk along footprints of varying widths on the floor <Figure 8>, and colorful footprint stickers on the floor to guide playful walking with color-matching activities <Figure 9>.

4-3. Reduced Risk of Secondary Infection and Accidents

The proposed activities focus on simple stretching and walking exercises, which can be performed without interacting with other patients. This minimizes the risk of cross-infection and accidents.

Additionally, because the activities are conducted at a controlled pace—encouraged by reading and progressing through the story—children remain safe without overexertion or rushing.

6. Conclusion

Lack of physical activity hinders the emotional and physical development of hospitalized children, delays their recovery, and deprives them of opportunities to alleviate negative emotions.

This can adversely impact treatment outcomes and significantly lower their quality of life during hospitalization. However, current pediatric hospitals lack services that enable children to engage in safe and enjoyable physical activities.

The proposed service allows hospitals to assist in children's recovery without significant financial burden. It also alleviates caregivers' concerns regarding secondary infections or accidents while encouraging physical activity. For the children, this service provides a playful experience that helps them achieve close to the recommended daily level of physical activity. By implementing this service, hospitals can better fulfill their primary purpose of promoting health recovery.

Nevertheless, this service has limitations, such as the repetitive nature of activities once installed, which may lead to boredom among children. To overcome this, future improvements will focus on incorporating elements that enhance children's creativity and provide greater freedom for imaginative engagement.

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