Improving Patients Experience in Peadiatric Emergency Waiting Room

Frederic EHRLER[a,1], Johan SIEBERT[b], Rolf WIPFLI[a], Cyrille DURET[a], Alain GERVAIX[b,c], and Christian LOVIS[a,c]

[a] *Division of medical information science, University Hospital of Geneva*
[b] *Pediatric Emergency Division, Children's Hospital, University Hospitals of Geneva*
[c] *University of Geneva, Geneva, Switzerland*

Abstract When visiting the emergency department, the perception of the time spent in the waiting room before the beginning of the care, may influence patients' experience. Based on models of service evaluation, highlighting the importance of informing people about their waiting process and their place in the queue, we have developed an innovative information screen aiming at improving perception of time by patients. Following an iterative process, a group of experts including computer scientists, ergonomists and caregivers designed a solution adapted to the pediatric context. The solution includes a screen displaying five lanes representing triage levels. Patients are represented by individual avatars, drawn sequentially in the appropriate line. The interface has been designed using gamification principle, aiming at increasing acceptance, lowering learning curve and improving satisfaction. Questionnaire based evaluation results revealed high satisfaction from the 278 respondents even if the informative content was not always completely clear.

Keywords. User-Computer Interface; Human Factors; Quality of Healthcare; Emergency Medicine; Triage; Consumer Behavior; Personal Satisfaction, Organizational Innovation.

1. Introduction

Emergency department (ED) can be the place of the first contact between patients and the healthcare institution. The smoothness of this experience is of prime importance as it will further influence the judgment of patient about the whole encounter, but also about future ED choice or the recommendations to other potential patients [1]. One of the recognized problems that alter negatively this experience is an excessive length of the wait. This can happen for patients with a non-urgent condition when they enter an already overcrowded ED [2]. In addition, because patients are taken care according to their condition rather than their arrival sequence, it generates misunderstandings and sometimes frustration, further worsening the experience and the perception of emergency room management [3].

Theoretical researches studying waiting time perception taught us that a key factor behind consumers' stress is the uncertainty of how long they must wait. Therefore, informing people about their positions in the waiting queue is an efficient way of

---

[1] Frederic Ehrler, Frederic.ehrler@hcuge.ch 4 Rue Gabrielle-Perret-Gentil, 1205 Geneva, Switzerland.

improving their affective response to the wait. When the wait is short, with or without information, consumers are not likely to experience stress and consider the wait acceptable [4]. When the wait is intermediate providing information to the people begins to have a significant effect. First, information helps to distract consumers from conscious awareness of the passage of time and improves service evaluation through a reduction of the waiting duration perceived. Second, the information reduces uncertainty, which suggests a significant mediating effect of affective response to the wait. Third, the information facilitates cognitive coping, leading consumers to reappraise the wait as being more acceptable and hence giving a better service evaluation.

Given this theoretical framework, we make the hypothesis that it is possible to improve the patients experience in paediatric emergency waiting room by providing information about the waiting process through a screen. In this article, we present the process leading to the design of this screen and its evaluation through questionnaires.

2. Methods

2.1. Interface ergonomic design through an iterative process

In order to design the screen, an iterative process going through specification, prototyping and development has been performed with a group of experts. This group included two computer scientists, an ergonomist, two ED physicians and a triage nurse. The discussions held during a focus group with the experts have lead to the identification of the data source, the functional, environmental and users' requirements, as well as usability goals. Once these requirements translated into specification, a prototype has been realized using sketching, wireframing and mockups. Finally, during the development phase, the screen has been refined through several iterations until a satisfactory solution has been validated.

2.2. Questionnaire driven evaluation

In order to evaluate the quality of the stay in the waiting room, home-made questionnaires have been prepared. Since we are in a paediatric environment, the questionnaires were targeting the parents of the patients. All the questionnaires' items were assertions for which respondent had to express their level of agreement by choosing one of the answers provided through a five levels Likert scale going from completely agree to completely disagree.
The dimensions evaluated in the questionnaire were the following:

1. **Stress:** You have felt stressed during your stay in the waiting room
2. **Satisfaction:** You are satisfied of your stay in the waiting room
3. **Frustration:** You have been frustrated that other patients have been seen before your child
4. **Information:** You had the feeling to be able to understand the position of your child in the waiting queue compared to other waiting patients

These questionnaires were distributed by nurses to the parents once their child was installed in examination room and therefore ended their wait.

3. Results

3.1. Identified requirements

The following requirements have been identified by the experts participating in the focus group
1. The interface must reflect the queuing situation: In ED, the classification of the patients is done into several levels of emergency. Once classified in one of these emergency levels, the patients are taken by order of arrival. A patient with a higher level of emergency has always priority over a patient with lower level of emergency.
2. Patients must be able to identify themselves: The patients must be able to identify themselves in the interface to see their progression in the queue, but without losing their anonymity, without ambiguity and notion of ranking.
3. Patients must be aware that emergency situations tend to slow down the overall progress: In case of serious emergency (such as resuscitation) many physicians and nurses may have to be mobilized to take care of this patient. In such situation, the progress of the care for the other patients will be temporarily slowed and, as a consequence, the progresses in the queue can seem stopped.
4. To maximize user acceptance and satisfaction: The screen must be attractive enough to draw patients' attention and to favour its use over the long term.

3.2. Prototyping

The initial information screen prototype is composed of a stack of five lines representing the levels of emergency defined in the Canadian triage and acuity scale (CTAS). Each line is filled with its associated colour as defined in table 1. Each patient is represented as a circle and is displayed sequentially in order of arrival (Figure 1 left).

Table 1. Level of emergency of the Canadian triage and acuity scale (CTAS)

Level	acuity	Time to physician	Associated color
I	Resuscitation	Immediate	Red
II	Emergent	≤ 15mn	Orange
III	Urgent	≤ 30 min	Yellow
IV	Less urgent	≤ 1 h	Green
V	Non-urgent	≤ 2 h	Blue

The clear separation of the patients into the five levels of emergency is very important since it ensures that every patient is taken in sequence and that none of them will be overtaken by a patient entered later in the queue. The left side of the screen represents the entrance in the emergency department and the right side represents the beginning of the medical care. In order to indicate that patients with higher levels of emergency have priority over patients with lower emergency levels, each of the emergency lines is slightly shifted on the right side. It shows visually that patients with level 1 emergency are the closest to the beginning of the care and will be taken in priority (Figure 2 left). In order for patients to be able to identify themselves on the screen, each of them receives an identifier based on the two first letters of its first name concatenated to the two first letters of its last name. Hence, patient's confidentiality is guaranteed and no language barrier affects the recognition of its identifier.

In order to maximize users' acceptance regarding the screen, we relied on concepts from hedonic information systems. Hedonic information systems aim to provide self-fulfilling rather than instrumental value to the users. They are strongly connected to home and leisure activities, focus on the fun-aspect of using information systems, and encourage prolonged rather than productive use. The hedonic nature of an information system is an important boundary condition to the validity of the technology acceptance model [5]. Specifically, perceived usefulness loses its dominant predictive value in favour of ease of use and enjoyment.

We mostly relied on gamification concepts such as the use of avatar and narrative context to immerge users inside a metaphoric story [6], [7]. This story is pretty simple: it is about the journey of the patients on the ED road, from their entry in the ED till being seen by a clinician. Practically, each waiting queue is represented by a road and each patient is represented by a car. Each time a patient enters the pediatric ED, a new car enters the screen, in the road associated to its emergency level. The car starts from the left side and moves forward until it reaches its final position behind the cars already waiting. Each time a patient leaves the waiting room, all the cars located on the same road move forward to the right. An ambulance enters the screen when a patient with emergency level 1 enters the ED. Finally, since other researches have also highlighted the impact of animations on attention, several parts of the display are animated. For instance, the background and the roads move forward continuously in order to give the impression of constant progression. This impression is further emphasized by the progression of the car along the roads (Figure 1 right).

Figure 1. From first prototype to final version of the information screen

3.3. Development

The software has been developed with HTML5/Javascript technology and thus can be executed on any platform. The software acts as a client toward the institution clinical information system that stores the current status of each patient. Since, in our hospital, the interface is displayed on a television, the software is executed on a dedicated proxy machine connected, on the one hand to the institution network and linked on the other hand to the television through a HDMI cable. This solution is particularly well adapted to our context since it doesn't require the installation of a whole computer, reduces strongly the necessary maintenance and is very discrete given the reduced size of the dedicated hardware.

3.4. Evaluation

The evaluation of the intervention by patients took place in the Geneva paediatric ED, which is a tertiary care, academic medical centre with a Level I trauma service. The paediatric ED provides care for more than 25'000 patients annually. It contains 18

licensed beds, 4 of which are trauma beds and 1 resuscitation room. In addition, 2 fast-track beds are available for low-acuity patients. 273 questionnaires were distributed to the parents of the patients once taken under medical supervision by a clinician.

Table 2. Answers distribution at the four questions of the questionnaire

	Stressed	**Satisfied**	**frustrated**	**Informed**
Totally agree	5%	23%	3%	9%
Agree	11%	50%	10%	23%
Nor agree nor disagree	12%	19%	22%	35%
Disagree	31%	5%	27%	19%
Totally disagree	40%	3%	38%	14%

As presented in Table 2, high satisfaction and low level of stress has been reported by the respondents (only 8 percent where unsatisfied). The frustration remains also low since more than 75% of the respondents are positive or neutral regarding the frustration. Finally, regarding the comprehension of the waiting process, 23% of the respondents remain incapable of understanding the position of their own child compared to the other patients.

4. Discussion

In overall, most respondents were highly satisfied. They have not suffered from stress nor frustration during their wait even if 23% of the respondents still remained incapable of evaluating the position of their child in regard to the other patients. Further questioning of some parents revealed that they have found the new information screen aesthetic, playful and easily understandable. Some of the respondents were only disappointed by the absence of precise indications about the waiting time.

References

[1] N. D. Magaret, T. a. Clark, C. R. Warden, a. R. Magnusson, and J. R. Hedges, "Patient Satisfaction in the Emergency Department-A Survey of Pediatric Patients and Their Parents," *Acad. Emerg. Med.*, vol. 9, no. 12, pp. 1379–1388, Dec. 2002.

[2] I. Higginson, "Emergency department crowding.," *Emerg. Med. J.*, vol. 29, no. 6, pp. 437–43, Jun. 2012.

[3] J. S. Olshaker and N. K. Rathlev, "Emergency Department overcrowding and ambulance diversion: the impact and potential solutions of extended boarding of admitted patients in the Emergency Department.," *J. Emerg. Med.*, vol. 30, no. 3, pp. 351–6, Apr. 2006.

[4] E. L. Cohen, H. a Wilkin, M. Tannebaum, M. S. Plew, and L. L. Haley, "When patients are impatient: the communication strategies utilized by emergency department employees to manage patients frustrated by wait times.," *Health Commun.*, vol. 28, no. 3, pp. 275–85, Jan. 2013.

[5] M. E. Bouwman, P. A. M. Kommers, and A. J. A. M. Van Deursen, "Revising TAM for hedonic location-based social networks: the influence of TAM, perceived enjoyment, innovativeness and extraversion," *Int. J. Web Based Communities*, vol. 10, no. 2, p. 188, 2014.

[6] A. Domínguez, J. Saenz-de-Navarrete, L. de-Marcos, L. Fernández-Sanz, C. Pagés, and J.-J. Martínez-Herráiz, "Gamifying learning experiences: Practical implications and outcomes," *Comput. Educ.*, vol. 63, pp. 380–392, Apr. 2013.

[7] B. Ben Shneiderman, "Designing for Fun : How Can We Design User Interfaces to Be More Fun ?," pp. 48–50.