Participatory Development of an Image-Based Communication Aid for Migrant Patients and Emergency Nurses

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Abstract. Language barriers hamper or delay delivery of urgent and emergency care to migrant children when they or their parents don't speak any of the languages commonly spoken in Switzerland. In such situations, nurses often fall back to use ad hoc communication aids, including translation apps and visual dictionaries, to collect information about a patient's medical history. In this paper, we report on the participatory design process for a novel image-based communication aid. It is specifically tailored to the needs of migrant patients and nurses within Swiss pediatric clinics. We collected requirements in surveys and in-depth interviews with pediatric nurses. A prototype app was developed and tested with users in a scenario-based usability test. The results clearly show that the images developed, especially for symptoms, accidents or nutrition and excretion, are well comprehensible for triage and anamnesis. In contrast, a temporal classification or chronological occurrence of health incidents is difficulty to express with images.

Keywords. Communication barriers, language, emergency care, migrant patients, pediatrics, communication aid, visual support

1. Introduction

Language barriers often affect the quality of treatment and care [1,2]. They increase the risk of adverse events and fatal outcomes in both hospital and primary care settings [3]. A Europe-wide survey of pediatric accident and emergency staff found that language barriers are the most common obstacle to emergency care for refugee children and young people [4]. Understandable communication in care is therefore essential for safe, high-quality and equitable healthcare for all patients. Existing solutions are limited in their effectiveness. Visual representations can be used to overcome language barriers [5,6].

In this paper, we describe the development of an image-based tool aiming at addressing communication barriers experienced in Swiss pediatric emergency care. Existing tools currently used in practice include translation apps, some of them visually enhanced, and visual dictionaries, both digital and traditional paper-based ones. Images used are often insufficiently expressive, the number of included images is very limited or aesthetically not very appealing so far. Following market analysis, we closely

examined four apps found to be relevant in terms of their suitability in Swiss pediatric emergencies. MediPicto [1] allows to make entries with visual support. Selection of language is restricted. medilang Pro [2] does not allow for patient questions. Available languages do not cover all languages necessary for usage in Switzerland. tipdoc emergency [3] contains the most relevant questions for collecting the medical history in pediatric emergencies. Questions can only be asked by nurses. Most of the existing apps are of limited utility. Pure translation apps use predefined phrases translated in a limited number of languages and fail when a language is unavailable. We will go beyond existing tools by supporting interaction by a non-verbal communication aid relying only upon images. We address the research question: What are the needs and requirements of a non-verbal, image-based digital communication for pediatric emergency anamnesis which will be perceived useful, feasible and acceptable for nurses, foreign-language patients and their relatives.

2. Methods

The communication aid was developed using a participatory design process. The approach adheres to the general principles of human centered design and interaction design. An interdisciplinary team of researchers from communication design, nursing research and medical informatics was formed and potential users (pediatric emergency nurses, migrant parents and children) were involved throughout the development. The development comprised several steps and was based on prior research by Kaufmann et al. [5,6]: 1) Collect requirements for the communication aid in discussion with nurses and by identifying limitations of existing approaches by literature search and market analysis. 2) Design images tailored to the most common communicative situations and validate understandability of images with migrant parents, children, and nurses. 3) Develop a prototype. 4) Conduct a usability test with nurses and migrant parents. Methodology and results of developing communication design images (step 2) will be described in another publication. In this work, we focus on the other three steps.

2.1. Requirements collection and prototype development

To gather requirements for our communication aid, we identified limitations and best practices in healthcare communication aids for the treatment of migrants, focusing on design issues. To analyze existing communication apps suitable for emergency settings, we searched for relevant apps in Google Search and in major app stores (Google Playstore, Apple App store). Apps were considered relevant when they aimed at supporting medical communication in emergencies and mentioned that they were aimed at supporting migrant patients. We also checked whether they would be suitable for use in pediatric emergency care in Switzerland. Assessment criteria included coverage of languages frequently occurring in Switzerland, focus on pediatrics or emergency, implementation of Swiss-specific administrative conditions like health insurance card, vaccination report or medication. Furthermore, we collected information needs of

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[1] https://www.aphp.fr/medipicto
[2] https://medilang.com/index.html
[3] http://www.setzer-verlag.com/Neuigkeiten/Tip-doc-emergency-App

nurses in pediatric emergency care and their current communication strategies when language barriers occur.

We used a questionnaire to collect information from the heads of nursing of 9 pediatric emergency units across German speaking Switzerland and conducted interviews with 10 nurses working in emergency units for children. We collected information on challenging communication situations when dealing with language barriers, and existing strategies and communication aids they use to cope with these barriers. Finally, we asked for features they would like to see in a communication aid. To learn more about challenges of the current process in emergency communication, we used case examples. We also asked in detail which information is difficult to obtain in cases of language barriers and which is relevant for treatment. Based on the collected requirements, we designed a mock-up for our communication aid using Figma. In several iterations and in strong collaboration with nurses, the mock-up was improved until a version was implemented as functional prototype.

2.2. User testing with prototype

We tested the prototype with potential users in a scenario-based study realized as role-play and with cognitive walkthrough. Taking into account the perspectives of nursing, design and informatics, we aimed at answering the following questions: 1) How do nurses and parents generally cope with the application? 2) How do nurses use the application in a first triage? 3) What images do nurses and parents miss in initial triage? 4) What difficulties do nurses and parents encounter in using the app in initial triage? 5) Which factors promote the integration of the app in everyday care? Participants were recruited from former master students and from pediatric emergency department nurses at a university children's hospital (nurses) and from personal network of contacts (parents). A tablet was available for the user testing. All conversations were recorded for analysis purposes. Observations were collected in a handwritten observation log. From the recordings and observation logs, we draw conclusions on the interaction and use of the application. Interviews were conducted after completing a particular scenario and participants were asked for their experiences and suggestions.

The test setting was as follows: a pediatric nurse and a parent sat together across a corner at a table. The tablet was on the table in front of them. A researcher explained the roles and had both test subjects read the scenario. Then the nurse was asked to start the role play. The participating parents had a mother tongue other than German, but could understand German little to well. The caregiver should refrain from using language as much as possible and the testing parent should try not to react to language, but only to pictures and non-verbal communication. If the nurse was missing a picture, could not find something in the app or had other thoughts about the process that did not run as smoothly as she is used to in practice, she should comment aloud. One researcher each from nursing, design and medical informatics observed the nurse and a parent with the imaginary child in role play. As soon as the nurse came to a decision regarding further treatment, the role play was stopped. This was followed by a questioning of the nurse and parent about the role play by the nurse researcher and the design researcher. The four scenarios for emergency cases were:

- Scenario 1: 3-year-old girl, high temperature
- Scenario 2: 7-year-old boy, stomachache, and lack of appetite
- Scenario 3: 3-month-old girl, diarrhea, heart surgery, penicillin allergy

- Scenario 4: 6-year-old boy, fall from climbing frame, vomiting

An internal pre-test with two employees of the Bern University of Arts and of the Bern University of Applied Sciences that were not involved in the project was conducted on November 16, 2021. The aim of the pre-test was to test understandability of case scenarios and to test the entire test setting. As a result, an additional feature was implemented in the prototype which is the possibility to enter data such as the date of birth.

3. Results

3.1. Requirements for a digital communication aid

A future communication aid should be a simple tool that is quickly available, covers the most common situations and enables a dialogue with both the non-German-speaking children and their families. If utilizing translations, it should cover the most frequently spoken languages by patients in Swiss emergency units. The tool should base on pictures or pictograms and has to provide well and clearly designed illustrations. This means that they must be unambiguous, of high contrast, scalable, medically correct, and understandable by people with different cultural background. Content-wise the communication aid should cover the topics of the SAMPLE schema (Symptoms, Allergies, Medication, Past medical history, Last oral intake, Events prior to incident) and consider the most frequent children's diseases and accidents. The structure should be flexible and the content individualizable to address the patient's current condition. We recognize a certain contradiction between the need to have a very simple tool and one that covers as many languages and as much information as possible. From the results, we came up with three solutions for our communication tool: (1) A tool that offers a collection of images that can be shown to the patient like in a "Point it: Traveller's language kit" book, (2) A tool that comprises translated phrases along the SAMPLE interrogation schema accompanied by explaining images, (3) A chat tool allowing to combine emojis or pictograms to picture phrases.
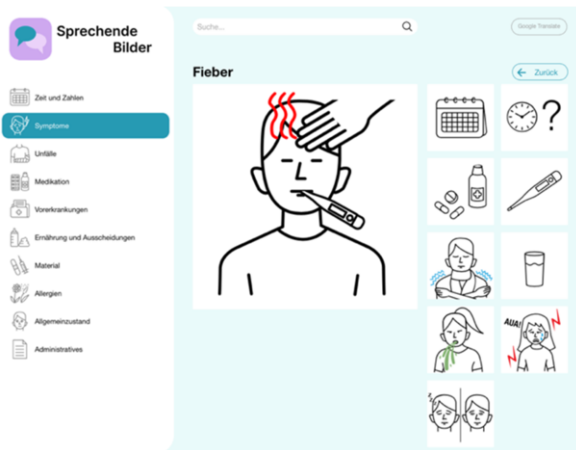
3.2. Prototype

We decided for solution 1 for prototype development, because an image collection to show during the conversation is easy to use. Translations would not be necessary since it is only based on images. Our communication aid comprises the following features: Responsive design for tablets and mobile phones, search function to identify relevant images, automatic suggestion of related images and translation of phrases. A screenshot can be seen in Fig. 1. Images are grouped along 10 categories: administrative issues, allergies, general condition, nutrition and excretion, material, medication, symptoms, accidents, existing medical conditions, time and numbers. The current version can be accessed through the web: https://sprechendebilder.ch/. The final prototype is developed as web app using Ionic/Vue.js. This means the structure of the app is similar to a Vue.js-Project; rendering and building of the app is realized by the Ionic framework. Image information is stored as JSON. All images included in the prototype were designed by members of the project team (BK, LO). For each image, meta data has been created manually including names / describing terms, categories, keywords, related images.

Google Cloud Translations API was chosen since it provides translations for the 11 most frequently used main languages[4] in Switzerland (the often-mentioned Tigrinya is missing, however).

3.3. User testing results

Five user testings were conducted between November 19 and 22, 2021. Three tests were conducted directly in the children emergency department (but in a controlled setting) of two hospitals. Two testings were realized within the university. Among the parents, we had 3 mothers (Argentine, Italian, Philippine) and two fathers (Brasilian, Syrian). Three nurses were working in children emergency care, two were former master students, one of whom currently works on the pediatric emergency unit. The user tests lasted one hour in average. Between two and three case scenarios were considered per user testing.

Figure 1. Tablet view of the prototype: On the left, a category can be selected (e.g. symptoms, medication, allergies). In the center, the image referring to fever has been selected and is shown enlarged. On the right, related images are shown. The search function is accessible through the data entry field on top.

During the role play, the images from the tool were more frequently used over time to communicate with the parent. The tablet was placed in the middle of the table in a way all persons could look at it. Looking at the pictures together allowed for an empathetic dialogue. Feedback on the images was entirely positive. They were found to be appealing, easy to understand and helpful, especially for the quick assessment of symptoms or the circumstances of an accident. The use of the translation functionality interrupted the interaction since only one person typed while the other person had to wait. Translations were complex or wrong; certain languages were unavailable; auto correct was enabled and corrected foreign language terms. The translation functionality seems to be not helpful. Nurses confirmed afterwards that they would use the tool in daily routine right from the beginning of the parent interrogation and not only when communication problems occur.

The testings showed that multiple images could be added, for example images on additional types of accidents or existing medical conditions. A category that is in the

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[4] https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/sprachen-religionen/sprachen.html

current prototype entirely missing is the follow-up procedure, i.e. images that describe which examinations will be conducted.

We identified three groups of information that were difficult to express using the images. First, the participants had problems in showing time ranges using the available images. Second, it was difficult for nurses to ask for previous illnesses or chronic diseases, i.e. illnesses or accidents that took place in the past or symptoms that occurred in the past. Third, the app and its images do not allow to express quantities. Information on allergies was also difficulty to express using the images. The nurses suggested to include a protocol functionality to the app storing which images had been selected to be able to re-capture the communication afterwards. Another extension is to enable combining certain images with other images or with numbers (e.g. to express how often the child vomited). In this way more complex phrases could be expressed. To facilitate communication, each symptom could be combined with a yes/no selection option.

4. Conclusions

An image-based communication tool to support interaction between migrant parents and nurses in emergency cases is perceived useful. It allows nurses to quickly assess the situation and provides the basis for an appreciative conversation. Many aspects can be communicated using images, however, there are limitations in purely image-based communications. We learned that it is non-trivial to create understandable images related to time or images of difficult-to-present subjects, e.g. general condition. Our project clearly shows that the images developed, especially for symptoms, accidents or nutrition and excretion, seem to be well comprehensible for triage and anamnesis, but the temporal classification or chronological occurrence of health incidents was difficult. We are planning to extend the tool by images on the follow-up procedure. A next step will be a real-world user testing, i.e. the tool will be used in real emergency cases.

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