Designing the future, Engineering Reality: Prototyping in the Emergency Department

Antonio Starnino, Clio Dosi, Matteo Vignoli

antoniostarnino@gmail.com

University of Reggio Emilia and Modena, Reggio Emilia, Italy

Abstract

This case study covers the implementation of a live prototype aimed at addressing the issue of overcrowding at the emergency department (ED) of the Santa Maria Nuova Hospital (ASMN) in Reggio Emilia (Italy). It was facilitated by a team of service designers and management engineers from the University of Modena and Reggio Emilia (UNIMORE), and a working group of 15 professionals composed of doctors, nurses and auxiliaries. The live prototype involved the 150+ staff of the emergency department and over 3,750 patients over a period of 34 days. The end result of the service was a smoother patient flow that reduced waiting time by 38%, and had a patient satisfaction rating of 94% increased staff-patient communication. The service also carried negative effects on how doctor's viewed their professional identity, and caused stress due to uncontrollable noise limits.

KEYWORDS: service design, live prototyping, healthcare, emergency department

Introduction

Emergency departments worldwide face a crisis of overcrowding, which occurs when there are not enough resources to serve incoming patients. This causes stress for staff and patients, and increases the likelihood of medical errors (Willoughby, K., Chan, B., & Strenger, M., 2013). To solve this problem, the top-management at ASMN wanted to restructure the emergency department and formed an internal team of 15 doctors, nurses and auxiliaries in order to facilitate the project. However in order to avoid structural changes that did not support internal needs they also decided to call for a one-year consultancy from UNIMORE's service designers and management engineers. Our solution had to consider two constraints: no extra personnel and no major structural changes allowed.

Research and design

Figure 1 shows a doctor at his desk. The position discouraged patient interaction.

We embarked on an immersive 2 months of research, that involved in-depth contextual interviews with 15 staff, and 5 patients, and over 60 hours of observation inside of the emergency department, and extensive secondary research.

Our research began with standard observations and shadowing in ED's 4 main ambulatories, at triage, and in the waiting room. We discovered that the ED functioned off a closed room ambulatory system that meant that the nurses had to constantly go out of the ambulatory, into the waiting room and then bring patients back into the ambulatory, creating dead time. We also observed that the design of these rooms discouraged doctor / patient interaction as the computers were placed in the corner. Doctors would get up to see the patients, and then quickly sit back down to write their reports.

Following the first phase of observation we performed stakeholders interviews with 14 staff workers, which included doctors, nurses, and auxiliaries of varied seniority. The stakeholder interviews were open ended, and sought to understand the different issues staff workers had while working in the emergency department. In interviewing the staff we discovered contrasting opinions. Some of them told us how being in a closed room made them feel cut off to the ED as a whole, with others saying that the privacy of an ambulatory was vital.

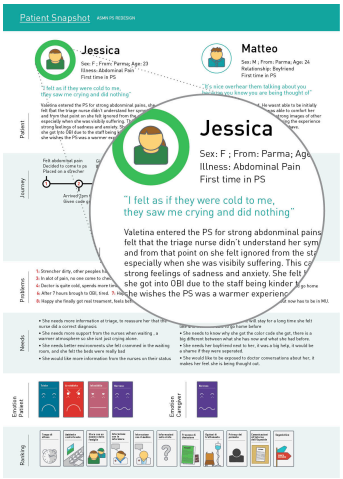

Figure 2 shows one of the patient persona pairs

We also performed 5 in depth contextual interviews with patients who had already completed a full experience through the emergency department. We asked them to explain to us each step of their journey, and used emotion cards to understand the feelings they felt. We also had them rank the various parts of the ED experience most important to least, explaining why. The data from these interviews were synthesized into 'Persona Pairs' originally explored by Allison Matthews and Diane Klein (2013). While the sample size was low, specific patterns had emerged: we learned that the contact between the patient and doctor/nurse was the most important part of the experience. Also almost all journeys highlighted frustration with the waiting time and a 'cold' experience inside of the ambulatories with little contact by the doctor, confirming our observation. This research phase led to our major insight that the ambulatories formed an emotional and logistical bottleneck.

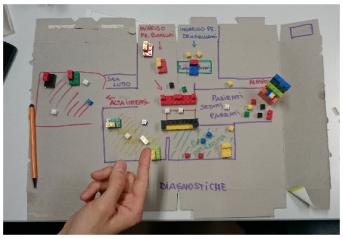

Figure 3 Nurse points to his prototype.

To come up with new solutions we organized a workshop with the 8 members of the ED staff. We created scenarios based on our user research and used them as the backbone of the workshop. This allowed participants to put themselves in the shoes of each of the user, uncovering subsequent needs. They then used these needs to brainstorm and rapid prototype new solutions.

We compiled these prototypes and findings and elaborated them into a presentation that was then shown to the entire internal working group. Together we decided to attempt one of the

prototypes entitled “abbattere le barriere” translating to “breaking down the barriers”. The prototype targeted low acuity patients who made up the highest percentage of inflow, and are a main cause of overcrowding (Liu, S., Hamedani, A., Brown, D., Asplin, B., & Jr., C., 2013). The service moved doctors and nurses out of the ambulatories and into an open space together with the patients. This was a radical change: rather than sitting at a desk with a computer waiting for the patient to come to them, doctors would be on their feet with a mobile laptop going to the patient. This would mean that the doctors and nurses had to work next to the waiting patients, giving them more flexibility to rapidly treat them. It also meant that doctors would work side by side rather than individually in a room, giving them the chance to quickly get a second opinion whenever they had doubts. Seeing the staff work also would help reduce patient frustration as they could visibly see the process. The space would address both the logistic problem of the closed ambulatories, but would also be a more interactive space for patients.

Live Prototyping: “Breaking down the barriers”

In a context as dynamic as an emergency department, we knew prototypes such as service re-enactments would not fully explore all of the possible problems that could occur. In order to understand if this service would work we needed to design a live prototype, which differed from a pilot as it would need be iteratively co-designed and adapted by the staff and patients using it.

Service prototyping in healthcare is a rarity, with very little case studies to base ourselves on. Many of the previous cases studied involved prototyping in simulation environments. Examples include cardboard prototyping which allowed participants to collaboratively design a space or service using low-cost and easily modifiable materials such as cardboard. While time-effective it was limited in its ability to replicate the variety of issues that could occur (Kronqvist, Juha, Heini Erving, and Teemu Leinonen, 2013).

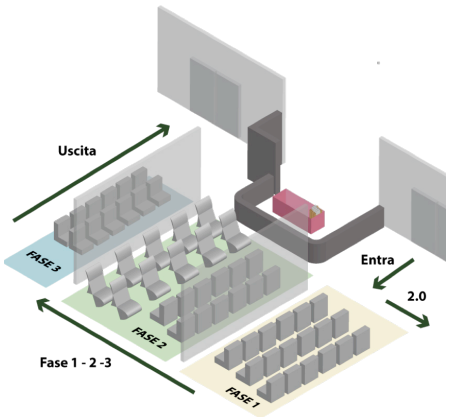

Figure 4 shows a 3d representation of the space.

Over the next three months we worked alongside the internal working group of ASMN and other internal offices at the hospital (Information systems, Structural office, Security office, and Management) on a week-by-week basis to co-create the live prototype. With the internal working group we designed a base service structure divided into 3 distinct spatial phases:

- Phase 1: Doctor visiting phase, where patients would wait to be seen by the doctor
- Phase 2: Treatment and exam waiting phase, where patients would wait for the results of their exams or receive treatment from a nurse
- Phase 3: Discharge phase where patients would wait as they were awaiting discharge.

The service designer created several scenarios visualizing the patient experience, helping gain alignment on the overall service process. This also helped guide the hospital staff, present in the working group, to understand all the technical and organizational aspects that needed to be included.

Implementing the service would mean also having to design the space. The only space big enough to run the live prototype was the emergency waiting room however we realized transforming it into an ambulatory would reduce the amount of seating available. This made it necessary to restrict the area to only patients and meant that we needed to create a new waiting room just for the friends and family members. In order to understand the size that each phase needed to be, as well as the overall impact our prototype might have on the ED, the management engineers ran many data simulations using data from last year patient accesses. We also met with hospital architects and civil engineers several times, to ensure that our plan was respecting safety norms and to have their help designing and organizing the space the live prototype would be held. The service also required the creation of a new role called the process nurse who would oversee the flow of the entire ED and keep the family members informed. In order to make their work smoother we developed a tablet application to avoid the need of having them bring a laptop back and forth.

After creating the base space and service design we needed to ensure that the prototype was properly communicated to the entire ASMN community both internally and externally:

Internal communication: We communicated this prototype with the entire ED staff and other stakeholders such as IT department; architects from the planning department and top management from the hospital. These meetings were vital in anticipating potential problems in the proposed design. We emphasized that the design was flexible and that any element was open to be changed as the prototype went on.

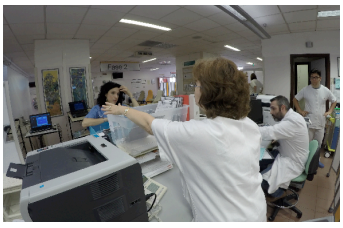

Figure 5 shows a nurse and doctor communicating

External communication: Communication also extended to the patient with specific resources made to ensure they understood what the service was. Inspired by the project A Better A&E by Lloyd Pearson (2011) we created brochures and signage that would explain to patients the concept of the service and what they could expect in each step. We also developed scripts for the staff to improve one-to-one communication with the patient.

Figure 6 patient doctor conversation

To test our prototype we settled on a 5 week-long continuous experimentation. We developed a feedback strategy to be able to understand issues that arose during the prototype. This included daily observations and 'check-ins' with staff and patients to understand how the service was running. Every week meetings were held in which the group had to sum-up the learnings and then decide what to change in the prototype. These changes would then be communicated to the entire staff through emails and one on one explanations.

Figure 7 nurse working on a 'hack'

On April 22nd 2015 we launched the live prototype, deciding to run it until May 31st 2015. Throughout this period we conducted over 80 hours observation and encountered a variety of issues. As new problems would appear we would note how the staff themselves resolved the issues, intervening when needed. This interactive cycle continued every week over the course of the live-prototype. Below is a small summary expresses the change over 5 weeks.

Week 1: We realized that the activities of the process nurse were too much for one person to have. We also saw doctors silently uncomfortable with the open space, using dividers to 'hide' themselves from the patients. In the weekly meeting we decided to divide the work of the process nurse amongst the triage nurses. We also decided to continue having the doctors work in the open space suggesting to them to avoid the barriers as it blocked their view of the patients, which posed a safety concern. This was also done to see if they would become more comfortable as the experiment went on.

Week 2: We began to encounter problems with visitors not respecting the rules of the space, and taking advantage of its temporary nature by trying to speak with the patients across the barriers. In the weekly meeting, we decided to move the dividers the doctors initially used to hide themselves, inside triage to stop people from looking through. We also worked on scripts we could say in order to calm down family members.

Week 3: By the 3rd week the service was running well, however we started to encounter deeper issues with identity. Doctors began to tell us about how they understood the importance of the service but did not like working there, as all they saw were low complexity patients: they also wanted to work on higher complexity patients. We also saw that the technology we implemented for the test was causing us issues. The tablet and application we felt would speed up the work of the nurses who had to speak to family members in fact slowed them down. In the weekly meeting we removed the tablet from the experiment.

Week 4&5: By the 4th and 5th week most of the staff were used to the new working method. However the problem of noise was one issue that constantly presented itself and that we were not able to solve. Much of the staff were complaining that they were not able to concentrate because of it. Meetings in the last two weeks were dedicated to brainstorming ways to reduce the noise, to no avail. Because of this, we decided to stop with the experiment rather than continuing it, despite the positive outcomes.

Throughout the live prototype we also realized that one private space was not enough, and a second was needed. This forced us to create a second makeshift private space with dividers, that over the course of the 5 weeks was iterated upon to become less and less provisionary. This need was one particular realization, that had the service been implemented without prototyping, would have potentially cost tens of thousands of Euros in restructuring costs.

Final Results

Overall we noticed better levels of interaction between the doctors and their patients, as they spent more time engaging in face-to-face conversation then in the old ambulatory structure. The final results of the prototype saw an overall 38% decrease in waiting time for the 3575 patients that entered the service despite seeing an 10% overall increase in the total number of patients that came into the emergency room during that time. We also saw a 22% decrease in total length of stay of patients. A random patient survey conducted with 36 patients inside of the live prototype also saw an overall satisfaction rating of 94%.

After the live prototype, we worked with the hospital architects to design a final spatial blueprint that addressed the needs that emerged from the co-created space. We presented this blueprint back to the entire ED staff in a plenary meeting, where we collected final feedback on the design. Main changes included: 1) Removal of phase 3 (discharge phase), as it was often underutilized by the staff that they felt it was not useful. 2) Creation of two additional flexible 'pod' private ambulatory spaces. 3) Both the issue with noise and doctor

identity were addressed with proper soundproofing and a continuous scheduling effort to ensure doctors aren't overly exposed to the working the new service. As of the beginning of January 2016, funding to realize the service has been found and the final service is due to be implemented by the end of 2016.

Conclusion

The live prototyping methodology allowed us to truly test a complex service that was co-designed with ED professionals around their needs. These weekly change-decisions helped ensure that even though this was a dynamic service prototype, staff knew that any big changes would occur weekly and not randomly. This simple rule allowed us to:

» 1) Live test in a safe and ordered way, to minimize change management issues. The entire staff knew how and who to contact in case of issues, and we made sure to make the process as transparent as possible.
» 2) Turn staff who often would be either the most reluctant or most vocally dissatisfied into proactive professionals, involving them in the co-creation of new service solutions.
» 3) Scale up the small changes or 'hacks' that we saw staff do in their day-to-day work.

By observing and reporting best practices to the internal working group, we were able to make sure that everyone learned and adopted these solutions. We suggest that this method is particularly useful in case of complex service prototypes, when there are too many interconnected variables that can affect the end user experience. It is also effective when the prototype requires a significant change of mindset.

Limitations

Limitations arose from patient feedback, as the number of interviews completed were not enough for the satisfaction rating to be statistically valid. Also due to the complexity of the prototype, it was difficult to isolate the impact of its individual aspects such as the spatial flow, working methodology, or the service scripts. So while the overall impact was positive it was hard to measure how positive or negative these individual aspects were.

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