

HEALTHCARE SIGNAGE DESIGN

GUIDELINES TO SUPPORT THE DEVELOPMENT OF
SIGNAGE SYSTEMS CENTERED ON THE USERS

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TO MY FAMILY AND FRIENDS

"If you've ever been lost in a parking structure, searching in vain for your car, then you know the power of design. If you've ever walked into the ladies' room when, in fact, you're a man ("That icon on the door sure looked male to me!"), then you know the power of design. If you've ever cast your vote for one candidate only to find it tallied to another, then you know the power of design.

Design can confuse.

Design can mislead.

Design can change the course of history."

(Baer & Vacarra, 2008, p.6)

ABSTRACT

How many times did we lose our way inside a hospital when trying to find a specific service? Even when we already know the hospital, how many of us have experienced difficulties in reaching a specific destination due to recent layout rearrangements, time-constraints, stress due to health conditions, and other limitations that reduce our wayfinding capabilities? How many of us found that we were lost inside the building looking for a way out, due to the fact that these buildings are normally a maze of unorganized sectors or intersections of corridors that seem to go everywhere but the destination we need?

There are already many studies regarding the subject of signage systems for healthcare, and of course, there are also many regulations and policies in what concerns the implementation methods and characteristics that these systems should possess. On one hand, there are already recommendations and guidelines that try to “prescribe” ways of designing and implementing those systems in an effective way. On the other hand, of those existing recommendations and guidelines, only a few explore *in situ* research to understand and gather the perceptions of the users regarding the element of signage system and its impacts on their service experience.

This dissertation investigates the users’ perceptions of signage systems on healthcare settings, with the aim of producing a set of guidelines that are not just based on existing literature, but, more importantly, on the users’ opinions.

Following several research methods, the objectives led to three main contributions. First, the analysis of the existing literature and guidelines led to the creation of the main framework of the signage characteristics on which the development of new signage systems should be settled. Furthermore, the analysis of areas that can be involved in the signage design was important to provide to the reader information that can enrich the final design approach adopted when creating new signage systems. Secondly, the research conducted with the users of four major Portuguese healthcare settings, was extremely important to provide a deeper understanding of the users’ needs and demands in what concerns the signage systems of such institutions. It constituted a key part of the research and a paramount basis for the guidelines created at the end of the process.

The resultant guidelines contributed to improve the existing literature and to increase the level of detail of the existing guidelines and recommendations. Not only because they are based on research conducted with users, but also, because it gathers a compilation of the available recommendations. Therefore, this dissertation contributes to the advance of signage systems design in healthcare by gathering some of the most important recommendations and indispensable reviews made by users, thus

providing a resource to support and facilitate decisions when designing, redesigning, and implementing such as systems efficiently.

RESUMO

Quantos de nós já nos perdemos dentro de um hospital quando procurávamos por um serviço específico? Mesmo quando já conhecemos o hospital, quantos de nós já experienciámos dificuldades em chegar a um destino específico devido a mudanças recentes no *layout*, a constrangimentos de tempo, ao stress consequente da nossa doença, ou outras limitações que reduziram as nossas capacidades de orientação naquele momento? Quantos de nós descobrimos que estávamos perdidos dentro de um edifício ao procurar a saída, devido ao facto de estes edifícios serem normalmente um labirinto de setores desorganizados ou interseções de corredores que parecem conduzir a todos os lugares, menos ao destino que precisamos?

Existem já muitos estudos acerca do tema de sistemas de sinalética para unidades de saúde, e claro, existem também muitas leis e políticas no que diz respeito a métodos de implementação e características que estes sistemas devem possuir. Por um lado, já existem algumas recomendações e linhas guia que tentam “prescrever” formas de desenhar e implementar estes sistemas de uma forma eficaz. Por outro lado, dessas recomendações e linhas guia existentes, apenas algumas, exploram e são baseadas em investigação de campo para compreender e recolher as perceções dos utilizadores acerca do sistema de sinalética e dos seus impactos nas suas experiências de serviço.

Esta dissertação investiga a perceção dos utilizadores relativamente aos sistemas de sinalização das unidades de saúde, com o propósito de produzir um conjunto de linhas guia que não sejam baseadas apenas na literatura existente, mas também nas opiniões dos utilizadores. Seguindo vários métodos de pesquisa, os objetivos conduziram a três principais contribuições. Primeiro, a análise da literatura e linhas guia existentes, levaram á criação do quadro principal das características da sinalização em que o desenvolvimento de novos sistemas de sinalética deve assentar. Mais ainda, a análise de algumas áreas que podem envolver-se no *design* de sinalética foi importante para fornecer conhecimento que pode enriquecer a metodologia final de *design* adotada aquando da criação de novos sistemas de sinalética. Segundo, a investigação realizada com os utilizadores de quatro grandes instituições de saúde portuguesas, foi extremamente importante para providenciar um conhecimento mais fundo das necessidades e expectativas dos utilizadores no que diz respeito à sinalética destas instituições. Constituiu uma importante parte desta pesquisa e uma base primordial para as linhas guia criadas no final deste processo.

As linhas guia resultantes contribuem para melhorar a literatura existente e para aumentar o nível de detalhe das linhas guia e recomendações existentes. Não só por serem baseadas na pesquisa desenvolvida com os utilizadores, mas também porque compila todas as recomendações encontradas. Esta dissertação contribui assim para o avanço do *design* de sinalética no setor da saúde através da

recolha de algumas das mais importantes recomendações e ao providenciar um recurso para basear decisões quando desenhar, redesenhar, e implementar de forma competente tais sistemas.

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CHAPTER 1 • INTRODUCTION

The present chapter aims to present the reasons that motivated this PhD project, together with the objectives expected to be achieved. Furthermore, this chapter presents a guide through the dissertation along with a small description of what is presented in each of the chapters that compose the document.

1.1. PROBLEM STATEMENT AND MOTIVATION

This project resulted from the growing interest that the topic of the user experiences in public services is gaining nowadays. As healthcare is one of the fields that have high impact on the users, not only at a physical level but also emotional, the interest in finding ways to enhance their experience is huge. One of the elements that can contribute to enhance or harm the user experience of a healthcare setting, is the signage as part of the overall wayfinding system of the institution.

How many times, we, as users of healthcare facilities, arrived to a specific institution without having an idea of which path to follow to reach a specific destination? How many times did we tried to follow the available signage, or even verbal directions, and ended up lost in the building? How many times did we tried to follow the signs and experienced difficulties in understanding the directions? How many times did we follow a sign and ended up in an intersection in which the direction we were following no longer existed in the signs?

These are difficulties experienced by many and that motivated the interest in this topic. The interest in the healthcare field and in the design discipline as a tool to facilitate people's daily life, have encouraged the exploration of this subject. Through the analysis of the literature on the subject, the growing interest in this field along with a lack of research in the area was noticeable, which posed even more of an interest to pursue a project within the subject.

The trend in the services sector is to provide the users with a more active role and involvement in their service provision, and healthcare sector seems to be no exception. The individuals experience an easier access to clinical information that result in demands for more responsibility in their own hospital experiences (Carpman & Grant, 1993). Some researchers argue that it is important to design supportive healthcare environments as they can help the process of recovery and enhance the psychological state of the patients. One of the groups that appears to be gaining a lot of attention regarding these concerns is the elderly, which most of the times experience a lot more difficulties than the younger users. As mentioned by Carpman and Grant (1993), the supportive design, which is a

“design that creates an environment reducing the amount of stress often experienced by patients, visitors, and staff in healthcare facilities”, should be a focal point when designing these settings (Carpman & Grant, 1993, p.9).

Designers and planners can help create supportive environments by considering the way users interact with the setting and among them, which demands the users’ involvement throughout the planning process. The users’ needs can be of different dimensions, but they are mainly related to the service provision, comfort, privacy and, many times, with wayfinding.

The wayfinding difficulties, as mentioned by Passini (1996), result in negative appreciations of the physical setting but also in degradation of the image and reputation of the institution. Users end up having a negative experience, due to getting lost inside the building, missing an appointment because they did not know where to go, or due to other problems created by the lack of articulation between elements of the wayfinding system. These navigation difficulties have consequences for the users but also for the institution itself. Passini (1996) mentions that “the ease of circulation within a building, the time saved by not having to consult confusing information displayed and even the liberation from time consuming direction giving by staff, are issues of building efficiency and have financial impacts that are not easy to calculate” (Passini, 1996, p.319-320).

Signage can play an important role in improving the users’ wayfinding, when well-designed and articulated with the remaining environmental features. Sometimes even with a well-designed signage, the complexity of the building and environmental features poses difficulties to the users’ navigation. Signage is definitely not the only element that should be considered to improve users’ wayfinding, but it is already proved that better signage can reduce difficulties by preventing confusion, unnecessary frustration of the users, reduce time spent by staff in giving directions, reduce the stress associated with wayfinding tasks and consequently can help reduce the costs of wayfinding issues (Carpman & Grant, 1993).

Therefore, the conducted research is related to the signage systems in healthcare facilities, and how its design can play an important role in the users’ experiences, by diminishing their difficulties inside the buildings. As it is commonly accepted that design should not be seen only as a matter of aesthetic, but primarily for its potential in helping people in their daily tasks, the design of signage systems in environments such as healthcare services becomes even more important due to the inclusive and social role that it can have.

1.2. RESEARCH OBJECTIVES

The main objective of this project was to create a set of guidelines that can be used for designing new signage systems for healthcare or for redesigning existing ones. In order to achieve this objective, the research aimed to collect the perceptions of the users of these institutions to better understand their needs regarding signage systems in healthcare facilities. Through the collection of their needs it would be possible to create a map of the users' requirements regarding signage in healthcare that along with existing standards and regulations for signage design, resulted in a compilation of good-practices.

The proposed guidelines provide an overview of the existing standards and regulations that can be followed, but also the perceptions of the signage design elements through the users' perspective. The resultant guidelines can be extremely important for stakeholders like designers, engineers, hospitals administrations and many other professionals working on the wayfinding subject within healthcare, as it can help them create more user-friendly, mainly simple, and easy to use and to understand, signage systems.

1.3. REPORT OUTLINE

The current dissertation is organized in additional five chapters.

In chapter two, a literature review regarding the topic is presented. In this chapter, literature regarding important areas of design applied to healthcare signage is presented and crucial aspects regarding their importance in its design are depicted. Also, the concept of Users' Experience is explained together with literature debating the influence that signage systems in healthcare can have in the overall service experience and perceptions of the users. It also presents standards and regulations available for healthcare signage, together with the analysis of literature describing cases in which the benefits of designing a good signage in healthcare are demonstrated. This chapter ends with selected cases of well-designed signage that can be seen as good reference cases.

Chapter three describes the institutions selected for conducting the study and the research methodologies applied. In the beginning of the chapter, the four healthcare institutions selected for the study are presented by outlining historic data and the population they serve. Together with the description of the four cases selected, the target groups, sample sizes and ethical approvals are defined. The end of this chapter describes the methods used to collect the intended data from the users along with the explanation of why those methods were selected.

The fourth chapter presents the results from each of the hospitals under study. The data collected, and its interpretation is presented for each of the four healthcare institutions selected, and at the end of the chapter a comparison is made between them. Then, the interpreted outcomes for each hospital are compared and differences are signaled between each of them. Also, a comparison distinguishing multiple photographic records from each hospital is presented to allow juxtaposition of the available signs and find similarities on the problems found in the facilities.

The following chapter, chapter five, is where the final outcome of this project is exposed, since it presents the guidelines created throughout the whole process. This chapter presents the guidelines addressing nine categories: (1) Text formatting; (2) Information hierarchy and density; (3) Language and terminology; (4) Symbols; (5) Colors; (6) Positioning and dimensions; (7) Illumination; (8) Materials and construction; and (9) Specific sign types.

The final chapter, chapter six, provides the conclusions, main contributions of this project and perspectives of possible future work.

The last chapter is followed by two appendices where the questionnaires applied and the photographic records of each hospital are made available.

CHAPTER 2 • LITERATURE REVIEW

This chapter provides an overview of the literature and studies conducted regarding the subject of signage systems in healthcare and its impacts on the users' service experiences. After the thorough and in-depth search conducted in this project, this chapter comprises the synthesis of the theoretical background and conceptual framework on which this specific research set its basis.

The aim of this literature review was to acknowledge what is already explored in the topic in order to create the framework for the intended research and to possibly fulfill gaps in the existing literature. Furthermore, it was also important to include and revise literature concerning areas directly connected with the design of signage systems as they can provide interesting insights and requirements needed in the following steps.

Hence, this chapter presents background information regarding areas that are strictly involved in signage design and for that reason need to be part of this project, as they can influence the way the signage is designed, or the way the message is displayed and interpreted by the users. This fundamental background information is related to important areas such as: Graphic and Communication design, Interaction design, Information design, Inclusive design, and Wayfinding design, since the contribution of these areas is valid to be explored in a project such as the one conducted and here.

2.1. GRAPHIC AND COMMUNICATION DESIGN

Although these two areas are related to each other, they are not the same as many people think. Graphic design is a response to a communication problem, so, its main objective is to communicate with the target audience in a concise and effective way (Twemlow, 2007). The Professional Association for Design (Arts, 2018), defines graphic design as “the art and practice of planning and projecting ideas and experiences with visual and textual content”. It says that it can use physical or virtual supports, and include images, words, or graphics, to transmit the message in an instant or over a long period of time (Arts, 2018). The graphic design is the “effective visualization of communication concepts” (GDC, 2018).

So, what is the difference between Graphic and Communication Design?

Communication design is a mix of design and information development, which is concerned with how the media intervention, including printed, crafted and electronic media, communicate messages to people. Contrarily, graphic design is mainly concerned with the syntax of the visual elements in the message, whereas communication design is also involved in the meaning users make

of it, i.e. semantics and pragmatics, even if it means creating new channels to ensure the message reaches its target public. A simplified definition of these two areas will be that graphic design is more concerned with the aesthetic part of the message, and communication design is concerned with the functional part, or the way the message reaches the public. One can say that these two disciplines are simultaneously used as they are interconnected and part of the daily work of designers. Graphic and communication designers have the purpose of helping achieve the communication goals by analyzing, structuring, planning, and creating images and textual messages that enhance visual communication with the public (GDC, 2018). They also need to make sure the message is received and there is, indeed, effective communication between the parties involved.

Both aforementioned areas deal with visual messages that are part of the messages that all of us receive in a daily basis and that affect our senses. These messages are sent by an emitter and received by a receptor, so the first creates and sends the message and the latter receives and interprets its meaning. The interpretation of the messages does not only depend on the knowledge, cultural background and experiences of the receptor, as it can be affected by the environmental distractions that can be noise or disturbances that difficult the message interpretation (Munari, 2006).

Besides environmental factors that can influence the interpretation of the message, interpretation is also affected by the receptor's filters, such as sensorial, functional and cultural. Figure 1 provides a diagram that presents the way the message is passed between the emitter and the receptor, and all the elements that can influence that message transmission.

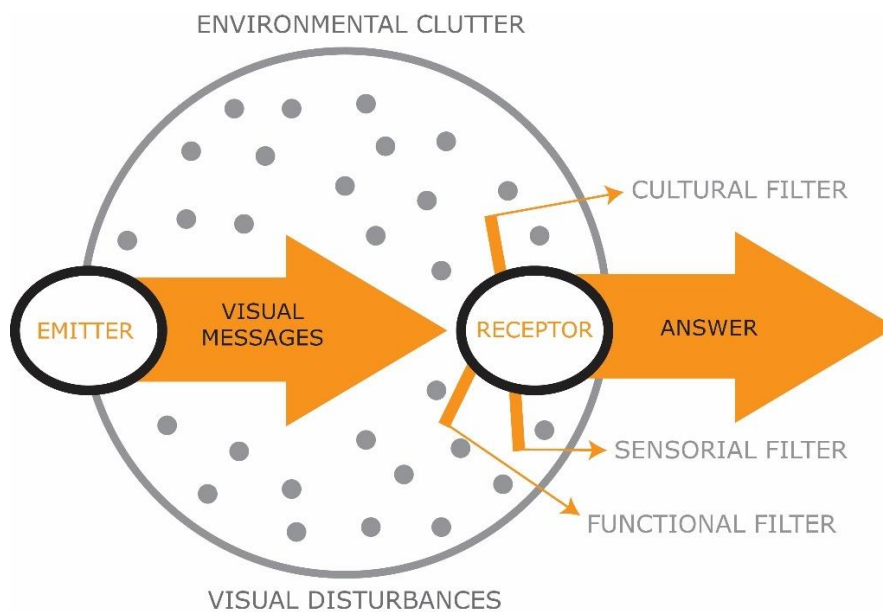


Figure 1 - Message exchange process between the emitter and the receptor (adapted from (Munari, 2006))

The **sensorial filter** is concerned to the physical limitations that can alter or even make it impossible for the user to interpret the message accurately. For example: a color-blind person will have difficulties in interpreting messages that are based on chromatic languages.

The **functional filter** involves the psychophysiological characteristics of the receptor. For example, a young kid will interpret some messages differently from an adult with much more life experience, or a person with a higher educational level will interpret the messages differently from someone with no educational degree.

The last filter is the **cultural** one, and it is related to the influence that the cultural background can have on the recognition and interpretation of the messages. For example, the use of the red cross for the humanitarian help is not well seen by the Muslim people and the symbol of this organization in their countries had to be changed due to the implemented culture.

Summing up, when creating a message, it is important to explore who are the receptors and how they will interpret the messages with the environment influences surrounding them. The designers must design the messages with the public in mind so they will be easily recognized and interpreted in an accurate and effective way.

Common types of graphic and communication design are the design of illustrations, typography, visual identities such as logos, etc. A graphic designer creates visual messages that communicate by using text and images. The interrelation of this discipline with Information design (explored in the next section) brings the use of color, symbols, typography and other methods to the aesthetic and cognitive choices of the designer. The combination of these two disciplines and elements involved are the tools to an effective communication (Baer & Vacarra, 2008).

Graphic and communication design in healthcare are mainly related to product branding, packaging, and with product marketing through web design and web communities that are currently used to communicate swiftly.

Specifically, in healthcare, the design of words and images is an extremely powerful device to establish the institutions' identity that has repercussions in the business growth. In this field, there is a need for providing a message to the users that is clear, concise, and easily interpretable, as this is the only way to be effective in communicating with such a variety of public involved in healthcare facilities. Examples regarding the implementation of communication and graphic design in healthcare are presented in Figure 2 to Figure 4.

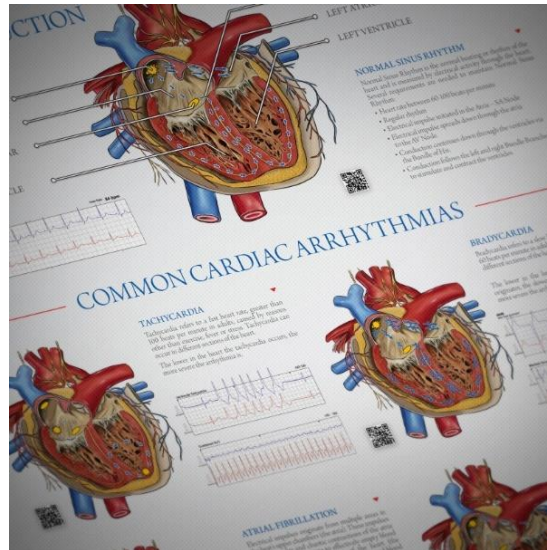


Figure 2 - "Graphic Design Medical Illustration for Medicomp" (from (LLC, 2018))



Figure 3 - "Medical Packaging Design for Phoenix Laboratories (GlaxoSmithLine)" (from (LLC, 2018))

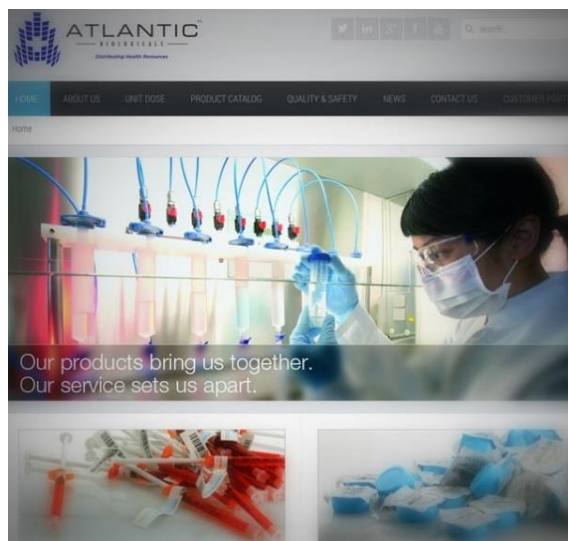


Figure 4 - "Pharmaceutical Web Design for Atlantic Biologicals" (from (LLC, 2018))

Additionally, graphic and communication design is also involved in the wayfinding system design, which is mentioned several times as environmental graphics (Arts, 2018). The environmental graphics field is associated with branding and signage applied in buildings, that is normally a combination of signs and symbols that form a larger system that helps people navigate and to know where they are. The graphic and communication designer, through his expertise, can help bring value to the design of this system and establish a relationship between all the parts involved. Figure 5 to Figure 10 depict examples of graphic and communication design used for wayfinding and signage in healthcare, where is possible to observe the use of typography, symbols and colors, used to enhance the users' wayfinding in facilities.



Figure 5 - Signage of medical offices (from (MDA, 2018))



Figure 6 - Signage using symbols and colors (from (Pinterest, 2018a))



Figure 7 - Emma Children's hospital. Integration of signage in the decorative environment (from (Pinterest, 2018b))



Figure 8 - Modular signage for offices identification (from (Grossini, 2018))



Figure 9 - Symbol identifying the physical rehabilitation area of a hospital (from (Blog, 2018))



Figure 10 - Radiology sign for Pediatric Unit (from (Lenoir, 2018))

2.2. INTERACTION DESIGN

Sharp, Rogers, and Preece (2007) define Interaction design as “designing interactive products to support people in their everyday and working lives”. Its aim is to bring usability to the design process of the products in order for them to be easy to use, effective in usage, and mainly enjoyable. The main purpose of this field is to create memorable experiences to the users, that will enhance their daily tasks whether in work or in their daily lives (Sharp, Rogers, and Preece, 2007, p.12).

The aim of an interaction designer is to create usability of features and systems with which the user interacts when using software, products, devices, environments, and services. The designer focus is on how the user interacts and manipulates the features of a product or system, as well as the response of these devices or systems to his interaction (Baer & Vacarra, 2008)

Unfortunately, one can find products that require users’ interaction, but were not designed with the user in mind, and have only been developed to perform their function lacking consideration of the type of interaction and experience that will be required by the users (Sharp et al., 2007). Therefore, it is possible to say that a main concern of the interaction design field is recognizing who the users are, how they will interact, act, and react to events that will occur when using the products or systems. This importance of exploring the users’ requirements and needs regarding a product, has transformed Interaction Design field into a mix of other disciplines that contribute with valuable knowledge. Figure 11 presents the areas involved and influencing the Interaction Design field.

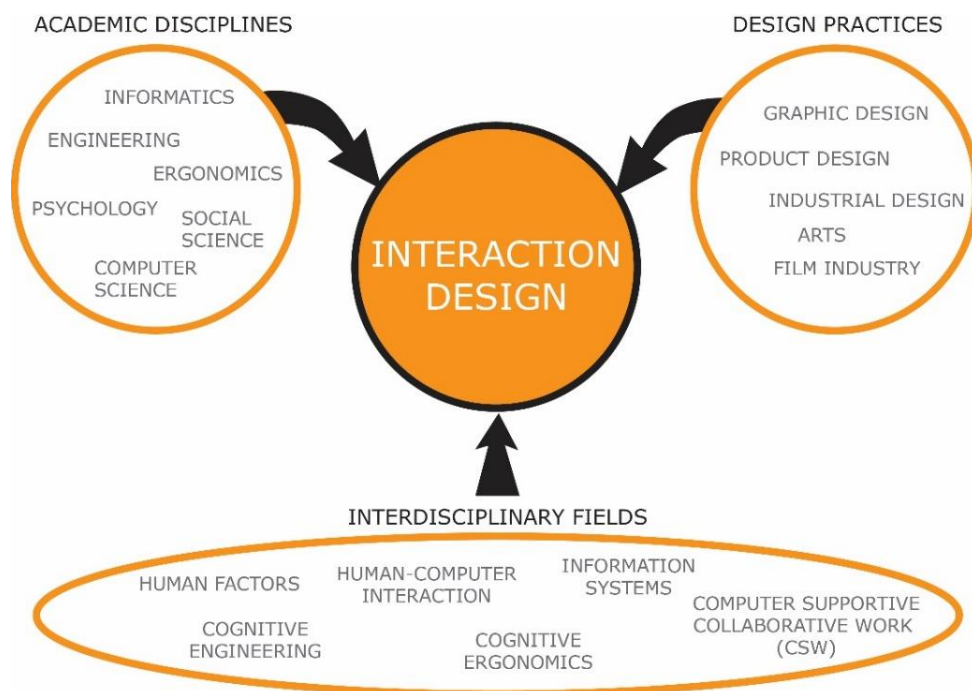


Figure 11 - Fields involved in Interaction Design: Academic, design and interdisciplinary fields (adapted from (Sharp et al., 2007))

As this field integrates a variety of other disciplines, it consequently involves a set of steps that help ensuring the development of a truly interactive and user-friendly product. The process of interaction design is divided into four stages, as described by Sharp et al. (2007), which are the following:

1. Identification of the users' needs and demands to establish the product/service/system requirements.
2. Developing a set of design concepts that meet all or the majority of the requirements.
3. Building prototypes and interactive versions to be assessed and tested by the users.
4. Continuously evaluating what is being developed throughout the whole process.

By performing these four activities, the designer is able to comply with the goals of interaction design field, which are: Usability and User Experience.

In what regards the **usability goals**, the interaction designer has to ensure that the developed product comply with the following requirements: effectiveness - it does what it is supposed to do; efficiency - it supports the user in the task; safety - protects the user from hazardous or undesirable situations/errors; utility - it is useful for the task; learnability - it is easy to learn; and memorability - once learned it is easy to remember. Those are the main principles of usability, which should be ensured and tested with users (Sharp et al., 2007).

In terms of the **User Experience**, it is seen as a critical element as it can determine the memories that people will retain from their interactions with a product/service/system (Donald A. Norman, 2002). Whether the user will determine his experience as good or bad, will depend on the emotions and cognitive aspects that the overall experience arises in him.

The designer should design the product by having in consideration these two aspects: Emotion and Cognition (Donald A. Norman, 2002).

To ensure a pleasurable interactive experience to the users, Sharp et al. (2007) claim that interaction design should be concerned with creating products/systems that are satisfying, enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding, and emotionally fulfilling. Figure 12 presents a diagram where is possible to realize the way the areas of usability and users' experience should be considered in the usability design field.

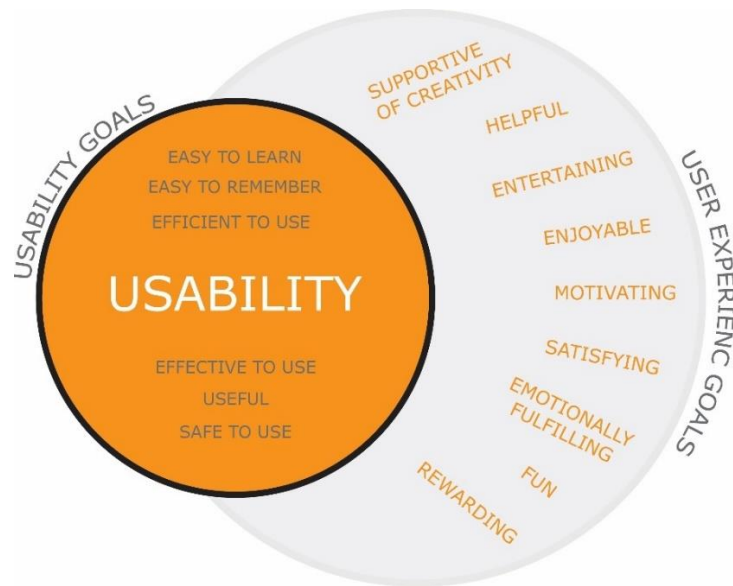


Figure 12 - Usability and User Experience goals of Interaction Design (adapted from (Sharp et al., 2007))

In order to better understand what is involved in interaction design, Gilliam Crampton Smith and Kevin Silver created a model of the five dimensions that are involved in this field, which are the following (Foundation, 2018):

1. Words – Those used in interactions such as buttons, should be meaningful and easy to understand, should communicate important information but not overwhelm the users.
2. Visual Representations – Use of graphical elements like images, typography, or icons that help transmit information and create an interaction.
3. Physical objects or space – Physical supports that provide the interaction with the user.
4. Time – Amount of time that the user spends interacting with the product.
5. Behavior – How the users perform the actions and interactions, how they operate the products, and how they react to the product, i.e. their emotional responses.

Summing up, the role of interaction design is to create products with which users must interact by exploring and developing the best solutions for aesthetic, physical, and functional parts.

"It has always been acknowledged that for interaction design to succeed, many disciplines need to be involved"

(Sharp et al., 2007, p.6)

In what concerns interaction design in healthcare, most of the applications that result from this field are related to technology, not only in terms of technology for care, but also technology that helps alleviate the use of human resources. Applications where interaction design has been involved in healthcare include new technologies to help wayfinding and also with technologies that make the tasks like the check-in in the hospital easier and quicker without the need of the staff involvement, Figure 13 to Figure 15.

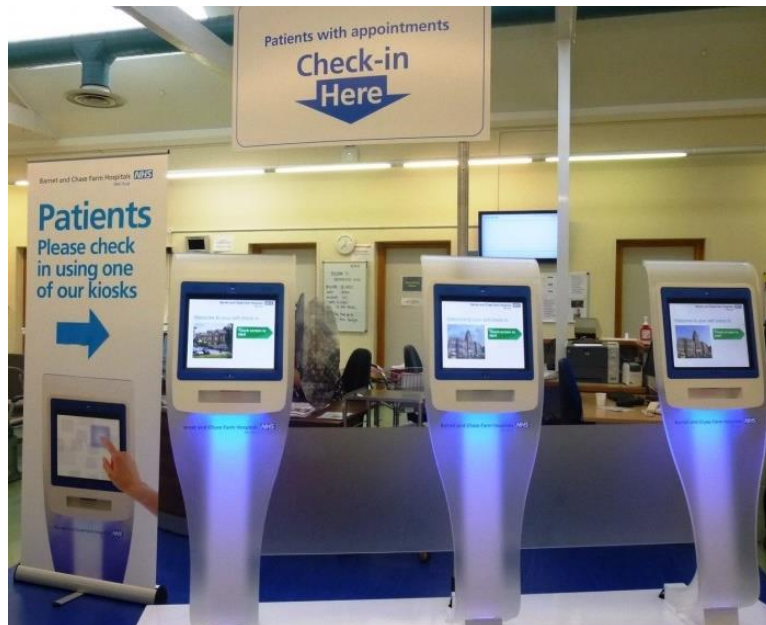


Figure 13 - Intouch Kiosks for check-in in Scottish NHS (from (health, 2014))



Figure 14 - Check-in machines developed for hospital de São João in Porto, Portugal

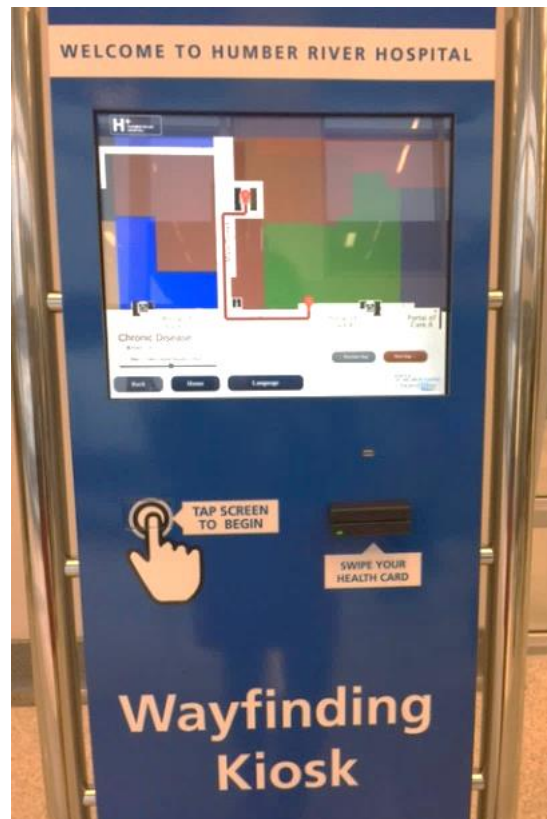


Figure 15 - Wayfinding kiosk (directory) at Humber River hospital, in Toronto, Canada (from (Hospital, 2015))

2.3. INFORMATION DESIGN

Information design is another important discipline for signage design. It is a relatively recent area and so it is the subject of many debates in the design community (Baer & Vacarra, 2008). In their book “Information Design Workbook: Graphic Approaches, Solutions, and Inspiration + 30 Case Studies”, Baer and Vacarra (2008), provide a definition developed by the Society for Technical Communication’s (STC) that describes information design as “the translating [of] complex, unorganized, or unstructured data into valuable, meaningful information” (Baer & Vacarra, 2008, p.12).

Likewise, Zwaga, Boersema, and Hoonhout (2003), define information design as the organization of data in a way that it can be used by people to achieve their goals and satisfy their needs, which means that the data organization is what evokes the meaning for the users. There are several supports that are used to transmit information, such as media and graphic elements, and they serve as a guide to the users’ behavior.

Zwaga et al. (2003), refer that the success of the information design depends on the coordination of two factors: the use of the information with the appropriate means/supports, and the use of the means/supports with the appropriate information (Zwaga et al., 2003). Further the appropriate information and the appropriate supports for transmitting it, knowing the audience to which the information is being transmitted are the determining factors for information design.

"There is nothing natural about information, no matter what it is called – data, knowledge, or fact, song, story or metaphor – has always been design" – Brenda Dervin

(Baer & Vacarra, 2008, p.14)

It can be said that information design can be divided in two phases. First, the data development phase, where an effective organization of the data is made to transform the data in meaningful information. Secondly, the support development phase, where the most adequately support for transmitting the information is created, and it guides and provides the users with the needed knowledge to perform the tasks (Zwaga et al., 2003). In each of these two phases, the designer must focus his work on three main elements (Baer & Vacarra, 2008):

1. **Content-focused:** The development of information design must be focused on the message content. For that, the designer needs to understand the aim of the information and the information to be transmitted.
2. **User-Centric:** As in interaction design, the information design needs to be centered and focused on the users' needs. The designer needs to learn what the users need and base his design decisions according to those requirements. As people have different ways to absorb the information and are exposed to elements that can influence the way they absorb it, it is extremely important that the designer asks the users what they need along the design process.
3. **Tools of the Trade:** In order to achieve a successful design of the information, the designer can make use of many tools. Establishing the hierarchy and flow of information, the composition or structure, weighting/grouping of the elements, typography and type style, color, wayfinding elements, images and negative space are ways to organize the information in a successful way.

The use of the aforementioned tactics and tools, brings together many areas of expertise like graphic design, information architecture, interaction design, usability engineering, human-computer interaction, writing, and editing (Figure 16).

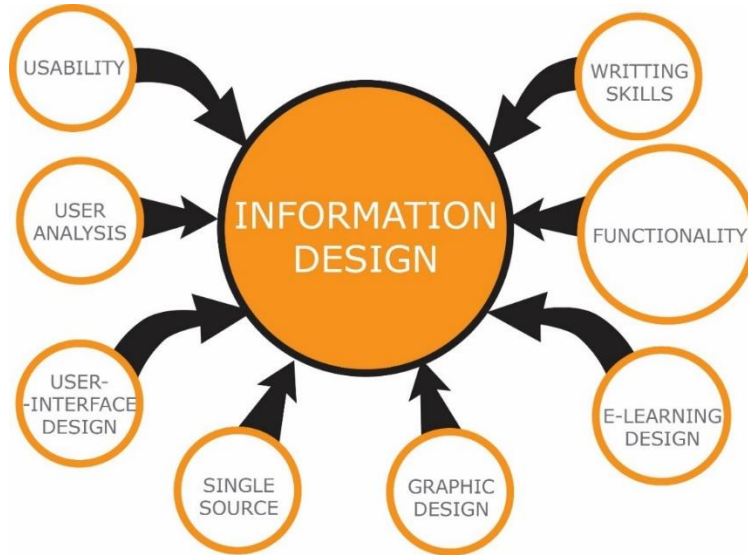


Figure 16 - Some of the fields involved in the information design field

As graphic and communication design, and the interaction design fields, the information design discipline is an important part of the design of healthcare settings. This scientific field can make the difference between the provision of simple and understandable information to the users or the creation of information overload that makes it even more difficult for the users to interpret and understand the messages. Information design is extremely important if one is talking about the wayfinding systems where the signage element is an indispensable part. Examples of information design applied to wayfinding purposes on signage for healthcare are shown from Figure 17 to Figure 19.

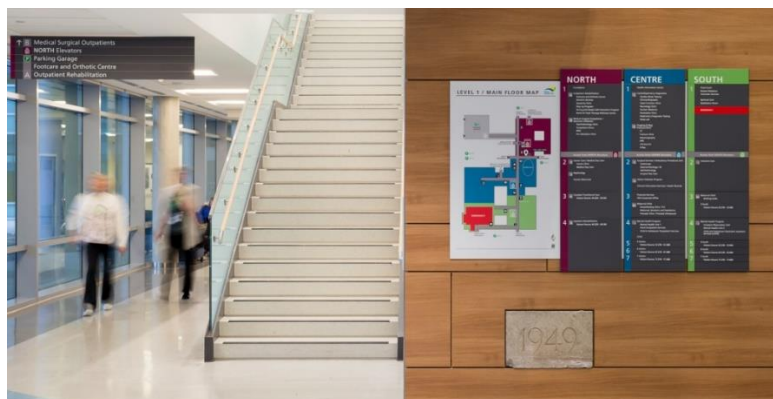


Figure 17 - Project developed for New Oakville hospital. 2D map and directory of the different parts of the building and medical specialties (from (envision, 2018))



Figure 18 - New Oakville hospital directories with grouped information regarding medical specialties (from (envision, 2018))



Figure 19 - New Oakville hospital directional signage with information grouped by hierarchy and typology of medical specialties (from (envision, 2018))

2.4. INCLUSIVE DESIGN

Inclusive design is a paramount discipline that should be involved in signage design, particularly in healthcare facilities. Healthcare facilities gather a mix and diversity of users with a myriad of different needs, with a range of health issues or disabilities, to which the settings and their environmental features need to answer. Before exploring inclusive design in healthcare settings and signage, it is extremely important to understand the concept of Inclusive and Universal design. Although they are complementary, they differ on their purposes.

As mentioned by Pickering (2016), inclusive design is “really more of a mindset than anything reducible to discrete skills” (Pickering, 2016, p.11). Imrie and Hall (2001) define inclusive design as “a documentation of the attitudes, values and practices of property professionals, including developers,

surveyors, and architects, in responding to the building needs of disabled people” (Imrie and Hall, 2001, p.3).

A more specific definition is given by The British Standard Institute (British Standards Institute, 2005) that says that the aim of inclusive design is to meet the needs of people with different ages and capabilities in a variety of contexts, as they defend that the access to information, products, services, and facilities, are a fundamental human right, so those need to be accessible and usable by as many people as possible. One can say that, inclusive design tries to develop products and services that can meet the needs of the whole population, so it expands the target audience to include as many users as possible and adapts the product/service in order to be used by as many people as possible (Clarkson, Coleman, Keates, & Lebbon, 2003).

In contrast, universal design accepts that it is not always possible to design a product that meets the needs of an entire population. Steinfeld and Maisel (2012) provide the following definition: “The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design”. Universal design is a continuous process of improvement till the full inclusion (if possible) and it is extremely dependent on the context where the design takes place (Steinfeld & Maisel, 2012, p. 28).

While inclusive design aims to adapt the design according to the needs of the customers, universal design aims to create a design solution that fits all. While inclusive design defines a specific target audience to which the product or service should extend its usability and makes informed decisions to maximize the product or service performance for that target public, universal design tries to create a design solution that can be suitable for everyone.

Nowadays, the access of all people to all the goods designed and commercialized is becoming a central social mentality and also a legal obligation to the companies in almost all the countries. The benefit of using inclusive and universal design approaches in the process of product or services development, is the fact that, when designed for being inclusive, the products or services are also more usable and accessible, and those are the main core features that users look for.

This means that with an investment on inclusivity, and consequently on usability and accessibility, the users are presented with an increasing choice of better products, and they automatically abandon those that do not fulfill their needs as an inclusive product does (Keates & Clarkson, 2003).

Healthcare facilities are one category of settings that receive the most people with different temporary or permanent disabilities due to health or congenital conditions. These people are extremely vulnerable as they are most of the times disabled and suffering from psychological stress due to their health conditions.

The primary purpose of a healthcare unit is to fulfill the needs of these groups, not only in terms of care, but also in terms of the environmental conditions and ease of use of the facilities. In this context, the design of the environmental features, such as architectural and decorative, along with the wayfinding systems, including signage and layout, play a crucial role.

Despite all the technological advances, not only in terms of treatment and care, but also in terms of environmental accessibility, there are still people from these groups of users that experience major difficulties due to their health problems and to the lack of adequacy of the settings to their needs. However, many advances are starting to appear, mainly in terms of the wayfinding systems. Nowadays, in some healthcare facilities, it is already possible to see design applications that aim to include groups like the vision-impaired, hear-impaired, and mobility-impaired users.

Although it is not possible to reach all the users, these advances have already made the experience of these settings better for these users. Figure 20 to Figure 24, show design applications that already exist for helping these groups not only in healthcare settings but in other types of facilities.



Figure 20 - On the left a sign indicating gender inclusive bathrooms with braille typography; on the right an ADA Braille sign for exam and waiting rooms (from (California, 2015) and (Signs, 2018), respectively)



Figure 21 - Modular and inclusive sign used for indicated medical specialties with indicators in Braille (from (Pinterest, 2018f))

*Universal Symbols
in Health Care,
expanded symbol set*



Figure 22 - Set on Universal symbols to be used in healthcare signage, developed by Hablamos Juntos Project together with Society for Environmental Graphic Design (from (Design, 2014))



Figure 23 - The use of symbols in big dimensions to increase legibility for those with visual disabilities or not (from (Pinterest, 2018e))



Figure 24 - Project developed by the designers Zhou Wenqiang, Bao Haimo, Jin Zhixun, Li Meiyun and Li Xinyi: staircase handrail with braille to help vision impaired users that can be used in any settings (from (Tuvie, 2018))

2.5. WAYFINDING DESIGN

The traditional approach of design for healthcare facilities is often focused on the functional aspects and in the delivering process of care. However, this focus on the functional and delivery part of the service, often leads to facilities that do not consider the psychological impact on the patients, family members, staff, etc. (Carpman & Grant, 1993). The lack of attention to these psychological details often result in stress for the patients and consequently negative impacts on the healing process, which can result in longer times spent in the hospital.

The developers and designers involved in the design process of healthcare facilities, can help reducing the stress and enhance the health recovery of the users by reducing the impact that the interactions with the environment can have on the users. One of the elements that must be planned by considering the users' needs is the wayfinding system.

Wayfinding, as Carpman and Grant (1993) define, is the easiness with which the users find their way inside a specific building. Trulove, Sprague, and Colony (2000) define the term as "Navigating from one place to another, or wayfinding, is a very basic activity, one in which people

engage throughout their lives.” (Trulove et al., 2000, p.76). They claim that wayfinding should be a problem-solving activity, in which decisions are made by the users through the interpretation of a system of features, that should be constituted by clear paths with visual, verbal, and auditory clues, such as signage, maps, landmarks, and other elements.

The wayfinding process is composed by many decisions that are interrelated, since each decision is influenced by the previous one. So, the wayfinding system is about effectiveness in communication through a succession of clues delivered through the sensory system of the users. The wayfinding process can be extremely important in helping the users to create a mental model of the setting, i.e. cognitive map, which can simplify the environment and help them navigate inside the settings (Tzeng & Huang, 2009).

One can say that wayfinding is a system that is constituted by physical and graphical cues that help the users getting a sense of where they are and what they should do to get to the place they need. Many people associate the wayfinding system only to signs. However, wayfinding is more than signs as it encompasses the overall configuration, layout or physical arrangement, space differentiation, landmarks, and other architectural group of aids that should work together to help guide the users. The signage system and its graphical characteristics can help the effectiveness of the wayfinding system, though they need to work in conjunction with the other features of the system.

As mentioned by Carpman and Grant (1993), in large and complex buildings like hospitals where the environment is most of the times a maze of corridors and intersections, the sense of helplessness and frustration can cause an overwhelming impact on the users, mainly to first-time visitors. Designing a signage that helps wayfinding can be valuable for the users. However, it needs to be connected to the other features that are part of the wayfinding system in order to effectively perform its objective (Carpman & Grant, 1993).

Although a good design of the wayfinding system is a good way to start, according to Karimi (2015), there is a sufficient body of research that proves that there are several aspects associated to the navigation experience and the physical elements of the buildings that affect the wayfinding process and consequently result in navigation errors. Karimi (2015) present seven aspects that can increase the errors made throughout a wayfinding experience, such as the visual access to destinations, the individual spatial capabilities, the existing navigational clues, the cognitive map created, the spatial learning capabilities, the wayfinding strategies adopted, and the characteristics of the physical environment and buildings' structure.

Unfortunately, most of the facilities designed for healthcare services provision, do not consider the wayfinding experience of the users, at least in a long-term. They are often huge and complex buildings, and above that, the type of service that is provided and the technological advances, require

rearrangements and extensions of these facilities over the years. What happens next, is that these building modifications and extensions are, most of the times, not predicted at the early stages of the development process. This results in unorganized layouts of services and with a maze of corridors and interconnections that may create confusion and frustration to the users. For healthcare facilities, this can mean additional costs that arise from the unsuccessful wayfinding system applied (Carpman & Grant, 1993). These costs can be classified in two aspects: operational and human. The operational factors that can mean more costs for the institutions are associated to appointments that the users can miss or arrive late due to being lost inside the facilities. The appointments missed and the late arrivals to the service, can influence the overall time that the doctor or specialist has available for his patients and can result in longer waiting times for the patients. These consequences can lead the users to other healthcare facilities in which they perceive the service provision as better and it can lead to a degradation of the institution brand and image.

Other operational issue that brings additional costs to the institution, is the working time wasted by the staff in providing directions and in guiding the users. The time that they spend with the users is time they should allocate in working in their daily tasks, and so, the institutions are losing their money since the productivity of their staff is lower than it should be.

Regarding the human factors of poor wayfinding that result in additional costs, they are related to the loss of sense of control of the user in his navigation activities, with the increasement of the users' stress, with the users' feelings of time lost, and also with long-term impacts on people with less physical and cognitive capabilities, such as the elderly. When navigating these types of facilities, one of the most important aspects to the patients and those using the services, is the sense of control over their activities inside the settings.

When one cannot find his way around, the sense of being in control of one's experience can be diminished and result in feelings of helplessness and lack of autonomy, feelings that are crucial for someone whose physical, psychological and cognitive competences may be reduced due to health conditions. Together with the feelings of being lost and of having wasted time in finding their way, feelings of stress, frustration and dissatisfaction also arise on the users. These negative emotions associated with a poor wayfinding experience, can lead to losses of users for the institution and a negative reputation which will alienate new potential users.

For the elderly, the case is far more complex since a poor wayfinding experience can have long-term impacts for them. In most cases, the sense of being in control and the autonomy in their tasks, is the most decisive factor for the elderly and many times what is left untouched of their capabilities.

In the wayfinding process, users go through three stages of decision to find their way, including: decision making, decision execution and information processing (Gibson, 2009).

In the first stage, **decision making**, the user decides whether or not to take the journey and develops a plan of action to get to the desired destination through a set of planned decisions. If the users are navigating an unfamiliar route they will need to pass to this stage of decision making in order to understand and perceive the environment in which they are navigating. If they are already familiar with the journey, they will automatically begin their journey in the decision execution stage (Tang, Wu, & Lin, 2009).

The **decision execution** phase is where the user puts his plan into action and begins the journey to the facility. Through this phase, there are many factors, including human and environmental, that can affect the journey and consequently lead to different wayfinding decisions. Each decision taken is composed of a behavior and a characteristic of the place, thus if the characteristic identified in the information provided is perceived in the real environment, the behaviors are executed. If the characteristic is not perceived the behavior is not executed and the user needs to come up with a new plan for his decision-making process. At this stage, the user will look for every possible information that can help him create a mental map of his journey and of the facility.

The last stage, **information processing** stage, is related to the information that the user must process inside the facility by using all his senses. At this stage the user needs to be capable of understanding the available information, including spatial and written information, in order to be able to navigate a particular setting autonomously.

Supplementary the use of the three wayfinding strategies, they make use of four of their senses, including: sight, sound, touch, and smell. The senses are used in various degrees and sometimes unconsciously (Smitshuijzen, 2007).

Sight is the sense in which people most rely on. Most people use their sight to look for information that can help them make the next wayfinding decision. However, their attention when using this sense can be perturbed by many distractions available and characteristic of a healthcare setting, such as: something looks as it may lead to their desired destination, a person they think that knows the site and is available to provide directions, a map to locate all the available destinations and even directional or locational signs. Healthcare institutions are used by many types of users, and some of them have visual impairments or are older people whose sight have become damaged with aging. When planning the wayfinding system and the design of its elements, these types of users should be considered, and the legibility and visibility of the wayfinding aids should be ensured.

In terms of **sound**, these types of facilities are often busy and noisy places. As these settings are many times full of people and material resources circulating from one place to another, the sounds that are produced may sometimes interfere with the wayfinding capabilities of the users. As it happens with the sight sense, people's hearing deteriorates with aging, and this can lead to specific and different

needs in terms of audible wayfinding aids. For people who are deaf or hearing impaired, the availability of an effective signage system can be crucial. Also, for people who have a degree of visual impairment, audible clues can be created to help guiding them through the facilities. However, consideration is needed in identifying and reduce the sounds that are normally produced in these facilities.

In terms of **touch**, the use of textures and different patterns on the architectural features, such as the stairs ledges, can be useful for all the users. If these architectural aids are helpful for all the users, they are even more important for people with visual impairments that are especially reliant on tactile and texturized aids.

Finally, **smell**, is often an ignored sense in wayfinding as it is used many times subconsciously. Yet, people often make use of smell to remember and identify places, and they often create a good or bad perception of the environment through smell. As it is a sense that can affect the emotional state and perceptions of the users, in a positive or negative way, it should always be considered as part of the wayfinding system. It does not mean that people will literally “follow their nose” to arrive to a specific destination, but it can help them remember wayfinding clues from, for example, previous visits to the settings.

If healthcare sites carefully consider the four senses used by people when trying to find their way, they will be capable of increasing the effectiveness of their wayfinding system and provide a better navigation experience to their users.

As wayfinding is more than just signs, towards helping the users’ guidance effectively, those need to be combined and connected with the remaining elements of the wayfinding system, such as architecture, landscaping, interior design, lighting, art, people, and printed and digital information. Used together as a system, these elements can help communicate the necessary information effectively and help people make good wayfinding decisions.

No element can work in isolation, all of the elements should be interconnected in an integrated system. Only through the connection of all the elements it will be possible to achieve an effective and functional wayfinding system. Examples of accepted good wayfinding systems are presented in Figure 25 to Figure 29, where is possible to observe the use of symbols, colors, typography, and other visual elements to improve the users’ experience of the service and their wayfinding capabilities.



Figure 25 - Lady Cilento Children's hospital wayfinding system created by Dotdash (from (SEGD, 2018))



Figure 26 - Symbol system implemented at the Children's hospital to guide the users (from (Mar, 2018))

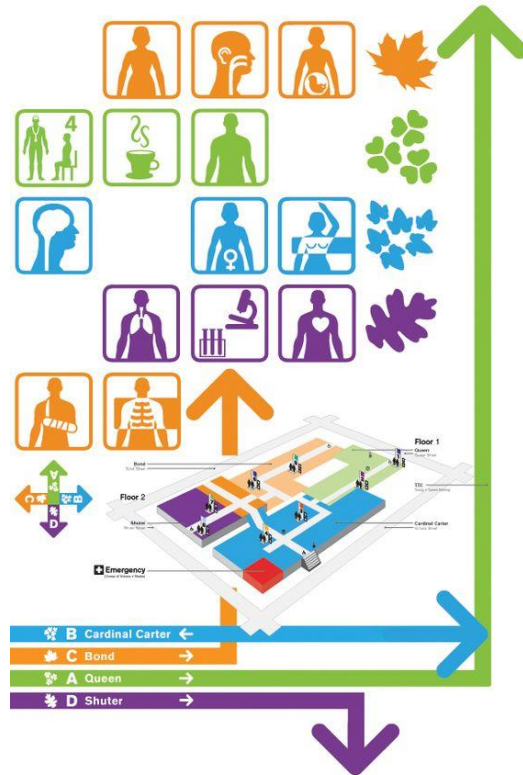


Figure 27 - Project for zone colors and arrows with colors and symbols on the floor or walls to help guide the users to the specific services (from (Pinterest, 2018g))



Figure 28 - New decorative and signage system implemented at the Emma Children's hospital in Amsterdam (from (Pinterest, 2018c))



Figure 29 - Massachusetts General hospital numbering system for medical offices (from (Pinterest, 2018d))

2.6. USERS' EXPERIENCE

One can define experience as the degree of understanding users have of the product/service, the feelings that arise from the interaction, how well the product or service serves the purpose to which it was designed in the first place and how well it fits in the context in which it is being used (Bate & Robert, 2007). However, experience is extremely subjective as it can mean anything and cannot be defined in a systematic way since it varies with many factors, such as the users' characteristics and the context in which it happens.

As Bate and Robert (2007) mention, experience is not something that can be assessed directly. It can only be described through the words of the people that were involved in it when they look back and try to describe how it was. So, in this sense, Bate and Robert (2007) described experience as something that is not real, and as a reconstruction of something lived by someone.

Nowadays, the service organizations and product developers are becoming aware of the importance of managing the users' experience, in the same way and with the same rigor that they manage the functional and operational aspects. Managers are aware that users are an incredible font of clues as they provide insights regarding the reliability and technical quality, i.e. cognitive and functional clues, the appearance and first impression, i.e. emotional and aesthetic clues, and the overall interactive quality, i.e. behavioral clues, of the service or product provided (Bate & Robert, 2007).

D.A. Norman (2004) refers to experience as interconnected with the emotional and cognitive part of the users, since he claims that we, as users, create our own memories based on the experiences that we had with the products or services, and based on the emotions and feelings that the interaction evoked on us. At the emotional and cognitive system there are three levels from which the users defined their experience: the visceral, behavioral and reflective level.

The **visceral level** is the pre-consciousness level, and so this is the level at which appearance and the first impression matters the most. It is mainly about the initial impact of the product and about its appearance, touch and how it feels to the user.

The **behavioral level** concerns the use and experience of use of a product or service. This level is related to the function, i.e. the activities it serves, the performance, i.e. how well it performs its function, and usability, i.e. how easy and understandable it is.

Finally, the **reflective level**, happens at the conscious level where feelings, emotions and cognition reside. At this level the user feels the full impact that the experience with the product or service has in his emotions and thoughts. This is the level that is most susceptible to influences of context, culture, experience, education, and other aspects (D.A. Norman, 2004).

Donald A. Norman (2002) in his book entitled “The Design of Everyday Things”, refers that the field of user experience is entirely connected with the human-centered design (HCD). HCD is highly concerned with the human needs, capabilities, and behaviors, and then with the designs to accommodate those requirements in the product or service. As it is a field that designs for the human experience, areas like interaction, industrial, and experience design are all compatible and should be working together in the field of the user experience design (Donald A. Norman, 2002). In this work, Donald A. Norman (2002) says that experience is critical as it sets the basis of how profoundly the users remind a specific interaction, and so, a good designer is the one that produce pleasurable experiences through the involvement of the users cognitive and emotional level that are tightly intertwined in an experience. He also mentions that, for the designer, the levels of emotion and cognition (reflective level) are the ones with more importance in the design, since “memories last far longer than the immediate experience or period of usage, which are the domains of visceral and behavioral levels” (Donald A. Norman, 2002, p.53).

Although the reflection level is what makes us recommend a product or a service, or avoid it, all the three levels must work together and must take part in the design process. They all play distinct roles and help determining if the user like or dislike the experience that is being provided (Donald A. Norman, 2002).

Bate and Robert (2007) claim that a good design should achieve quality in the overall experience that is formed by three aspects:

- **Affect:** the feelings of the user transmitted by the interaction and the affective quality of that interaction.
- **Motivation or value:** the cost-benefit terms of the economic or psychological experience.
- **Cognitive:** what is known, thought or believed by a person regarding the interaction with a specific product or a service.

To create quality in experience, designers should design considering the ten elements that compose experience: Reflection and awareness, Sensation; Perception, Thought, Memory, Imagination, Emotion and Expression, Desire, Volition, and Action and Conduct. Through the consideration of these elements, the designers should be able to design for experience and for achieving quality of experience (Bate & Robert, 2007).

"Experiences are one of the most valuable memories we have...Successful experiences are valuable both financially and emotionally and the more we learn about how to create them (whether through approach, process, understanding, or specific criteria), the better the experiences we can create and the more enriching our lives can become" – Nathan Shedroff

(Bate & Robert, 2007, p.1)

Concerning the field of users' experience in current healthcare, the trend is to recognize that patients, staff, family members, and all the people who make use of such facilities are more than just simple receivers of the service. The aim is to look at the users as the center of the all service provision, and with that in mind, the tendency is to put them in the center of the all development process and make them participants rather than mere spectators.

Healthcare organizations are starting to wake up for the implications of the growing competition in the field and of wider patient choice regarding the existing institutions in this area. They are aware that if the service provided does not satisfy their customer, there is a huge possibility that unsatisfied users choose to be treated or cared in other institutions rather than theirs.

Considering this fact, Bate and Robert (2007) suggest that healthcare professionals should start to reorient the improvement processes around the patients' and users' experiences, by placing them at the heart of the design process and clinical objectives. They mention that the challenge is to understand the users' experiences in a more profound level that includes all aspects of experiencing a service or product, including physical, cognitive, aesthetic and above all emotional aspects, and to use that understanding to design a healthcare experience that is more pleasant and satisfiable than the ones before (Bate & Robert, 2007).

The concept of users' experience concerns the every emotion and attitude of the user when using or when anticipating the use of a specific product or service. In other words, it is associated with the time before, present and after the interaction of the user takes place with a specific product or service, and the perceptions and emotions felt during each stage will be the basis for categorizing his experience. As it is a consequence of the user interaction with the product or service, this interaction will be influenced by all the emotions, preferences, beliefs, and physical and psychological responses of the user regarding this element.

Additionally, it includes also the users' perceptions regarding its utility, usability and efficiency to serve its purpose. This interaction can be influenced by his previous experiences, aptitudes and personality in context of use. Users' experience is seen as subjective and dynamic. Subjective because it deals with individual perceptions and thoughts of the users regarding a specific system or product, and dynamic because, their experience is constantly being modified over time due to changes in the users' individual psychological or physical state and in the usage context.

Mainly in healthcare, the human and cultural considerations should be regarded as crucial to the design process, as users become involved in a context in which they are not comfortable as they are not there for pleasure or enjoyment but for essential care, or sometimes for more critical clinical reasons. In this context, the design of experiences that at the very least do not induce negative emotions like fear, anxiety, or panic, is extremely important to provide to the user a more pleasant experience (Bate & Robert, 2007).

One approach that came up to help designing for the user experience in fields such as healthcare, is Evidence-based design (EBD). This approach (see Figure 30) is focused on involving the users in the design process and on designing for the human experience.

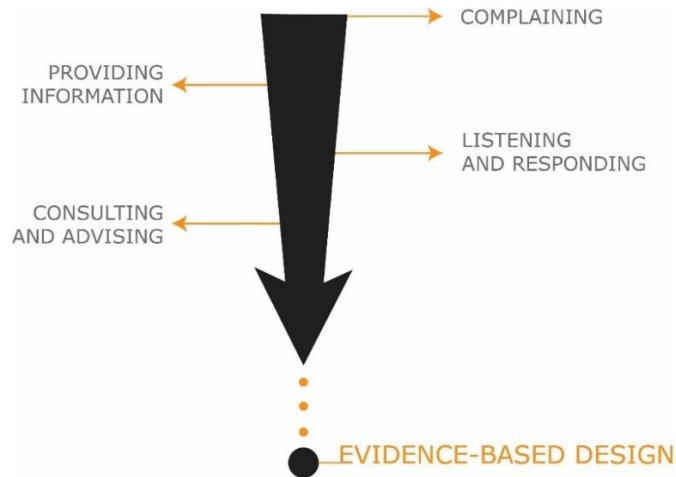


Figure 30 - Patient's clues used by the evidence-based design approach (adapted from (Bate & Robert, 2007))

It uses the research about the built environment and also about the improvement of the patient outcomes through its involvement in the design process of a number of elements that compose these institutions. Its main purpose is to create harmony between the workflow, care-delivery processes, and behaviors of the patients, as they interact with the building and the caregivers.

2.7. SIGNAGE DESIGN

Each step of the users' itinerary inside or outside an institution, requires the users to read and interpret the environment and its surroundings, and the use of aids such as signage, landmarks, maps, interior elements, like as artwork, display boards and information counters, structural elements, furniture, and other features can help in those interpretations. The signage is one of the elements that can help guide the users within the facilities, since its purpose is to direct, inform, identify, and likewise in specific signs, define appropriate behaviors that users should follow (Carpman & Grant, 1993).

When entering the institutions, the main concern of the users is to know where to go to find the destination they are looking for. For this purpose, a well-designed signage system together with other environmental features, appropriately designed for the target audience, can help orientate them and prevent confusion, frustration, stress, and even time losses (Carpman & Grant, 1993). As signs are not the solution for most of the wayfinding problems of the users, they must be connected to all the other environmental aids of the facilities (Ministry of Health, 2014).

As mentioned by Pati, Harvey, Willis, and Pati (2015), signs constitute one of the first sources of information that subjects sought for when entering the facilities, and further their communicative purpose, they can improve the service logistics as they can reduce wayfinding problems and service

time (Boonyachut, Sunyavivat, & Boonyachut, 2012). Although the signage system is not the only element that may provide environmental guidance, primarily the first-time visitors will be looking for these types of information supports when they arrive to an unfamiliar environment, and they expect them to provide the information they need (Ministry of Health, 2014).

There are three types of signs that make part of a wayfinding system and that should be considered according to the needs of information required, which are (Ministry of Health, 2014): Directional signs - information regarding which direction to follow; Identity or Locational signs - identify the locations and tell people where they are; Directory or Orientation signs - give general information regarding the location of places and how to get there.

The methods for defining the sign types vary, but there are two main basic approaches: to type signs by physical characteristics, such as size, shape, material and mounting method, or by communication function whether the sign communicates identification, direction or other types of information. Each of these types of signs will serve a specific purpose in the institution and a study must be made to the institution layout and services location in order to understand which types of signs must be applied and where should they be positioned.

Conducted to knowing this, the physical characteristics of the site, circulation pathways, and decision points must be analyzed together with the mapping of the possible journeys made by the users. Together with these aspects, factors like the time and budget, the image and brand, the formal and thematic context of the site, the applicable codes of the signage and the users' profiles, are aspects that also constraint the signage program and that must be planned early in the process of design.

As abovementioned, signs play a key role in conveying the information clearly to the users; However, there are many factors that should be considered in its design and implementation with the intention for the sign to achieve its purpose effectively. These factors are related to the informational content of each sign and its graphical characteristics, and with the hardware system where the placement and other physical characteristics of the signs is planned (Calori, 2007).

Finally, technology is also taking a major role in healthcare facilities, not only in terms of the medical services provided but also for wayfinding purposes. When planning the signage system, technologies like digital signs, kiosks or smartphone applications, can be considered to help the users overcome certain wayfinding difficulties.

In healthcare institutions, the variety of users and the complexity of the facilities layout, requires a good orientation strategy and consequently a well-developed wayfinding system, where signage plays an important role. Although wayfinding is a natural and intuitive behaviour (Zijlstra, Hagedoorn, Krijnen, Van der Schans, & Mobach, 2016) of those visiting healthcare settings,

unfortunately its planning is, most of the times, considered once the construction of the facilities is complete (Devlin, 2014).

Some studies argue that a good wayfinding system can bring benefits for the institutions in terms of less usage of staff working time used in providing directions and guiding the users, and in better experiences for everyone that visits these settings. Furthermore, it is proved through the existing research, that better wayfinding systems reduce the stress of the users and the anxiety, and help improve their service experience at an emotional and cognitive level (Ministry of Health, 2014).

According to the study conducted by Ministry of Health (2014), there are costs associated with a poor wayfinding system. These costs are associated to the anxiety and frustration felt by the users when navigating settings that are difficult to get around that, at the end, may lead them to ask the staff for directions, which influences the staff usage of their working time, or worse, end up influencing their health recovery and health outcomes.

“The ease of circulation within a building, the time saved by not having to consult confusing information displays and even the liberation from time consuming direction giving by staff, are issues of building efficiency and have financial impacts that, admittedly, are not easy to calculate.”

(Passini, 1996, pp. 319-320)

There are studies that show that signage impacts the users’ wayfinding behaviours and that it should be planned in the early design stages of the overall configuration of the building (Rousek & Hallbeck, 2011a). Due to a lack of planning in the early stages, many hospitals end up being a maze of disconnected spaces and intersections of unorganized corridors that are consequence of the expansions and reorganizations that they suffer along the years. These problems that arise from this lack of planning and rearrangements, result in a big challenge for the users that try to navigate the facilities and try to reach their desired destinations (Rousek & Hallbeck, 2011b).

Mollerup (2009) shares these thoughts by providing four reasons to explain why people do get lost and experience wayfinding difficulties inside healthcare facilities:

- The complexity of the settings due to expansions, rearrangements, and lack of long-term planning of the facilities layout.
- The number of users' previous visits to the settings, and rearrangements applied till their last visit.
- The use of scientific terminology and complicated language not suitable for many of the users that visit an hospital, such as elderly and illiterate users.
- The reduced wayfinding capabilities of some users due to health conditions or disabilities.

If the wayfinding system implemented does not serve its purpose effectively, there are specific problems that arise, such as late arrivals to medical appointments, patient visits, or inpatient admissions, which may end up influencing the waiting times, increase patients stress, frustration, and anxiety, and also impact the staff working time and daily agendas (Cooper, 2010).

There are authors who suggest that a better facility design and wayfinding system, along with an efficient layout and signage program, can positively impact the patients' perceptions of the service, reduce negative feelings associated with being in the hospital, and benefit patient care and medical outcomes (Chambers & Bowman, 2011; Ulrich & Zimring, 2004; Zimring, Denham, Jacob, Cowan, Do, Hall, Kamerow, Kasali, & Steinberg, 2013).

Carpman and Grant (1993) also share this opinion as they claim that a better signage system reduces difficulties and stress associated with the wayfinding tasks, and consequently help in health treatments and recovery. As it was already mentioned, wayfinding is not composed only by signs. However, signage has the specific purpose of communicating information to people about the environment (Calori, 2007) and is one of the truly interactive elements of the environment, and therefore the element in which is crucial to consider the users' needs.

The main purpose of the signage system is to guide people, improve patient safety and health outcomes, improve the effectiveness of staff time, and reduce wayfinding costs (Potter, 2017). According to Gibson (2009), everyone who has ever tried to find their way inside a complicated building, recognizes the importance of an easy-to-understand signage.

Further the guidance purpose of the signage, this wayfinding element has also an important impact on the emotions and perceptions of the users, as it can help the users feel more autonomous and confident in their navigational experiences. For some of the users, like for example the elderly or disabled people, autonomy and confidence are one of the most important feelings since they can make them feel less dependent of their health of physical conditions.

In his study, Nelson-Shulman (1983), found that patients that were exposed to signage in the admitting area of an hospital, made fewer questions and demands to the staff since they were more

knowledgeable about the procedures and the services available, contrarily to the patients that did not had access to this information (Nelson-Shulman, 1983).

However, the simple implementation of signage, does not mean that wayfinding difficulties will disappear and that the users' navigation inside the facilities will become easier. In order to provide an effective wayfinding to their users, all the wayfinding elements of the healthcare environment need to work in conjunction.

Therefore, authors, such as Rousek and Hallbeck (2011a), suggest that signage design must consider four factors in order to be effectively designed:

- **Signage recognition:** the users should be able to recognize the meaning and purpose of a specific sign.
- **Signage color:** the use of colors that can establish a meaning for the users and help their guidance inside the setting.
- **Signage font type:** careful choice of the font type and style since it can influence signage legibility and interpretation. Both color and font format should be tested among the users.
- **Americans with Disabilities Act (ADA) guidelines:** which provide guidelines for designing the signage system, i.e. as to the use of symbols and specific parameters, in consideration to those with disabilities, such as visual impaired, hearing impaired, blind people and mobility impaired.

Given the huge variety of users with different languages, cultural backgrounds, disabilities, educational levels, ages, and so on, even with a well-designed signage system, it is almost impossible to solve all the users' wayfinding difficulties and answer all the users' needs. The users' variety makes it extremely difficult to come up with a design of a signage solution that suit everyone.

For example, the use only of text in signage, while it can improve the comprehension of a message for a specific number of users, it can also be limiting for those who do not share the same language as the one displayed on the signs (Scialfa, Spadafora, Klein, Lesnik, Dial, & Heinrich, 2008).

The easiness of travelling is bringing more challenges for the healthcare settings, and further their common and regular users, healthcare settings need to plan all their wayfinding program so as to accommodate those who come from abroad (Cowgill, Bolek, & SEGD, 2003).

Together with the problem of language, the educational level and cultural background of the users can also create some challenges to the facilities design, as for example, there are people with lack of educational levels that are unable to read. Although, there are already examples of signage

systems that try to overcome this problem through the use of symbols and simpler terminology on the signs to help the users with these limitations (Campbell & Scott, 2014).

Authors, like Hashim, Alkaabi, and Bharwani (2014), claim that before implementing symbols on signage in healthcare settings, those need to be tested among the users, as they claim that those with higher educational levels are more likely to recognize and interpret them in a correct way. Also, Young and Wogalter (2000), suggest that the use of abstract symbols that are oversimplified is not the way to go, as there are users that have troubles in its interpretation. In contrast, they found that the use of human body parts representations or body parts performing the specific action described on the signs, were easily understood and interpreted by the majority of the users.

Also gender is described in the literature as an influence for the signage interpretation. Devlin and Bernstein (1995), conducted a study to test the effectiveness of seven different kinds of wayfinding scenarios with different wayfinding information available. They arrived at the conclusion, as other studies had also suggested, that men made fewer errors and were more confident of their wayfinding decisions than women.

To achieve an effective and easy to understand signage system, its design needs to be developed with consistency regarding the other existing wayfinding aids. It should be planned in the early stages of the facility design and should consider not only the building configuration, but also the future expansions and rearrangements, the users' profiles, the information needed, the typology of signs, and its physical and graphical characteristics, and finally the costs and overall budget for the project.

2.7.1. CURRENT STANDARDS AND GUIDELINES

Currently, there are regulations and guidelines available for the design of healthcare signage. Some are specific for healthcare institutions, other are related to the signage systems in general, and other concern topics such as inclusivity that are somehow related and can provide important insights for designing signage systems that can meet the needs of everyone.

Much of the available regulations are international, mainly American and Australian, but are used worldwide as guidance for many countries concerned with designing signage systems that obey the existing regulations and that can meet their users' expectations. In what concerns the Portuguese case, there are very few regulations and guidelines regarding the design and implementation of signage systems in public services, as Portugal makes use of many international standards such as the ones developed by International Organization for Standardization (ISO).

Below are indicated the standards and guidelines which were used in this project, followed by a description of their content and purposes.

STANDARDS FOR SIGNAGE SYSTEMS IN PUBLIC SERVICES

Disability (access to premises buildings) Standards 2010 – Australia: This manuscript comprises a set of standards related to the inclusivity of users with disabilities. The aim of the standards is described as ensuring that “dignified, equitable, cost-effective and reasonably achievable access to buildings, and facilities and services within buildings, is provided for people with disability, and to give certainty to building certifiers, buildings developers, and building managers that, if access to buildings is provided in accordance with these standards, the provision of that access, to the extent covered by these standards, will not be unlawful under the Act” (Government, 2010, p.3).

National Safety and Quality Health Service (NSQHS) Standards – Australia: These standards provide a consistent and uniform set of measures of safety and quality to be applied in a wide variety of healthcare services. It makes use of Evidence-based design to deal with existing gaps between the current practices that affect a large number of users of such institutions. These standards concern the provision of safe and quality of care to the users, together with some best-practices for designing the facilities with the users’ needs involved in the process (Care, 2012).

Americans with Disabilities Act (ADA) – America: This is an American law that prohibits the discrimination against individuals with disabilities in all areas and services of the public life, and it is now very much applied in terms of the signage systems. The purpose of this regulation is to make sure that people with disabilities have the same rights and opportunities as everyone else. It aims to guarantee equal opportunities to individuals with disabilities in public accommodations, employment, transportation, state and local government services. It is divided in five main sections addressing different areas of the public services (Division, 1990).

American National Standards – ANSI Z535.1-5 – America: This standard relates to the use of colors on safety signs. It provides a system to select colors based on Munsell notations, CIE colorimetric data, chromatic regions, and color formulas for each ANSI and ISO safety color used on safety signs, labels, and tags. Although it is related mainly with the safety signs, it can be useful also for selecting the colors used on other signage applied, as it can constraint the typology of colors used in order to not mislead the users’ interpretation of the signage available (Association, 2002).

ISO/FDIS 3864-1: 2001 (E) – Switzerland: It establishes the safety identification colors and design principles for safety signs used in public spaces. The aim of these principles is accident prevention, fire protection, health hazard information and emergency evacuation. It also defines the basic principles for developing standards concerning safety signage (Standardization, 2001).

ISO 9186-3 – Switzerland: It presents a method for testing the associations of graphical symbols used on signs intended to communicate information to the users who are familiar with those symbols, i.e. the referent. The referents are specialized in the symbols meaning, so the users of the public settings must be trained to interpret the symbols correctly. The aim of these standards is to create graphical symbols that are recognized by the users that are familiar with the referents when no additional information about its meaning is provided. When its interpretation alone is not possible, supplementary text must be provided to explain its meaning in the language of the regular users (Standardization, 2014).

British Standards BS 5378-1: 1980. Safety signs and colors – United Kingdom: It provides a system of safety colors and safety signs to communicate information regarding prevention of accidents, warning of health hazards and emergency purposes (British Standard Institute, 1980).

BS 5499: 1990. Fire safety signs, notices and graphic symbols – United Kingdom: It sets and defined the characteristics and colors of signage that provides information regarding fire precautions and means of escape in case of fire (British Standard Institute, 1990).

BS 5499-5: 2002. Graphical symbols and signs – United Kingdom: It concerns the safety signs using geometric shapes and safety colors to provide information for actions to take for preventing or reduce the risk of accidents or hazards (British Standard Institute, 2002a).

BS 8501: 2002. graphic symbols and signs. Public information symbols – United Kingdom: It provides a compilation of public symbols to apply on signage systems and recommendations on how they should be used. The standard is not applicable to safety or traffic signs, and the use of symbols although grouped by areas, must be made in other areas where it is considered appropriate (British Standard Institute, 2002b).

GUIDELINES FOR SIGNAGE SYSTEMS IN HEALTHCARE SERVICES

Guidelines for Design and Construction of Hospital and HealthCare Facilities – America: It provides a set of guidelines and best-practices to aid in the design and construction of hospitals and other types of healthcare facilities. Its aim is to keep pace with the evolving healthcare needs and respond to requests for up-to-date guidance from provides, designers and regulators. It provides a set

of recommendations divided by the types of healthcare services provided, such as general hospitals, nursing facilities, outpatient facilities, rehabilitation facilities, and psychiatric facilities. It is intended to be a manual of guidelines and recommendations, but it also can be used as regulation (Institute of Architects, Group, Revision Committee, & Michaels, 1996).

Wayfinding system audit – Australia: The wayfinding audit document was created to be used to audit new buildings and the immediate spaces surrounding them in terms of wayfinding. It is mainly directed to new buildings, surrounding environments, existing buildings and for improving wayfinding in large complexes such as university campuses, hospitals, schools and urban spaces like malls and shopping centers. It provides a system to audit the features that compose a wayfinding system of a specific setting, such as: architecture, landscape, interior design, lighting and cognitive landmarks (Apelt, 2007).

Wayfinding for Healthcare Facilities – Australia: This manual of guidelines is focused not only on the signage system design but mainly in providing a broader perspective based on the patients and their families' wayfinding issues. It provides auditing tools and systems focused on wayfinding. Its purpose is to assist with useful approaches for wayfinding in healthcare facilities, provide information on possible wayfinding strategies to adopt, identify common journeys and steps of the users' wayfinding, and provide tools to design and improve those wayfinding systems for healthcare facilities (Ministry of Health, 2014).

Wayfinding: Guidance for Healthcare Facilities NHS Estates – United Kingdom: The focus of this report is on assessing and improving wayfinding systems for healthcare facilities. It includes best-practices guidelines throughout the all document with illustrations of recommendations to follow and to avoid when designing an effective wayfinding system (Jeffrey, 1999).

Specialist Clinics Wayfinding Guidelines: The Outpatient Journey – Australia: This manuscript was developed to assist the public hospitals in Victoria, with the main aim of improving the experience of the patients visiting clinics within the hospital grounds or outpatient departments (Services, 2011).

2.7.2. REFERENCE CASES OF WELL-DESIGNED SIGNAGE IN HEALTHCARE

In the quest to find the best-practices resulting in a well-designed, user centered signage system, we came across with good examples of healthcare signage that followed the principles described in the revised literature. On the examples shown below, it is possible to observe that certain best-practices described on the literature, regarding graphical and physical characteristics of the signage system, were followed and applied so that the best wayfinding experience is provided to the users.

Emma Children’s Hospital – Amsterdam, Holland

Located at the Medical Academic Center of Amsterdam, the Emma Children’s hospital is a reference example of the implementation of good signage system together with decorations that promote the recovery and treatment of young adults and children (OPERA, 2012), Figure 31.



Figure 31 - Signage system and decorations implemented on Emma Children's hospital in Amsterdam (from (OPERA, 2012))

Kata Civic Polyclinic – Shirosi, Japan

The signage system implemented on Kata Civic Polyclinic (Figure 32) is based on the high visibility and legibility of the information. The signage is mainly implemented on the floor in which the contrast between the environment (mainly white) and the signage (information displayed in red), contribute to a good legibility and visibility of all the information that is intended to be communicated to the users of the settings (H. D. Institute, 2011).



Figure 32 - Signage system implemented at Kata Civic Polyclinic, in Japan (from (H. D. Institute, 2011))

Auburn Hospital – Sydney, Australia

The signage system of the Auburn hospital in Sydney (Figure 33), was developed with the aim of reducing the stress of the patients inside those complex facilities. The color scheme was selected from the institutional image in order to be adequate to all the medical areas of the building, while keeping the needed legibility and functionality for such a big and complex building (North, 2011).

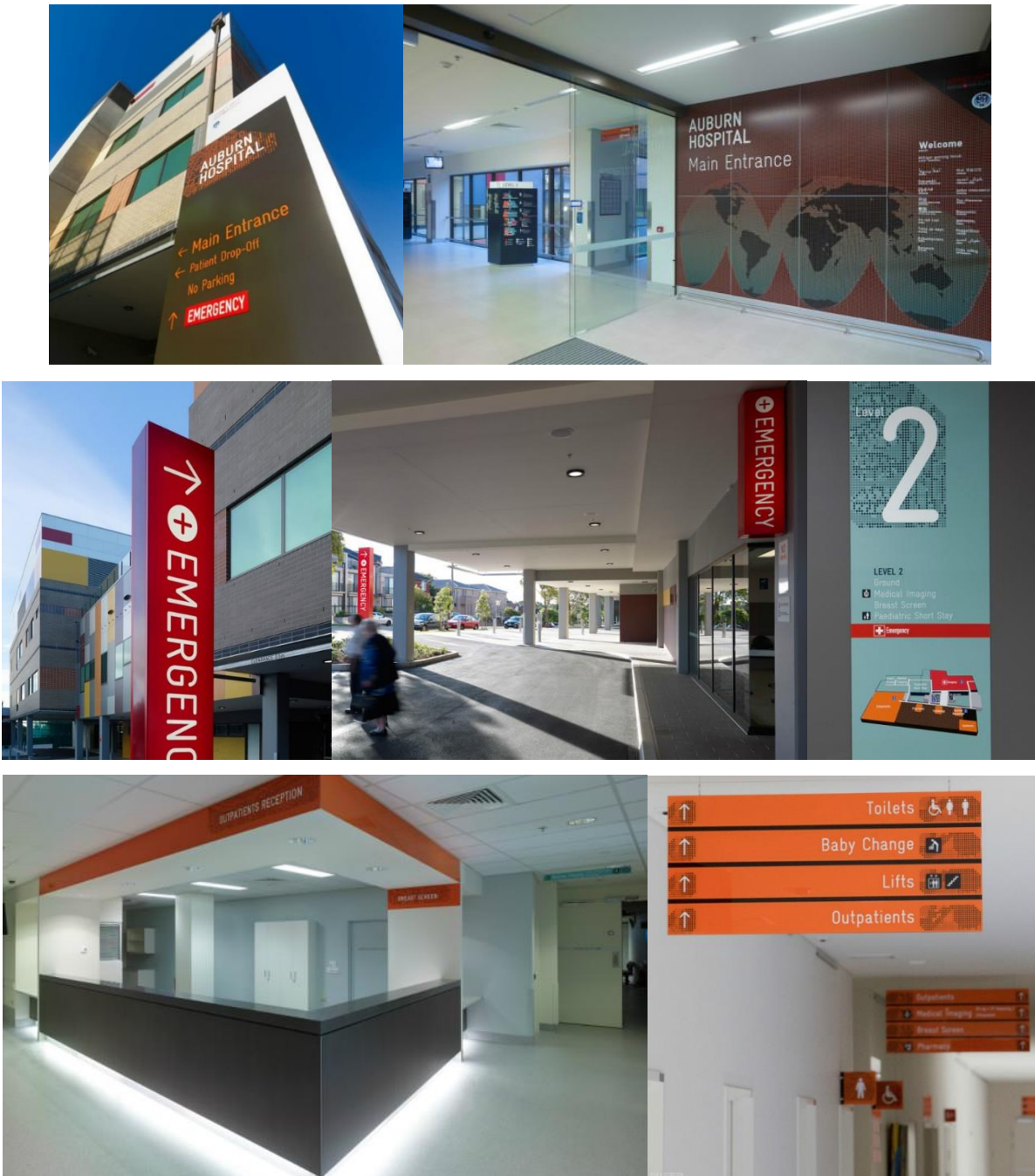


Figure 33 - Signage system applied at Auburn hospital, in Australia (from (North, 2011))

2.8. REFERENCE CASE: HOSPITAL PRIVADO DE VIANA DO CASTELO, PORTUGAL

During the research conducted in this project, looking to find a good example of a well-developed signage system in Portugal, we came across with the private hospital at Viana do Castelo, Portugal. After visiting this hospital, although it was not a public institution, it could be considered as a possible example to use as a reference case in this project. The entrance of the inpatient and permanent assistance services is adequately signaled with locational signs that make it easy for the users to notice and recognize the hospital (Figure 34 to Figure 36).



Figure 34 - The entrance of the inpatient and permanent assistance of Hospital Particular de Viana do Castelo (HPVC)



Figure 35 - Hospital designation through identification/locational signage visible from the outside



Figure 36 - Entrances indicating that permanent assistance is provided at this building

At the main hall of this building, the users can find a directory of all the medical specialties that the hospital provides, together with the names of the doctors for each specialty (Figure 37 to Figure 39). Together with these directories, there is an information desk that provides information and help to the users, and in which there is directional signage suspended from the ceiling indicating which direction the users should go to each of the services (Figure 40 to Figure 41).



Figure 37 - Directory of the provided medical services and respective available doctors



Figure 38 - Directory of medical services



Figure 39 - Detail of the directory of doctors available for each medical area provided



Figure 40 - Information desk available at the building entrance



Figure 41 - Directional signage suspended from the ceiling above the information desk

On the left side of the information desk, it is possible to access the elevators that will take the users to the upper or lower levels of the building. The elevators have a sign indicating the most important medical areas and the floor in which they are settled (Figure 42 and Figure 43). On the inside, a directory of the services by floor is presented to the users.



Figure 42 - Signage outside the elevators



Figure 43 - Directory of medical services and amenities functioning on each floor

At this floor, the users can have access to the Clinical analysis, Orthopedics, Permanent Assistance and Administrative services. All the area is covered with directional and locational signs that make use of symbols and contrasting colors, which follows the colors of the hospital logo, that help guide the users through the settings (Figure 44 to Figure 49).

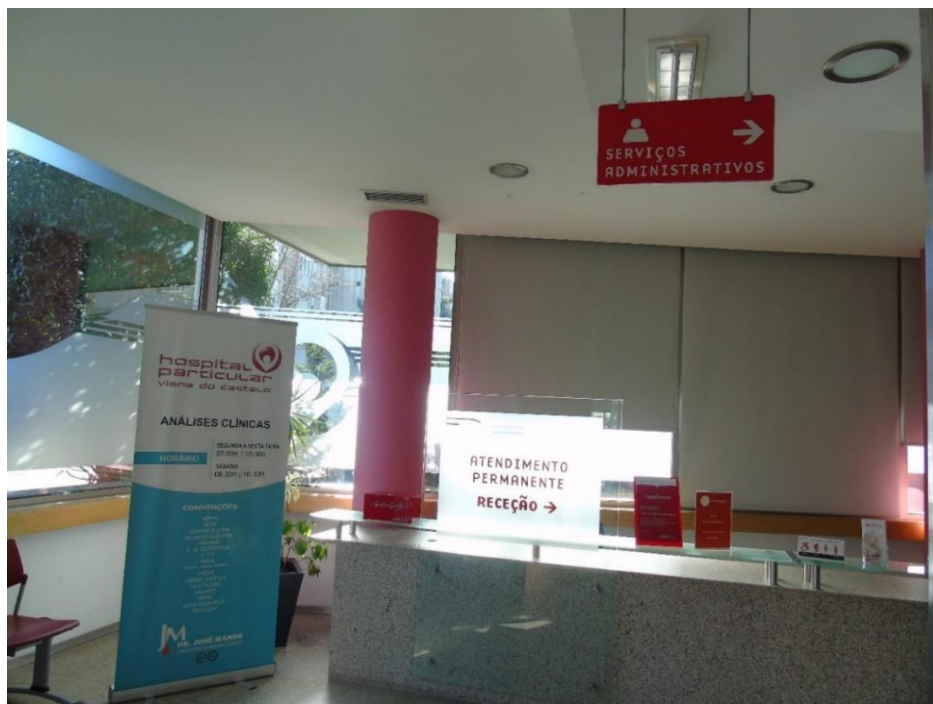


Figure 44 - The reception desk of the permanent assistance service



Figure 45 - Suspended directional signage indicating the permanent assistance, orthopedics and clinical analysis services



Figure 46 - Wall-mounted signage indicating the reception desk for permanent assistance and the administrative services



Figure 47 - Regulation signage indicating the elevator is exclusive for wheelchair and stretchers only



Figure 48 - Indications on the wall directing the users for the maxillo-facial exam



Figure 49 - Symbol used to indicate the orthopedic service

On the lower floor (floor -1), the users can find the medical areas of Gastroenterology, Cardiology and Pneumology. They are signaled through directional and identification signage with symbols associated with helping the users identify the medical services (Figure 50 to Figure 55). Although the graphical characteristics of the signs enhance the users' wayfinding, sometimes there are some inconsistencies in their placement that can harm their visibility and legibility, for example, reflections that lights cause on the signs and that end up harming their legibility, Figure 52.



Figure 50 - Detail of the directional signage with the symbols used for gastroenterology, cardiology and pneumology services



Figure 51 - Reception desk for gastroenterology service



Figure 52 - Directional signage indicating the cardiology and pneumonology services



Figure 53 - Symbol and textual information on door indicating the access is only allowed to the staff



Figure 54 - Locational/Identification signage indicating the toilet facilities for the users



Figure 55 - Directional signage indicating the directions to the exit

Floor -2, is the floor in which the Physiotherapy medical area is settled. In this area, further the directory that indicates the medical areas provided on that floor, identification/location signage is provided to identify the service, the medical offices and respective doctors available (Figure 56 to Figure 58).



Figure 56 - Directory of medical areas that are provided at the physiotherapy floor



Figure 57 - Entrance of the physiotherapy unit



Figure 58 - Locational/Identification signage indicating the medical office for physiatry

At the upper level, on the 2nd floor, the Woman and Child Clinic is established, and comprises the services of Pediatrics, Obstetrics and Gynecology, together with the inpatient area for these

services. At this floor, it is visible a change on the colors and signage used, and also in the decoration that was designed considering the children and women visiting those services (Figure 59 to Figure 63).



Figure 59 - Woman and Child Clinic with the Pediatrics, Obstetrics, and Gynecology services, together with an inpatient area



Figure 60 - Identification signage indicating a medical office for Pediatrics



Figure 61 - Identification signage indicating a medical office for Gynecology and Obstetrics



Figure 62 - Directional signage indicating the direction for the reception desk



Figure 63 - Directional signage indicating the toilet facilities and changing room for babies

On the 3rd floor of this building the users can find the inpatient area. Together with some regulatory signage, for example, indicating that in this area there should be silence, the identification of the rooms is made through numbers and pictures with the names of important Portuguese personalities. The use of such symbology was made for helping the users to reach the room of their relatives or friends more easily through the names of these important Portuguese personas (Figure 64 to Figure 68).



Figure 64 - Regulatory signage indicating that in that area the users should be silent



Figure 65 - Hospital designation and logo below the reception desk of the inpatient area

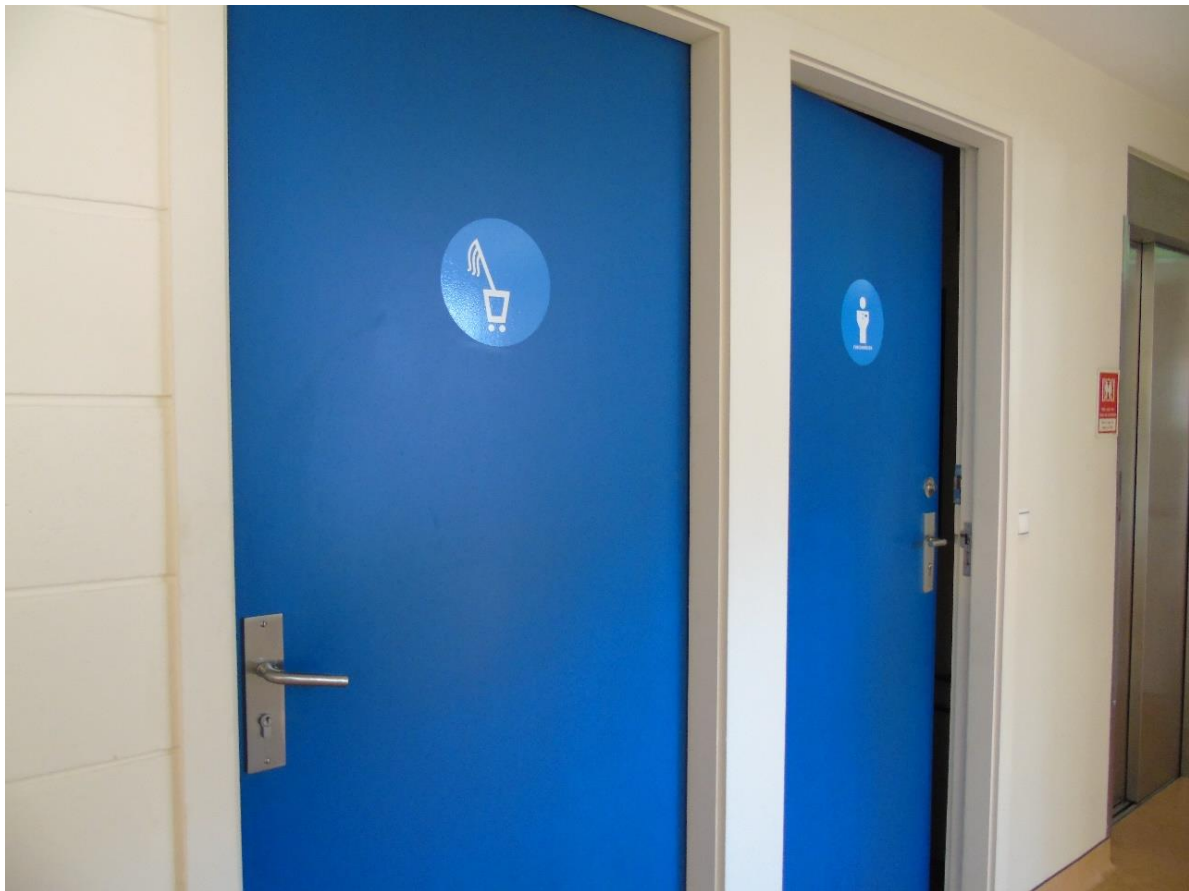


Figure 66 - Identification on the doors informing the users of amenities such as storage areas or toilet facilities



Figure 67 - Room identification through number 37 and the name of Garcia de Orta



Figure 68 - Rooms 32 and 33 identified with the names of Pedro Nunes and Abel Salazar personalities

On the other building where the outpatient area is settled, the signage follows the same design style as the signage of the first building. The red color is used to follow the institutional image of the hospital, and symbols together with text are used to help users' guidance.

The building is composed by two different floors. The entrance floor (floor 0) provides the reception desk for the check-in and check-outs for all the services, and it is where the outpatient services like Nursing, General surgery, Psychology, Neurology, Allergy, Pneumology and

Orthopedics are settled. The Stomatology Service, or Dentist, are settled on the first floor of the building (see Figure 69 to Figure 77).



Figure 69 - Directional signage indicating the entrance for the outpatient and external consultation building



Figure 70 - Information on the entrance doors indicating the external consultation building



Figure 71 - Reception desk at the entrance of the outpatient building



Figure 72 - Wall information available to the users, regarding the mission, vision, and values of the institution



Figure 73 - The Nursing room

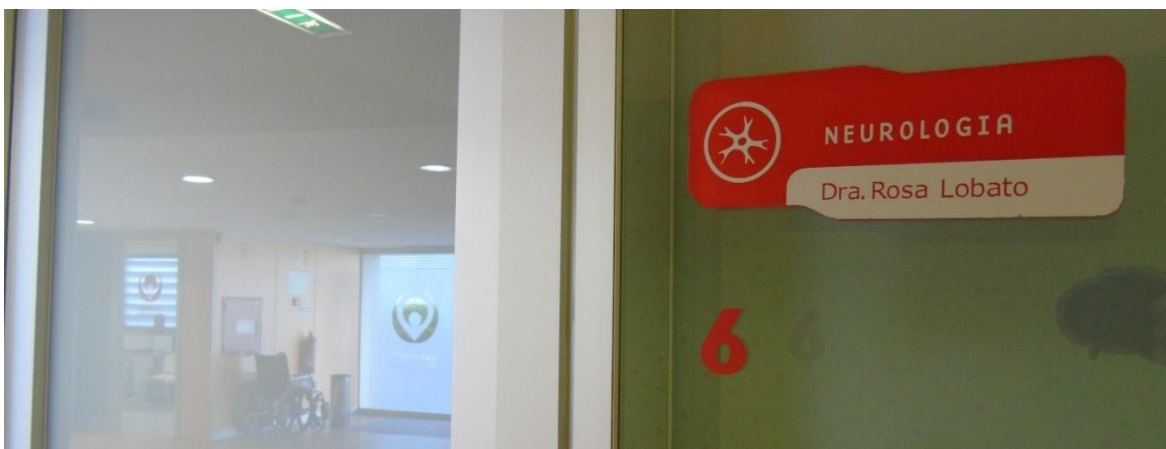
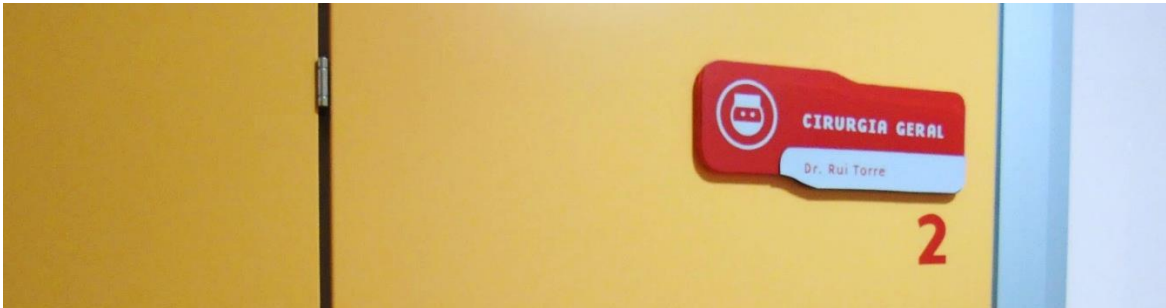


Figure 74 - Medical offices for General surgery, Psychology, and Neurology



Figure 75 - Entrance and reception desk of the Stomatology service on the 1st floor



Figure 76 - Medical offices of the Stomatology service



Figure 77 - Identification and directional signage indicating the toilet facilities and reception desk of the Stomatology service

2.8.1. INTERVIEW WITH THE DESIGNER OF THE SIGNAGE OF HOSPITAL PARTICULAR DE VIANA DO CASTELO

When this case study was selected as a reference case, the team considered that it would be extremely important to contact the designer or designers involved in the process development of the implemented signage. The interest was mainly in comprehending the reasons that led to this specific design, and also understand how some decisions were taken for some characteristics of this signage.

As there was no possibility to perform the interview face-to-face with the designer Hugo Amadeu Santos, a structured written interview was developed with a total of thirteen questions that could gather important information regarding the development of the implemented design. The questions (Qi) and answers (Ai) were:

Q1: What is your current occupation?

A1: “I am a freelancer in the area of Communication and Web Designer, and also an Illustrator and a Programmer.”

Q2: In which way were you involved in the design of the signage system available at HPVC?

A2: “My work was to develop all the visual system of the hospital, as well as the development of all the images/sketches allocated in all the windows, including at the entrance, the coffee and the canteen. The only graphical reference existing at the time was the logo/brand of the institution that was previously developed.”

Q3: How did you came up with the design of the symbols/icons of the services, WC, and other commodities identified on the signs?

A3: “It was a wonderful challenge. I have always felt attracted to pictograms. Although it was not a requirement of this job, I felt that it was important to incorporate them on the signage. At the time, my visual experience in a hospital environment was not memorable at all. In the majority of the cases, the environment was not welcoming and the signage available only complied with an objective function; in most of the cases the only pictograms available were for the WC. For me, it was important to break the usual trends. The “negative”, i.e. the use of the red background instead of white, was one of those ideas, the rounded corners of the plaques was another one.

In fact, the biggest challenge was the development of all the iconography of the medical specialties. Being the range of options so varied, like Orthopedics, Psychology, etc., I assumed at first that I was not going to create a fixed grid of design: the type from Otl Aicher, Munich 72; rather, I would search in each of the medical specialties, the easiest shape to be understood. Thereby, in some cases, I explored a realistic simplification, like, for example, as to Pneumology, on others, I would use a symbolic simplification, like happened with Cardiology.

There were two principles guiding/gravitating constantly: Humor and Sobriety. On one hand, the Humor in the sense of making the reading more pleasant, cozy, and on the other, the Sobriety in the sense of making the reading fast and simple.”

Q4: The created symbols/pictograms were design form the stretch or their design was inspired in pre-existing references?

A4: “The Human design used as the basis, was developed by me and inspired in a design that I had done many years ago. I created the first line of key elements: Man and Woman, and then I defined the type of language that I wanted to use: rounded corners, stain or silhouette. I established the lines thickness when there were lines, and from that point, I adapted the language to the concepts being described.

From the formal point of view, the medical specialties, as I have already referred, were the ones with which I dealt with more difficulties in finding other references, and although they were all created by me, they were inspired in known representations, for example: Orthopedics – skeleton simplification and Surgery – Lego.

Hence, I would not say that the developed symbols are brand new...At most, in some cases, maybe it was the first time they were used in a hospital context, but I do not have that pretension.”

Q5: If they were based in some references, which were?

A5: “Not being properly “based”, it can be said that there was “inspiration” from several languages, as logotypes, illustrations, and comics. Although I had not adopted a well defined grid as in the works of Otl Aicher for the Olympic Games of 1972 in Munich, this was a work that inspired me, without a doubt, particularly the idea of “family” through the use of rounded corners.”

Q6: Were regulations, legislations, or guidelines, followed for the development of the signage?

A6: There were no presentation of regulations, legislations, or guidelines by the client. Somehow, it was pretty much a work of intuition, reflection, and discussion.

Q7: How long did it take the process of planning and design of the signage?

A7: “Honestly, I am not sure, but I suppose 3 to 4 months would be a good estimation.”

Q8: Was there a period of test of the new signage that contributed to the improvement of redesign of the signs developed?

A8: “From what I am aware, no.”

Q9: Were the opinions and perceptions of the users consulted or collected throughout the design process?

A9: “From what I am aware, no.”

Q10: How was the planning of the number of signs, the typology of signs needed, and its location made?

A10: “The architectural plant of the hospital was presented, the several floors and areas were defined, like outpatient area and inpatient area. From that point, it was debated where the information was needed and how it would be displayed: on the wall, suspended from the ceilings, etc.. In the case of

the floor's indication on the stairs, a graphism was conceived in a matrix that was "filled" as the stairs went up."

Q11: The colors selected and implemented on the signs followed some regulations or guidelines, or it was selected specifically for this case? Was it intended to match in any way the corporate identity (logo) of the institution?

A11: "The colors selected were based on the logo. I think that initially the logo was green. I do not know if it was me that choose the red version, but it was this color that served as the basis."

Q12: Why was the red selected as the background color?

A12: "Red is without a doubt a polemic color. I know that, at the time, they were not all completely convinced about the red, and I do not know if I can say that it was a good solution. Personally, and professionally, I like it a lot. I think you got a slightly different environment, but the intended Sobriety remained."

Q13: Please, use this question to add some opinion that does not appear in the previous questions.

A13: "It was a unique opportunity and I want to believe that I did a good job. After all these years, I see a lot of what I think could be improved."

2.9. SUMMARY

Throughout this chapter, important information was presented regarding areas that are intrinsically connected with the design of signage systems and that should be included and considered in the overall process of the signage development and implementation. Each area is presented through the definition of its purpose and aim, together with the presentation of examples of how those areas are implemented on signage design for healthcare.

Each of the areas presented – graphic and communication design, interaction design, information design, inclusive design, wayfinding, user experience, provides important considerations and acquirements that, if well applied, can lead to better signage systems and consequently, to better wayfinding experiences for the users. In services like healthcare, the right combination of such areas is even more important as it can help ameliorate the users' experience of the settings, and consequently, as already proved by the literature, improve the users' health outcomes.

This chapter continued by presenting some of the existing regulations and best-practice guidelines that are currently available and that should be consulted when developing a new signage system or when renewing an existing one. Although the regulations and guidelines presented are helpful and should be part of the signage system design, it is obvious that they are lacking of the users' perceptions and opinions on the subject. There is a need for a deeper study of the users' needs regarding such systems, and furthermore, the need of developing guidelines that are based on that data.

Some examples of well-developed signage systems in foreign institutions were presented, followed by a selected reference case in Portugal: Hospital Particular de Viana do Castelo (HPVC). The photographic records of the signage system of HPVC provide an overview of what is considered in this project, and according to the literature analyzed, as a good example of a well designed signage system; mainly, due to the fact that it answers most of the guidelines collected throughout this study and in which the resultant guidelines were based.

The chapter concludes with the interview conducted to the designer that conceived the signage system of HPVC. In this interview, the designer explains how the design of the all signage system was conceived, and which were the basis for this specific design. Through the interview, the designer shares some important aspects of the design conception phase, and he revealed that there were no legal regulations followed throughout the process. Although this is just one reference case, this leads one to believe that most of the designs conceived for signage systems in healthcare do not consider the existing regulations or guidelines on the subject, and are merely developed based on the common sense of the developers.

CHAPTER 3 • RESEARCH METHODS

Throughout this chapter, the methodological procedures used to reach the proposed objectives of this project are presented, together with the description of the institutions analyzed during the same period. The use of such methods was selected to guarantee the possibility to replicate the study conducted in the future.

In the beginning of this chapter, the institutions that were used as case studies for this project are presented; hence, some historical data is provided together with the definition of the population that uses annually the services of each hospital. The availability of such data allows to settle the dimension of each hospital and the typology of the users of each of the settings.

Later in the chapter, the method used to analyze the samples is presented, together with the data used in this analysis. This chapter ends with the explanation and justification of the quantitative and qualitative methods that were applied throughout the study, and from which important data was extracted for the resulting guidelines.

3.1. SELECTED CASE STUDIES

The main objective of this project, as it was mentioned before, was the creation of a set of guidelines for the development of new healthcare signage systems or for redesigning outdated ones, and to do that, partnerships were established with four different healthcare institutions in Portugal. The intention was to conduct the study in each of the four selected institutions, to gather information addressing the users' perceptions and experiences resulting from the usage of the available signage and to identify problems that currently exist on those systems.

The four selected institutions were:

- Hospital A – Santa Luzia, Viana do Castelo (Northern Portugal), from Unidade Local de Saúde do Alto Minho (ULSAM).
- Hospital B – Santo António, Porto (Northern Portugal), from Centro Hospitalar do Porto (CHPorto).
- Hospital C – Infante D. Pedro, Aveiro (Center of Portugal), from Centro Hospitalar do Baixo Vouga (CHPV).
- Hospital D – São João, Porto (Northern Portugal), from Centro Hospitalar do Porto (CHPorto).

These four healthcare facilities are established in different demographic areas of Portugal, and the reason that led to these choices was due to the importance to include different participants from various cultural backgrounds, with distinct characteristics, such as age ranges and educational levels.

This allowed to explore whether the needs of the users of such institutions varied according to the different characteristics of the respondents themselves and if those needs influenced their behaviors when using the available signage. The next section presents the characteristics of the four selected institutions concerning their history and the population they serve.

3.1.1. HOSPITAL A - SANTA LUZIA (VIANA DO CASTELO)



Figure 78 - Entrance of hospital A - Santa Luzia, Viana do Castelo

This hospital is established at the city center of Viana do Castelo and it is the public general hospital that provides healthcare services to the population of the north of Portugal and the sub-regions of Alto Minho (Figure 78). The building started to be constructed in 1976 and its construction only ended in 1984.

The architecture of this building is constituted by volumes of parallelepiped configuration disposed parallel and perpendicular to each other according to their functions. The access to the building is made through the main hall in which services like the outpatient area, radiology department, labs, pharmacy, and administrative and technical services are established. The inpatient area is established on the upper levels of the building and distributed through the six floors available. This hospital, according to the financial report of 2015 that was provided by the hospital administration, provided only in this year a number of 229,886 medical consultations.

3.1.2. HOSPITAL B - SANTO ANTÓNIO (PORTO)



Figure 79 - Main entrance of hospital B - Santo António, in Porto

This hospital was known in the old days as hospital Real de Santo António (Figure 79), and it is located in the center of Porto city. Further its main purpose of healthcare service providing, this hospital is also used for academic purposes since it is responsible for the teaching of the Integrated master's degree in medicine from Instituto de Ciências Biomédicas Abel Salazar (ICBAS), University of Porto.

Although it is already an old building with a lot of architectural and historical value, it is one of the most modern and well equipped public hospitals of Portugal and one of the references in the provision of healthcare services for the population in the north of Portugal. Regarding its architectural and historical characteristics, the building was projected by the English architect John Carr, however, at first, it was not constructed along with its initial project due to financial constraints. Its construction only started in April of 1769 and the hospital only started to receive its patients in August of 1799. In 1825, the Medicine school started to work in the same building and till that time the hospital was managed by Santa Casa da Misericórdia do Porto - an institution that provides social support to the community. In 1975, the government started to manage the hospital turning it into a general public hospital.

As other hospitals in Porto, hospital de Santo António accommodates a lot of different services and a huge number of patients. According to their financial report, which was provided by the institution, from 2004, in that year the total amount of outpatient services provided was of 341,600 medical consultations with a trend to increase from year to year.

3.1.3. HOSPITAL C - INFANTE D. PEDRO (AVEIRO)



Figure 80 - Main entrance of hospital C - Infante D. Pedro, in Aveiro

The construction of the hospital was concluded in 1915, although the hospital was already receiving patients since 1914. With the beginning of its activity, it was obvious that the initial facilities were not enough to answer all the healthcare needs of the city with a population continuously growing. From 1957 to 1989, in order to overcome this problem, rearrangements and expansions to the initial facilities were made and the full initial capacity of 300 beds was increased to a total capacity of 417 beds.

In 2002, the hospital known till then as “hospital distrital”, changed its designation to hospital Infante D. Pedro (Figure 80), and it was integrated in a grid of healthcare services provision of the National Service Healthcare. This hospital is, in nowadays complementing the district hospitals of Estarreja and Águeda.

In what regards the population seeking for healthcare in this hospital, according to the financial report of 2005, the number of outpatient services provided was of 113,670 medical consultations.

3.1.4. HOSPITAL D - SÃO JOÃO (PORTO)



Figure 81 - Main entrance hospital D - São João, in Porto

This hospital is located in the periphery of Porto city and provides direct assistance to many parishes and municipalities of the city (Figure 81). It is also a reference institution for some medical cases coming from districts like Braga and Viana do Castelo which are cities located further in the north of Portugal.

The hospital was completed in 1943 and at that time it was designated as hospital de Ensino do Porto, connected with the Medical school of the University of Porto. However, this project suffered a delay due to repercussions of the 2nd World War, and the inauguration of the hospital only happened in 1959. This hospital continues to operate in the same building after fifty-seven years although the building has already suffered expansions and rearrangements.

Given the hospital dimension and the diversity of healthcare services provided, it provides primary care for a lot of people living near the city. According to their financial report from 2014, the outpatient area recorded a total of 765,471 medical consultations.

3.2. SAMPLING METHODS

3.2.1. TARGET GROUPS

The participants selected for the study were patients, staff and visitors of the chosen healthcare institutions. The main focus of this selection was the exploration of different needs that these groups have, resulting in different wayfinding and navigational behaviors.

Regarding the patients, there were two types of patients to consider, the ones who have already visited the hospital before and so they are familiar with the settings, and the ones who are visiting the settings for the first time and so they are unfamiliar with the buildings' composition. Obviously, the needs of these two types of patients will be different since one of them will need less help from the staff and from the wayfinding elements available.

The visitors are those users who come to a specific hospital to visit someone in the inpatient area, including family, friends, or others, to provide help or companion to a patient, or even to ask for information without using the medical services of the hospital. They have also already visited the setting or not, and so, as they are familiar or unfamiliar with the facilities they will experience different difficulties. Also, their levels of stress will be different from the patients who have the additional problem of their health condition.

The staff are the workers available throughout the settings, which can be volunteers, cleaning staff, doctors, administrative staff or others. All of them can circulate inside the buildings and they will have to make use of their navigational capabilities with the wayfinding elements available. Their past working time in that hospital can aid or harm their navigation inside the setting since they will be more or less familiar with some parts of the facilities, which can create difficulties for them in circulating inside the buildings. This familiarity will also be important when the patients ask for their help to get directions to go to a specific place of the hospital.

In this study, the focus was on the volunteers available in the institutions, since they are the ones who are accessible to provide help to the patients and other users circulating the facilities, and so they are the ones who have more knowledge about the difficulties experienced by the users.

However, we also included opinions of other staff members, that were interested on the research being developed. Summing up, the participants selected for this research were patients, visitors, people providing help or companion to patients, and members of the staff more specifically volunteers.

3.2.2. SAMPLE SIZE AND ETHICAL APPROVALS

For each of the institutions, two areas were considered for the analysis: the outpatient area and the visitor's atrium. To perform the analysis in each of these areas, approvals from the Administration and Ethical Commission of each of the facilities had to be required as there were ethical concerns to the institutions that needed to be guaranteed.

In order to apply the questionnaires in the outpatient area it was important to calculate the sample size needed for the data collection to be accurate. The sample size was defined based on the number of annual consultations of each hospital, provided by the administrations and computed with the help of an automatic calculator of samples (netquest, 2018).

In Table 1, it is possible to see the resulting samples needed for each institution.

Table 1 - Elements used for calculating the samples of questionnaires applied in each selected hospital

Hospital Name	Population	Sampling Error	Trust Level	Sample
Hospital A – Santa Luzia, Viana do Castelo	229,886	5%	95%	384 surveys
Hospital B – Santo António, Porto	667,750	5%	95%	384 surveys
Hospital C – Infante D. Pedro, Aveiro	113,670	5%	95%	383 surveys
Hospital D – São João, Porto	765,471	5%	95%	384 surveys

In all four institutions, the required documentation was submitted to ask for permission to perform the study and authorization was given by all the Ethical Commissions of the institutions.

The study was conducted through the following periods of time:

- Hospital A | Santa Luzia, Viana do Castelo – from May to July of 2016;
- Hospital B | Santo António, Porto – from October to December of 2016;
- Hospital C | Infante D. Pedro, Aveiro – from January to March of 2017;
- Hospital D | de São João, Porto – from April to June of 2017.

For ethical purposes, all the participants were given a description of the research and data collection method to apply, together with an informed consent that should be signed by them if they wished to participate in the research. All personal data provided by the participants was kept and will be kept anonymous and confidential as asked by the four institutions Ethical Committees.

3.3. DATA COLLECTION METHODS

In this research project, a mix between quantitative and qualitative methods was used, since the intention was to collect specific quantitative data in what concerns the perceptions and evaluations of the users regarding the signage available, and qualitative data as to behaviors and opinions of the users regarding their interaction with signage and their difficulties in using it.

3.3.1. QUANTITATIVE METHOD

The quantitative method used was questionnaires. The questionnaires contained a total of seventeen questions, divided in four sections: Demographic characteristics, Signage system evaluation, Satisfaction with current signage, and Respondents' suggestions for signage improvement.

They were built through literature on the topic and other similar works (Foddy, 1994; Malta, 2013). The main reason for using questionnaires had to do with specific evaluations to collect from the users, and with ethical concerns and limitations imposed by the institutions, that were possible to overcome with anonymous and confidential questionnaires.

To validate the questions and ensure that the questionnaires were properly understood in all the settings selected, a pre-test was made with twenty-five users aleatory selected from hospital A. The results allowed the refinement and rearrangement of the final questionnaire applied in all the hospitals.

At hospital D - São João (Porto), the questionnaires applied were different. The hospital administration together with the office for the design and maintenance of the hospital, at that time, had implemented a new signage system with a new design in the outpatient area. In this hospital, the research attempted to collect the users' perceptions and opinions regarding the new signage implemented, comparing to the old versions of signs. The aim was to understand if the new signage was better than the old one, and if so, to capture the best practices that were used and that led to the good results achieved.

3.3.2. QUALITATIVE METHODS

The qualitative methods applied in this project were: Direct observations (non-participant), Written interviews, and Photographic records.

The Direct observations were made to the users of the settings, i.e. patients, visitors and staff, and the aim was to capture their behaviors when interacting with the signage available in order to

understand the experienced difficulties and the features that contributed to a good or bad experience of navigation inside the settings. These observations were made without the active participation of the investigator, and without any interference from him. To maintain the anonymity and confidentiality of the users observed, no video records were used, and the observations were recorded on paper by the main investigator *in situ*.

In the beginning, the intention was to personally interview the staff in a face-to-face interview. However, due to the limited time and availability of the staff and volunteers, a written interview was created that was delivered on paper to the staff. Most of the staff members that answered the interview were volunteers, as they were the ones who spent most time directing the users and they had a bigger notion of the difficulties they experience in the settings.

One of the expected findings of this project was to see if there were similarities between institutions regarding existent problems with the signage systems. In order to perform that analysis, a photographic record of the signage was performed in the areas where the study was conducted. With these photographic records, which were also based in opinions given by the users circulating inside the settings, it was possible to create a comparison grid between the hospitals analyzed and identify the similarities or differences in the signage systems.

At hospital D - São João (Porto), the same methods were applied. However, the aim was to explore the efficiency of the new signage implemented at the outpatient area, compared to the old version of signage that continues available in other areas that were not yet redesigned. In the comparison grid of the photographic records, this hospital was not included in the analysis.

3.4. SUMMARY

This chapter presented the selected hospitals in which the study was conducted, together with the calculation of the sample to use and the methods to apply to gather the intended data.

Four institutions were selected to apply the research methods: hospital A – Santa Luzia, in Viana do Castelo; hospital B – Santo António, Porto; hospital C – Infante D. Pedro, in Aveiro; and hospital D – São João, Porto. Two of these hospitals are settled in one of the biggest cities of Portugal – Porto – and so, they can offer a mix of population that was interesting to explore and to compare with the populations from hospitals A and C, which are smaller and globally much older.

The studied samples comprise patients and visitors that were using the facilities for the first time or not, and members of the staff, more precisely volunteers. The size of each sample was

calculated based on the annual number of outpatient consultations, and a total of 384 questionnaires was reached.

At the end of the chapter, the research methods that were used in this study were presented. The use of questionnaires, direct observations, written interviews, and comparison grids of photographic records allowed to verify, as is presented in Chapter 4, the similarities or disparities between the existing signage. According to the limitations imposed by the ethical commissions of the studied institutions, the use of these methods seemed to be the most adequate and the ones through which it was possible to gather the intended data for this project.

CHAPTER 4 • USERS' OPINIONS: RESULTS AND DISCUSSION

This chapter presents the data obtained from the quantitative and qualitative research methods applied on each of the four case studies in this project.

First, the results from the questionnaires applied in all four case studies are presented. This starts by providing general demographic data, then it is presented the respondents' evaluations of specific characteristics of the current signage in each institution, and it is provided the data related to the satisfaction of the users with the current signage. Then, an analysis of the influence that gender, age and educational level, had on the respondents' answers is provided. Finally, the findings and discussions of the gathered results are pointed out, followed by a subsection in which the suggestions for improvements given by the users are indicated.

After the questionnaires, the results and findings obtained from the direct observations conducted in the outpatient and visitors' areas are presented. This is followed by the interviews conducted with volunteers of the institutions, with the resultant opinions presented as well as an analysis about its similarities with the results obtained from the questionnaires.

The chapter ends by presenting a comparison grid concerning the studied hospitals. The criteria of comparison used to build this grid were based on already existing guidelines and best-practices. This grid allows to identify similarities or differences among the signage systems of the four studied institutions¹.

4.1. QUESTIONNAIRES – HOSPITALS A, B AND C

This subsection sets out the results of the questionnaires applied in hospital A (Santa Luzia, Viana do Castelo), B (Santo António, Porto) and C (Infante D. Pedro, Aveiro), initially assessing the descriptive data of the respondents to establish the control variables and the characteristics of the participants. This is followed by three subsections, which are: (i) Signage System Evaluation, (ii) Satisfaction with Current Signage, and (iii) Respondents' Suggestions for improvements. Finally, a critical discussion of the results and its implications is presented to ascertain whether the data can contribute or not for the expected result of this project.

The statistical analysis of the questionnaires was made through IBM SPSS Statistics 24 software, and further the descriptive analysis, statistical post-hoc tests such as Chi-square, Mann-

¹ The data collected from all the hospitals can be accessed through the following link: https://drive.google.com/drive/folders/1kPaFA_1ymJ7BX81ioBHdesesVMFGa135

Whitney U and Kruskal-Wallis, were applied depending on the nature of the dependent variable ($p < 0.05$ considered for statistical significance). The intention was to check the existence of relations between the variables of gender, age, and level of education with the question made, and to verify if there were differences on the way signage is evaluated from hospital to hospital.

In the case of hospital D (São João, Porto), the questionnaire was different since it was an institution in which improvements were already made to the signage system and so, the intention was to see if the users' evaluations of the new signage, when comparing to the previous signage were better (Rodrigues, Tavares, and Coelho (2017) and Rodrigues, Tavares, and Coelho (2016)). This case will be presented separately from the analysis of hospitals A, B and C.

4.1.1. DESCRIPTIVE STATISTICS

Although the calculated sample size of the questionnaires to be used in each hospital was 384, the total number of the implemented questionnaires was bigger in order to compensate the questionnaires that could be improperly filled by the users. In **hospital A (Santa Luzia, Viana do Castelo)** a total of 544 questionnaires were filled from which **510** were used in the study, in **hospital B (Santo António, Porto)** from the 405 applied, **386** were used, in **hospital C (Infante D. Pedro, Aveiro)** a total of 410 questionnaires were filled and **391** were used, and finally, in **hospital D (São João, Porto)** a total of 405 questionnaires were applied from which **386** were used.

The respondents involved were selected aleatorily, which means that every person using the outpatient area could be selected for filling the questionnaire. Below, the demographic characteristics are presented together with other variables that set the respondents profile.

Gender: Although ideally the research should have inquired a 50/50 split of males and females to ensure the consistency of the data collected, this was not possible due to the uneven gender distribution of the hospitals and to limitations of time. Accordingly, the research population of hospitals A (Standard Deviation = 0.448), B (SD = 0.479), and C (SD = 0.457) was mainly constituted by females, Figure 82.

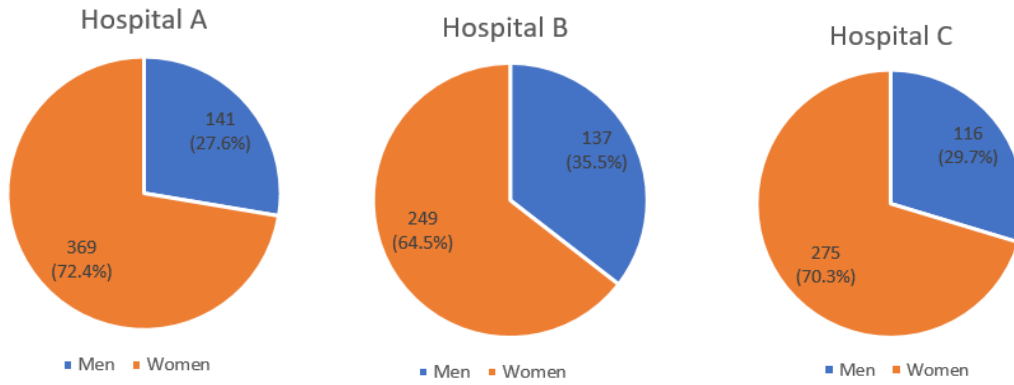


Figure 82 - Gender characteristic of the samples from hospitals A, B, and C

Age: The initial belief was that hospital B – Santo António (Porto) would have more diversity in terms of the respondents’ age, and hospital A – Santa Luzia (Viana do Castelo) and C – Infante D. Pedro (Aveiro) would present a more elderly population due to being established in smaller towns than hospital B. However, it can be observed in Figure 83, that age does not vary so much from hospital to hospital. The average ages are 39 years-old in hospital A (SD = 1.265), 40 years-old in hospital B (SD = 1.339), and 37 years-old in hospital C (SD = 1.147), which means that age varies from 37 to 40 years old in the analyzed hospitals.

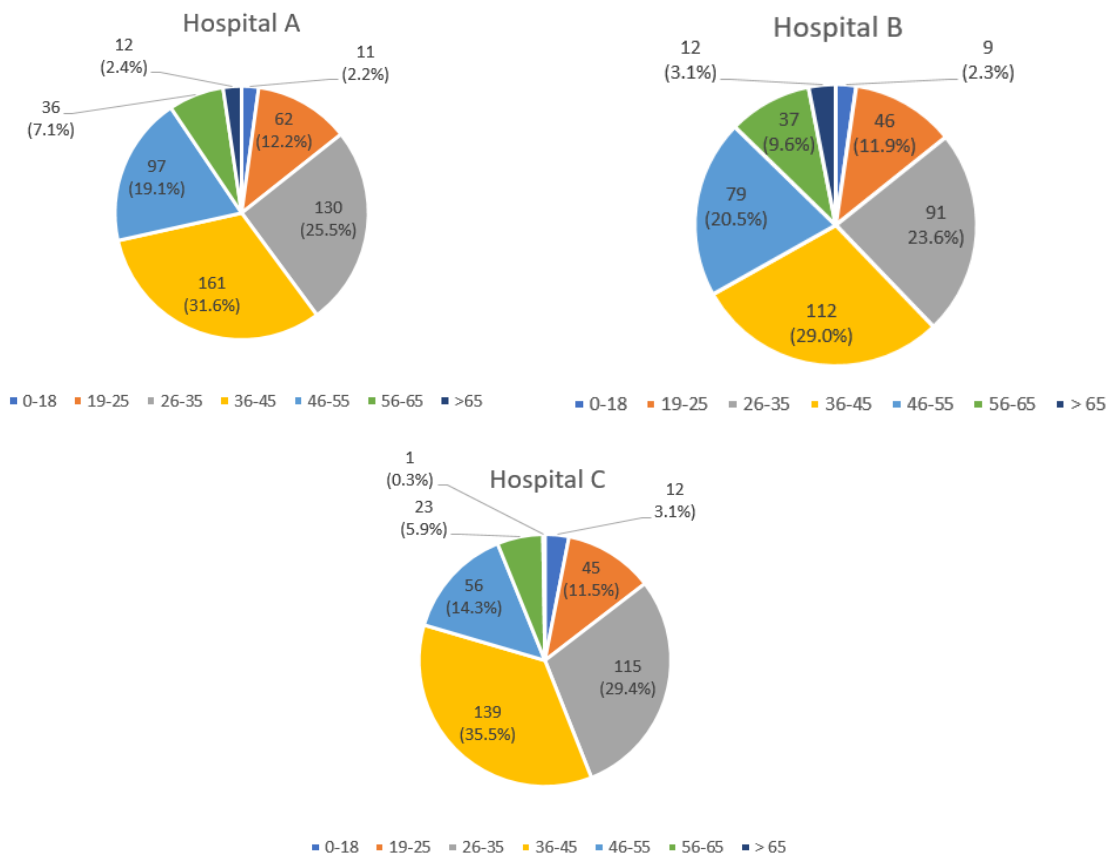


Figure 83 - Age characteristic of the samples from hospitals A, B, and C

Educational Level: In Figure 84, the educational levels of the respondents are presented. In all hospitals, there was a higher number of users with secondary school or bachelor’s degree or higher, and no relevant differences between the respondents' educational levels were found (SD hospital A = 1.058, SD hospital B = 1.139, SD hospital C = 1.123).

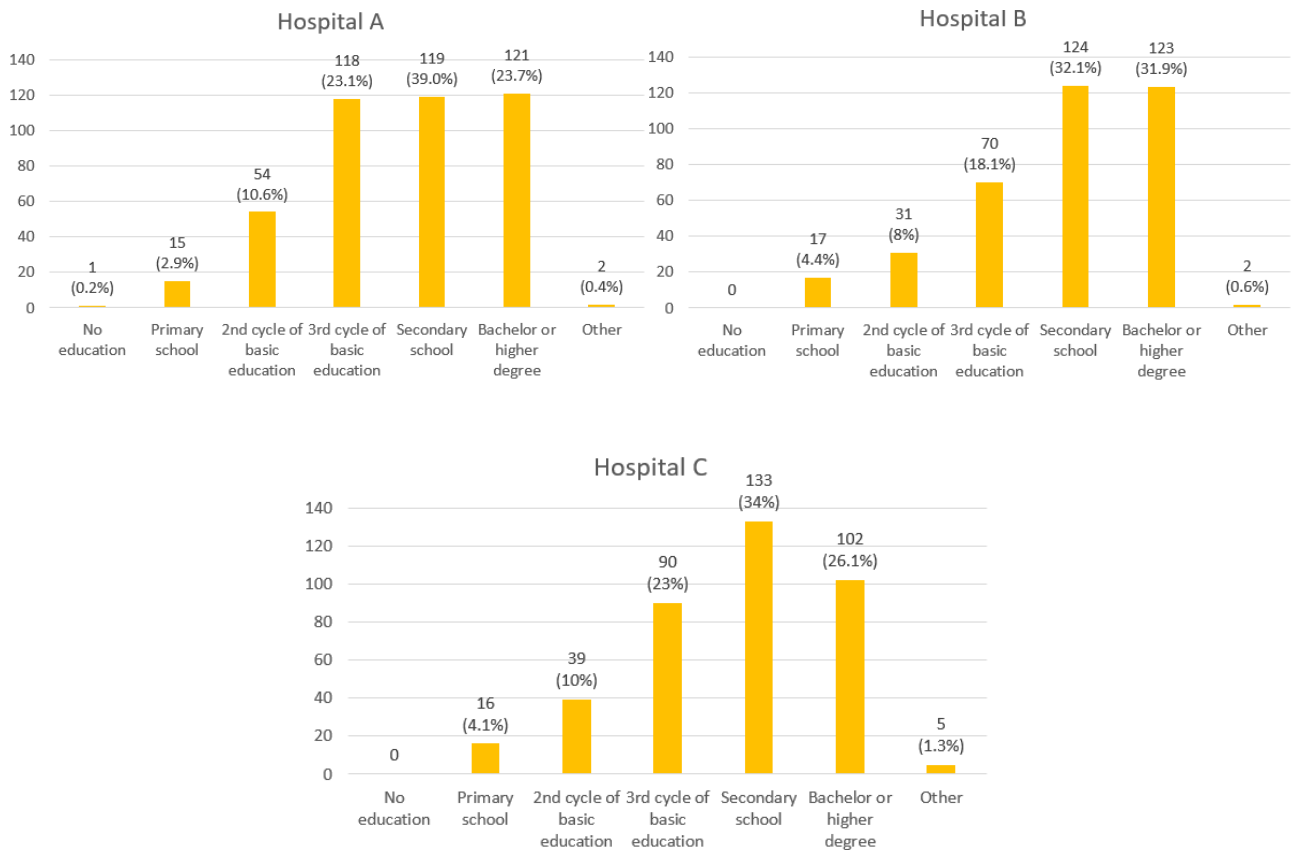


Figure 84 - Educational characteristic of the samples from hospitals A, B, and C

Number of previous visits and visual disabilities: In all hospitals, there were only a few respondents who were visiting them for the first time, while the majority had already used the facilities and declared to not suffer from any visual disabilities (Figure 85 and Figure 86, respectively).

Question: Is it the first time you visit this hospital?

(SD hospital A = 0.116, SD hospital B = 0.218, SD hospital C = 0.150)

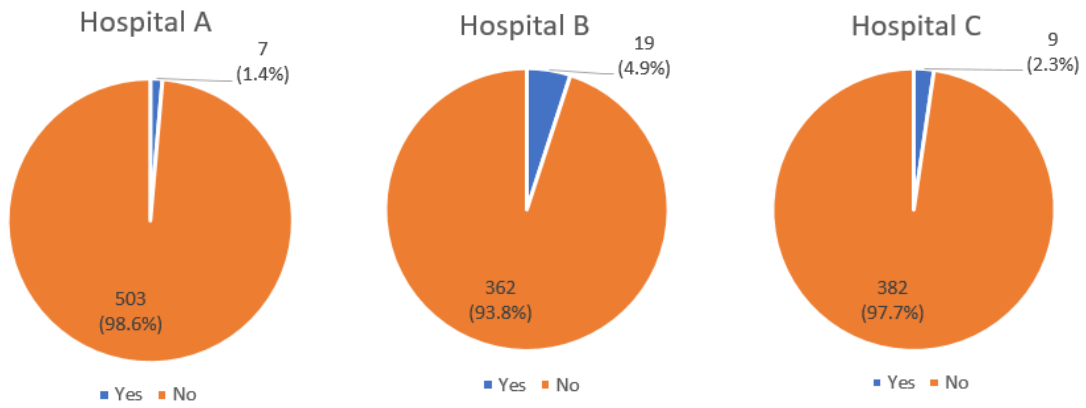


Figure 85 - Number of previous visits of the samples from hospitals A, B, and C

Question: Do you suffer from any kind of visual disabilities?

(SD hospital A = 0.220, SD hospital B = 0.282, SD hospital C = 0.236)

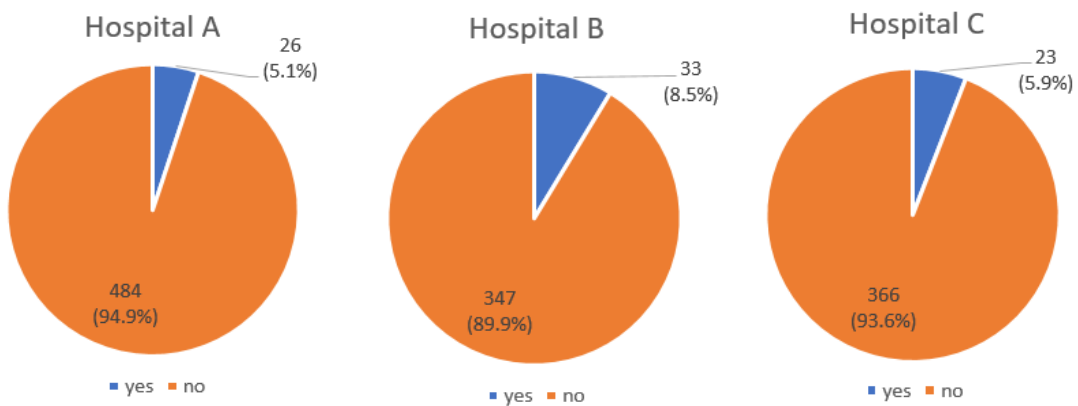


Figure 86 - Visual disabilities of the samples from hospitals A, B, and C

Reasons for visiting the hospital: In the three hospitals A, B and C (Figure 87) the respondents declare to visit the hospital mainly for medical consultations, medical emergencies and for visiting a patient, family member or friend. In hospital C, in Aveiro, a considerable number of respondents also mentioned that they use the hospital for providing help and companionship to patients (SD hospital A = 1.318, SD hospital B = 1.248, SD hospital C = 1.853).

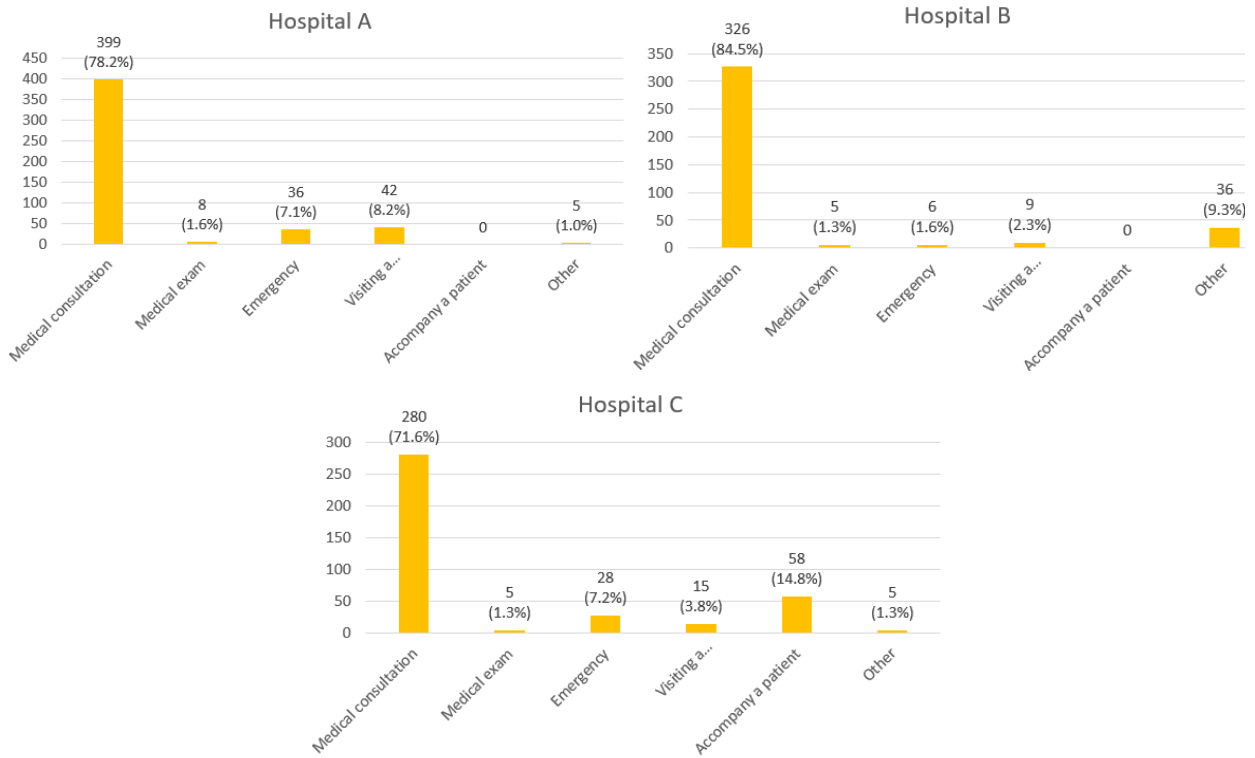


Figure 87 - Reasons of visit to that hospital by the samples from hospitals A, B, and C

4.1.2. SIGNAGE SYSTEM EVALUATION

The first question searched for the users' perceptions about the signage identifying the entrances of the hospitals, and the intention was to see if the users thought the entrances were adequately signaled or not. The majority of the users said that the entrances were well-signalized (Figure 88).

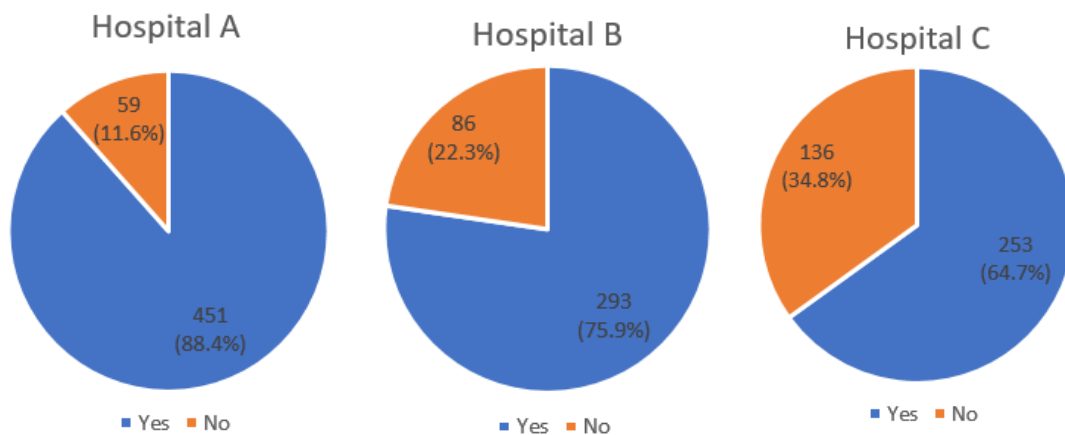


Figure 88 - Answers of the samples from hospitals A, B, and C to the question: "Do you think the entrances are well-signalized?"

No relations were found between age, gender and educational level for hospital A (SD = 0.320). In hospital B (SD = 0.419), statistical relationships for age and educational level were found. In what concerns age, the chi-square test resulted in a $p = 0.021$, and strong relations were found between the group from 19 to 25 years old with the perception that the entrances are not well signalized, whereas the group from 46 to 55 years old, mainly found the entrances well signalized. Regarding the educational level (chi-square test, $p = 0.005$), respondents with the 3rd cycle of basic education had strong perception of the entrances being well signalized, while people with bachelor’s degree or higher seemed to see the signage of the entrances as less adequate. In hospital C (SD = 0.477), the educational level influenced the answer to whether the entrances were well-signalized or not (chi-square test, $p = 0.022$), as the group with “bachelor’s degree or higher” reveals a strong relationship with the perception of the entrances being poorly signalized.

In the second question, the clear majority of respondents declared to have not experienced any delays due to being lost inside the facilities (Figure 89).

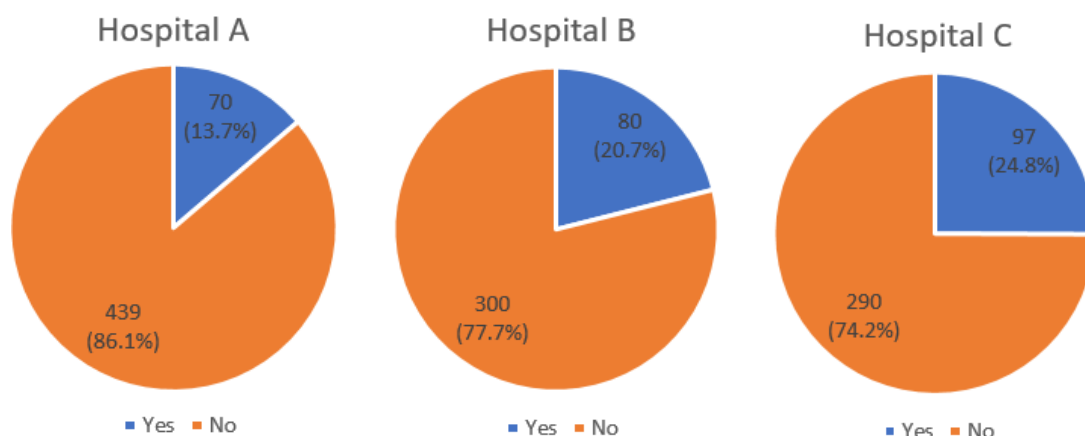


Figure 89 - Answers of the samples from hospitals A, B, and C to the question: "Have you ever been late for some consultation or medical exam because you could not find the intended destination?"

No relations were found between age, gender and educational level for hospital A (SD = 0.345). For hospital B, relationships were found with age, and in hospital C, relationships were found with the educational level.

In hospital B (SD = 0.408), people between 19 and 35 years old had the strongest relation with the experience of wayfinding difficulties that made them arrive late to the destinations, while the group from 36 to 45 years were the ones who felt less these difficulties (chi-square test, $p = 0.041$).

In hospital C (SD = 0.434), the groups with higher educational levels, such as bachelor’s degree or higher, were the ones who had the strongest relation with the answer “Yes”, so they were the ones who had experienced more navigation difficulties (chi-square test, $p = 0.003$).

Regarding the users' behaviors when trying to find their way inside the facilities, most users prefer to directly ask for directions instead of finding their way through the signs (Figure 90).

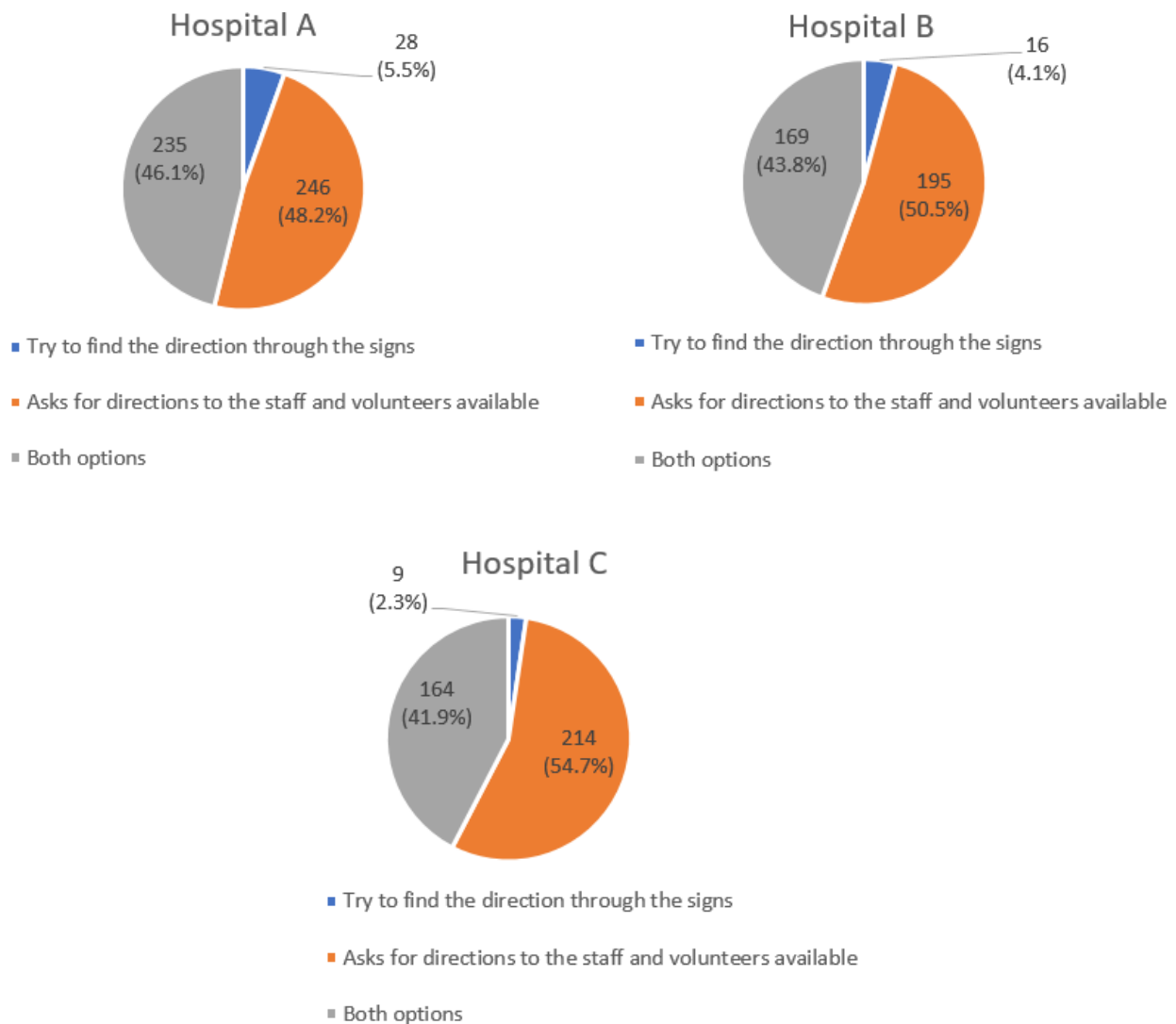


Figure 90 - Answers of the samples from hospitals A, B, and C to the question: "When you do not know how to go to a specific destination inside the hospital, what do you do?"

No relations were found between age, gender and educational level for hospital C (SD = 0.536). In hospital A (SD = 0.593), relationships were found for educational level and age. The Chi-square test for educational level revealed a $p = 0.016$, and it was possible to see that the group of respondents who had the primary school and the 2nd cycle of basic education, were the ones who ask more for directions to the staff, while users with bachelor's degree or higher were the ones that make more use of the signs. In what concerns age, with a $p = 0.017$ in the Chi-square test, a deeper analysis revealed that the groups from 19 to 25 years old are strongly related to the autonomous use of signs, the groups

from 26 to 35 and 46 to 55 years old use both options, i.e. ask for help and follow the signs, and finally the group from 56 to 65 years old strongly relates with asking for directions without using the signs.

Concerning hospital B (SD = 0.571), statistical relationships were found for gender (chi-square test, $p = 0.003$), as the male gender revealed a strong relation with the use of signs to reach the destination autonomously, which can mean that males are more willing to find their way inside the buildings without asking for help.

The evaluation of of the signage characteristics was made through a Likert scale from 1 to 5 (1 – totally disagree, to 5 – totally agree). In all the hospitals, the evaluations made had a mean above the value 3, which indicates that in all hospitals the characteristics were evaluated positively. Table 2, provides the mean (μ) and standard deviation (σ) values for each of the characteristics.

Table 2 - Mean (μ) and Standard Deviation (σ_x) values of the eight studied characteristics regarding the available signage of each hospital under analysis

Characteristic	Hospital A (Viana do Castelo)	Hospital B (Porto)	Hospital C (Aveiro)
The number of signage available is sufficient	$\mu = 3.64$ $\sigma_x = 1.016$	$\mu = 3.53$ $\sigma_x = 1.042$	$\mu = 3.18$ $\sigma_x = 1.162$
The signs are well-placed throughout the hospital	$\mu = 3.71$ $\sigma_x = 0.991$	$\mu = 3.59$ $\sigma_x = 1.026$	$\mu = 3.21$ $\sigma_x = 1.173$
The nomenclature on the signs is easy to understand	$\mu = 4.03$ $\sigma_x = 0.876$	$\mu = 3.97$ $\sigma_x = 0.917$	$\mu = 3.74$ $\sigma_x = 1.040$
The signs are visible throughout the hospital	$\mu = 3.78$ $\sigma_x = 1.034$	$\mu = 3.62$ $\sigma_x = 1.095$	$\mu = 3.39$ $\sigma_x = 1.140$
The text on the signs is visible and legible	$\mu = 3.91$ $\sigma_x = 0.917$	$\mu = 3.83$ $\sigma_x = 0.990$	$\mu = 3.68$ $\sigma_x = 1.069$
The text dimensions are adequate	$\mu = 3.82$ $\sigma_x = 0.984$	$\mu = 3.68$ $\sigma_x = 1.050$	$\mu = 3.52$ $\sigma_x = 1.066$
The quantity of information on the signs is adequate	$\mu = 3.89$ $\sigma_x = 0.933$	$\mu = 3.83$ $\sigma_x = 0.958$	$\mu = 3.66$ $\sigma_x = 1.022$
The height at which the signs are placed is adequate	$\mu = 3.96$ $\sigma_x = 0.925$	$\mu = 3.86$ $\sigma_x = 0.968$	$\mu = 3.76$ $\sigma_x = 0.959$

The evaluations were very similar in each of the hospitals (Figure 91). However, we could observe that there were more negative and average evaluations (from 1 to 3) in hospital B – Santo António (Porto) and C – Infante D. Pedro (Aveiro) than in hospital A – Santa Luzia (Viana do Castelo), even though that hospital A had a bigger sample of respondents than hospitals B and C. What is the reason for this discrepancy in a higher number of negative and average evaluations in hospital B and C? Maybe the complexity and intricacy of the structure may be behind the disparity of those numbers.

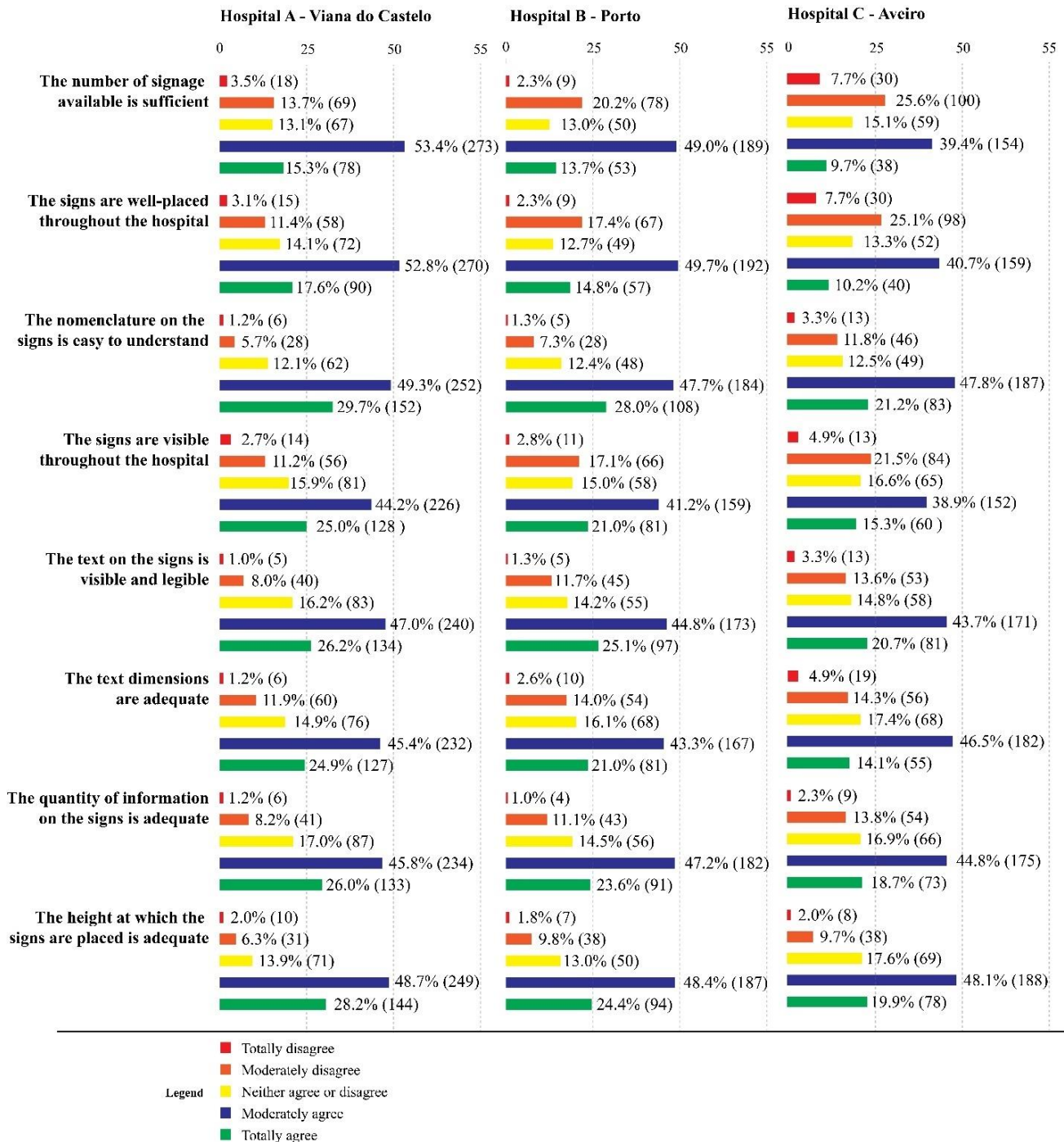


Figure 91 - Evaluations made to eight characteristics of the signage by the respondents of each hospital under analysis

In hospitals A, B, and C, no influence was found for age and gender. However, through a Kruskal-Wallis test, relationship was found for education. The test concluded that the medians of the population were not the same, and this was expected since the sample of each educational level was not equal. In order to know if these evaluations were dependent on the educational level, we would need to conduct further tests with equal samples from each educational degree, which was not possible due to time constraints.

Nevertheless, by analyzing the results obtained for all the hospitals, it was visible that, the groups with higher educational levels, such as people with bachelors' or higher degree, never used the highest value of evaluation (5), contrary to people with lowest educational levels. This can mean that people with higher educational levels are more restrained when evaluating such characteristics, as they may have knowledge of other existing signage systems with better designs in such characteristics, or may be more demanding in aspects of the design aspects of this element.

Regarding the inclusion of symbols on the signs to help identify the services, most of the users, in all hospitals, answered that they should be included (Figure 92).

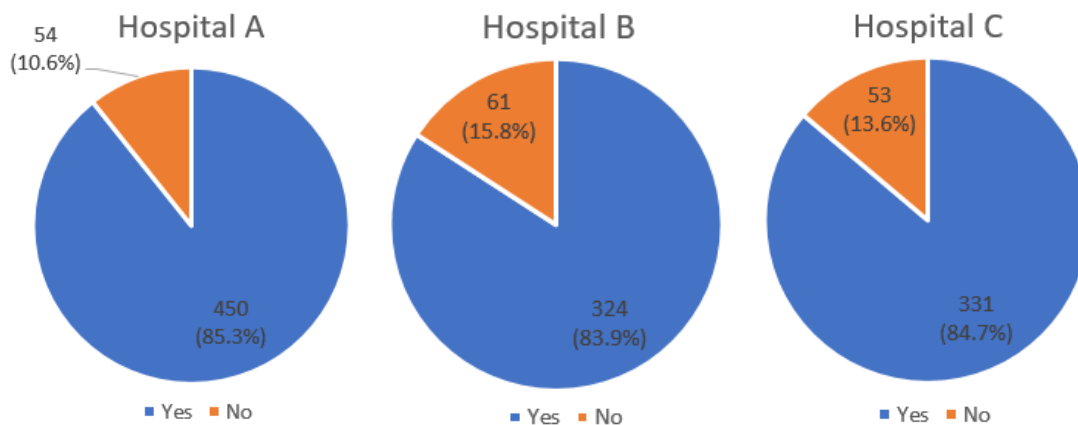


Figure 92 - Answers of the samples from hospitals A, B, and C to the question: "Do you think that if the signs had images or pictograms associated with the text, it will be easier for you to identify the departments?"

The Chi-Square test ($p = 0.019$) revealed that educational level influenced this choice on hospital A ($SD = 0.310$), with the groups below the 3rd cycle of basic education disagreeing more with the use of pictograms, whilst the ones with higher education, above secondary school, being in accordance with their use (SD hospital B = 0.366, SD hospital C = 0.45).

To the question - Do you think that signs should have different colors to identify different services or departments? - the majority of the respondents agreed with the use of a system of colors (SD hospital A = 0.346, SD hospital B = 0.366, SD hospital C = 0.327), Figure 93.

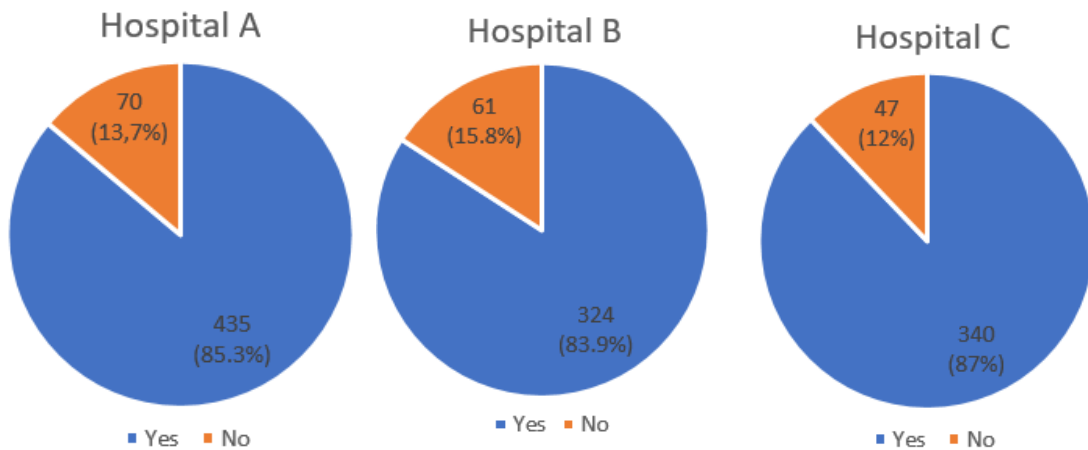


Figure 93 - Answers of the samples from hospitals A, B, and C to the question: "Do you think that the signs should have colors to identify the different departments?"

Question 7, was related to four symbols retrieved from the manual of Universal Symbols in Health Care, developed by Hablamos Juntos project (Berger, 2010). The respondents were invited to select the symbols that they considered adequate or not to each of the medical services presented, and they could select more than one medical service as adequate to each symbol (Figure 94).

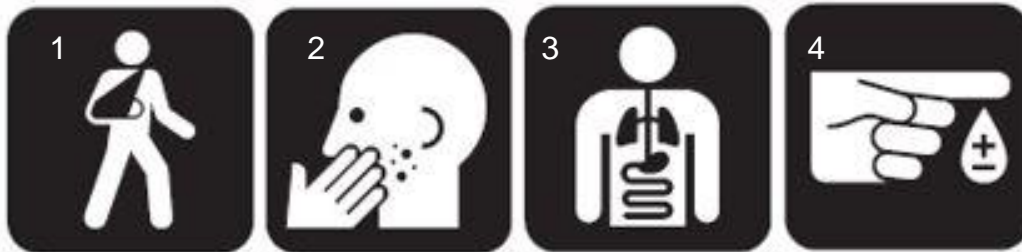


Figure 94 - Meaning of the symbols used on the questionnaires (left to right): 1 – Outpatient Department, 2 – Dermatology Department, 3 – Internal Medicine Department, 4 – Endocrinology Department (from (Berger, 2010))

The only symbol that was most of the times correctly interpreted by the respondents, was symbol 2, which was the one correctly selected as more adequate by the respondents of all hospitals to Dermatology. In the case of symbols 1 and 4, the medical services to which the symbols were developed were only considered lastly as appropriate. In the case of symbol 3, the right medical service was the second choice by the respondents from all hospitals (Figure 95, Figure 96, and Figure 97).

Healthcare Signage Design • Results and Discussion

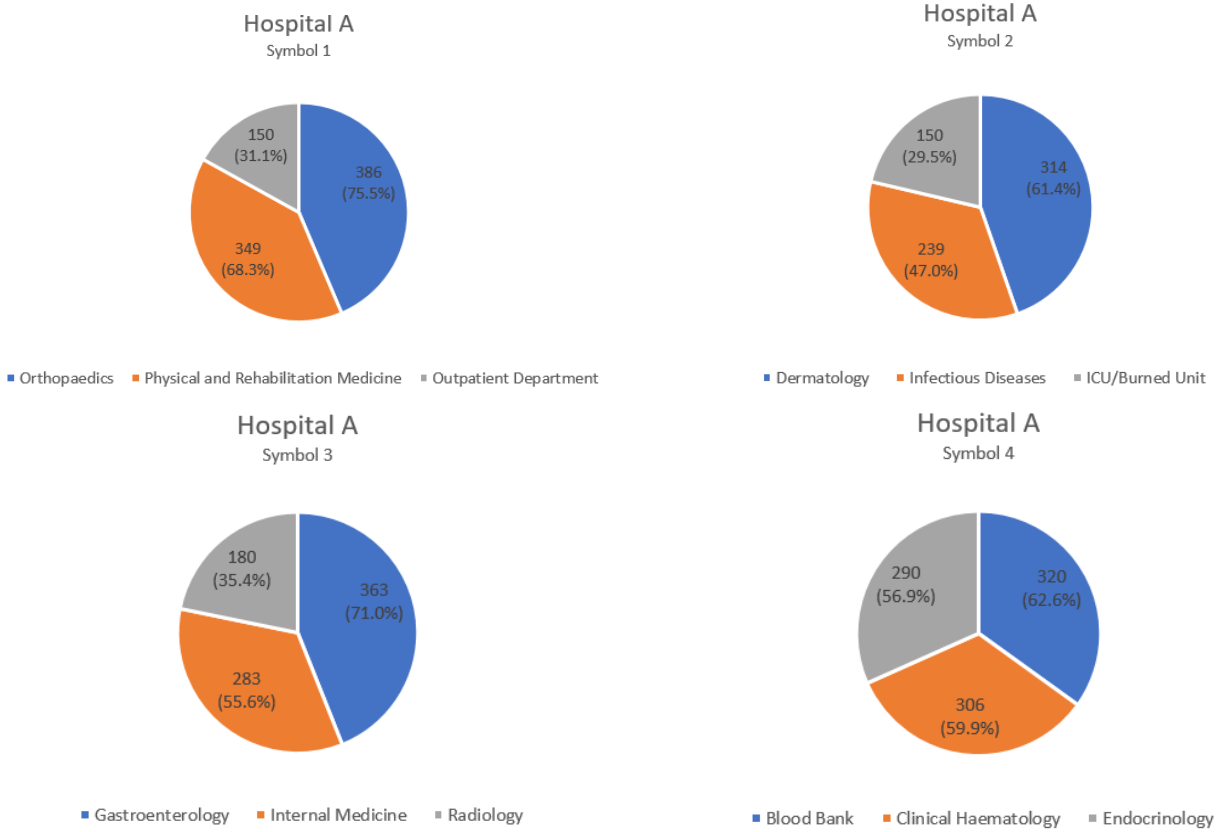


Figure 95 - Answers of the sample from hospital A to the question: "To which specialties do you think that symbol 1, 2, 3, and 4 can be adequate?"

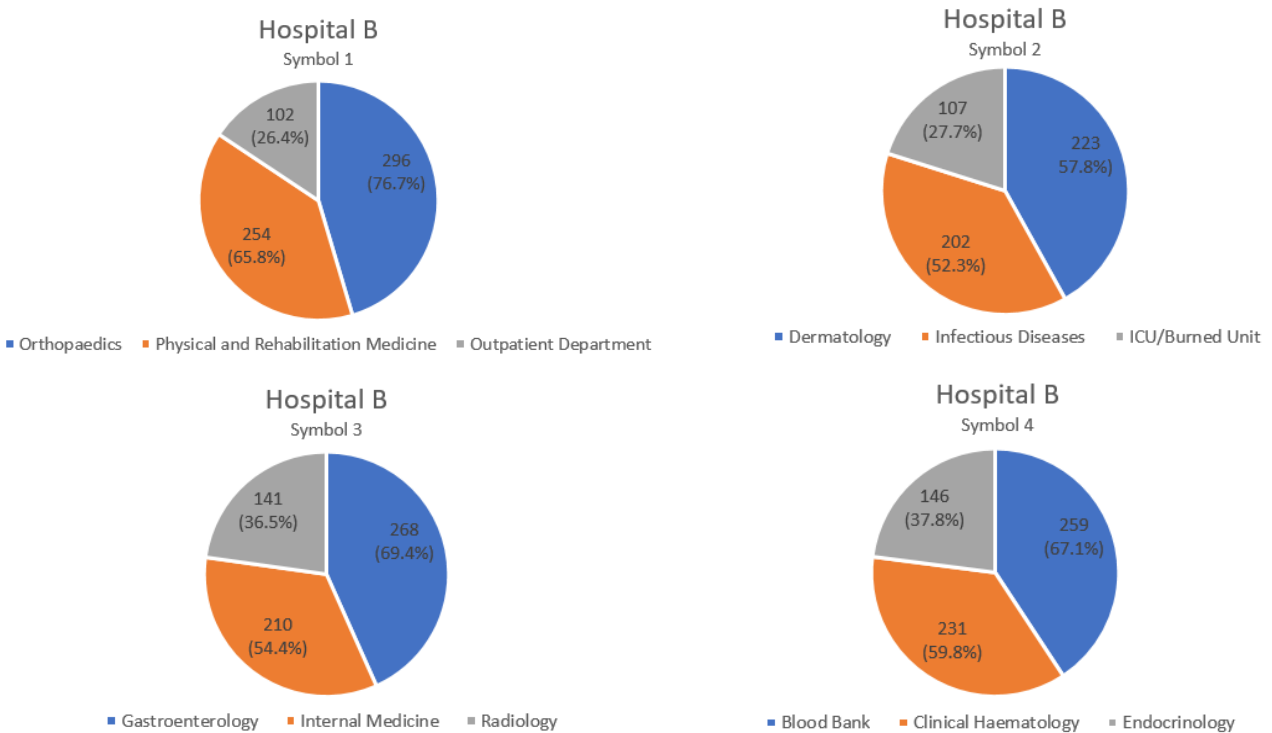


Figure 96 - Answers of the sample from hospital B to the question: "To which specialties do you think that symbol 1, 2, 3, and 4 can be adequate?"

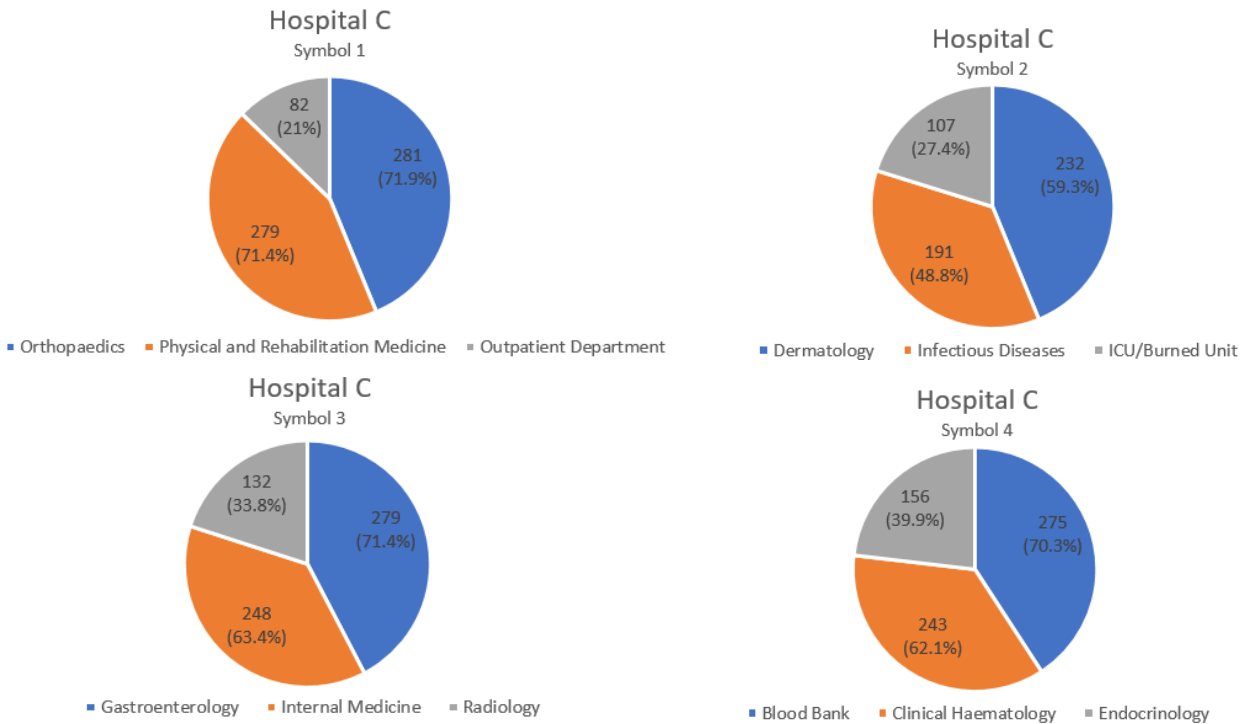


Figure 97 - Answers of the sample from hospital C to the question: "To which specialties do you think that symbol 1, 2, 3, and 4 can be adequate?"

In hospital A, statistical relations were found for age, gender and educational level through chi-square tests. In the case of age, it was found that age could influence the choice of symbol 1 for Physical and Rehabilitation Medicine ($p = 0.025$) and for Outpatient Department ($p = 0.000$). People between 36 to 45 and above 65 years old, were the ones who found this symbol more adequate to Outpatient Department, while the groups from 19 to 25 and 26 to 35 years old found it inadequate to this service. Concerning Physical and Rehabilitation Medicine, people within 46 to 55 and above 65 years old were the ones to find it more adequate to this department. In the case of gender, it was found to influence the choice of symbol 1 for Physical and Rehabilitation Medicine ($p = 0.002$), since the analysis revealed that women were the ones to find the symbol more adequate, while men were more prompt to select inadequate.

Concerning the educational level, to symbol 1, people with the 3rd cycle of basic education were the ones to find the symbol more adequate to Outpatient Department ($p = 0.005$), while people with higher degrees like "bachelor's degree or higher" would not find the symbol adequate to this service. Concerning symbol 2, people with 3rd cycle of basic education found it adequate to Dermatology ($p = 0.010$) while people with a bachelor's degree or higher considered inadequate. Also, people with 2nd cycle of basic education found the symbol adequate to ICU/Burned Unit ($p = 0.026$) while people with bachelor's degree or higher did not. Symbol 3 was found adequate more times by

people with 2nd cycle of basic education and 3rd cycle of basic education to Radiology ($p = 0.005$), and again, people with higher education, i.e. bachelor's degree or higher, did not agree.

In hospital B, statistically significant relationships were found for age, gender, and education. Regarding age, relations were found with symbol 1. The results revealed that people that most considered symbol 1 as adequate to Outpatient department ($p = 0.005$), were respondents between 26 to 35 years old, while groups between 46 to 55 years found it inadequate. Also, this symbol was more associated with Physical and Rehabilitation Medicine ($p = 0.002$) by the groups from 19 to 25 and 26 to 35 years, while people from 36 to 45 and 46 to 55 years old did not associate this symbol to this service.

Likewise, the chi-square test revealed a relationship between gender and the choices for symbols 3 and 4. The analysis revealed that females were more willing to associate symbol 3 to Gastroenterology ($p = 0.001$) than male. For symbol 4, females were the ones that associated the symbol more with Clinical Hematology ($p = 0.037$) and Blood Bank ($p = 0.025$), while male gender selected this symbol as inadequate to these departments. The educational level also showed influenced on the selections made for symbols 1 and 4. On Symbol 1, people with primary school degree had a strong relation with finding this symbol adequate to Outpatient department ($p = 0.002$). However, people with bachelor's degree or higher, found it inadequate. Regarding symbol 4, the same happened for Endocrinology department ($p = 0.003$) that was stronger associated with this symbol by the people with primary school degree and inadequate by people with bachelor's degree or higher.

Regarding the respondents from hospital C, significant relationships were found for age and educational level. Regarding age, relations were found for symbol 2 as adequate to ICU/Burned Unit ($p = 0.039$) by people up to 18 years old. For symbol 3, the selection of adequate to Internal Medicine ($p = 0.042$) seems to have a strong relation with the group of 19 to 25 years old. Regarding the educational level, people with higher degrees of education were the ones that found symbol 1 inadequate to Orthopedics ($p = 0.042$), and people with lower degrees of education selected this symbol as more adequate to Physical and Rehabilitation Medicine ($p = 0.002$), which was the right answer. Regarding symbol 2, people with bachelor or higher degree of education appeared to disagree with the selection of this symbol to Dermatology ($p = 0.000$) and ICU/Burned Unit ($p = 0.003$), while people with the primary school found it adequate.

The same happens for symbol 3, where people with lower degrees of education, mainly primary school and 3rd cycle of basic education, agreed with the use of this symbol to Gastroenterology ($p = 0.001$) and Radiology ($p = 0.000$), while people with a bachelor's degree or higher found it inadequate to these services. Concerning symbol 4, the findings were similar, while people with primary school

or 3rd cycle of basic education found this symbol adequate to Endocrinology ($p = 0.000$), people with bachelor's degree or higher found it inadequate.

In agreement with the results, it can be said that the demographic and educational characteristics of the respondents can influence their interpretations of the symbols used in healthcare settings to differentiate services or departments, which means that it is crucial to test them in a real context with real users, in order to evaluate their adequacy or not.

In the question that evaluated the level of stress felt by the users when they were lost inside the buildings and have to use the signs to find their way (Figure 98), the majority of them selected the values 3 or 4 in a differential scale from 1 to 5, where 1: Very Calm, 2: Calm, 3: Neither calm or stressed, 4: Stressed, and 5: Very Stressed.

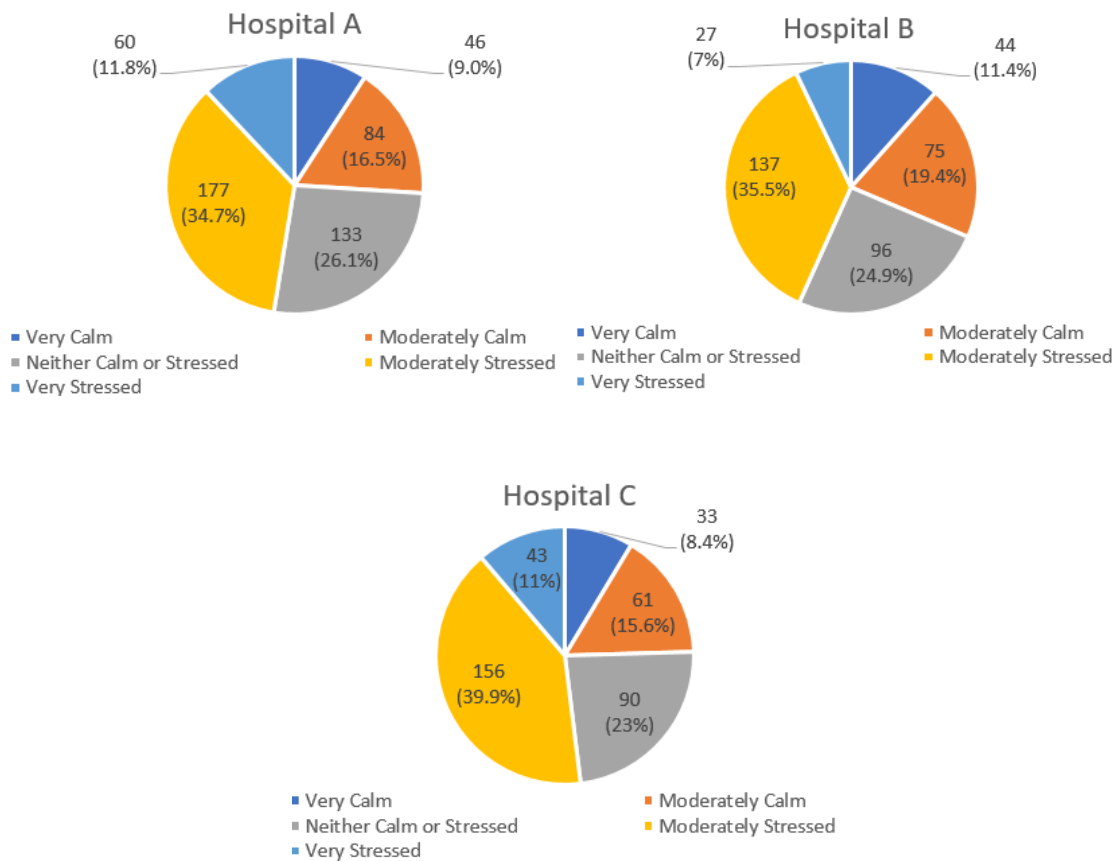


Figure 98 - Answers of the samples from hospitals A, B, and C to the question: "Please indicate the level of stress you feel when you cannot find the service you want inside the hospital."

In hospital A – Santa Luzia (Viana do Castelo), through the results of the Mann-Whitney U and Kruskal-Wallis tests, relations were found for gender ($SD = 1.146$). With a result of $p = 0.027$ from the Mann-Whitney test, women appeared to feel more stress than men; however, since the number

of female respondents was much higher (361) than the male (139), further research would be crucial to prove or discard this relation.

For hospital B – Santo António (Porto), no relations were found for age or education ($SD = 1.143$). The Mann-Whitney U test results found that gender seems to influence the level of stress felt, as women revealed higher stress levels than man ($p = 0.008$). However, as it happened in hospital A, the number of female respondents to this question was higher than male respondents, so to confirm or refute this possibility, further research would be necessary.

Concerning hospital C – Infante D. Pedro (Aveiro), significant relations were found for age and gender ($SD = 1.128$). Regarding age, when applying the Kruskal-Wallis test, a $p = 0.037$ was obtained, with the biggest statistical differences between the group up to 18 years with 19 to 25, 26 to 35, 36 to 45 and 46 to 55 years old, and between the group from 56 to 65 years with 19 to 25 years old. The group up to 18 years revealed evaluations between 1 and 3 while the mentioned groups, i.e. 19 to 25, 26 to 35, 36 to 45 and 46 to 55 groups, had evaluations between 2 and 4. The same happened with group from 56 to 65 years with evaluations between 2 and 4 and group from 19 to 25 with evaluations between 3 and 4. **Facing these results, it is possible to say that a relation seems to exist between lower evaluation values and lowers ages, and between higher evaluations and higher ages, which means that the higher the age of the respondent, the higher seems to be the levels of stress felt.** Concerning gender, the Mann-Whitney U test showed that females from hospital C had the highest evaluations of stress while man had the lowest ($p = 0.035$). However, like on the other two hospitals, the difference between the number of females (270) and males (113) of hospital C in this question, implies a further study with an equal sample for each gender to confirm or refute this conclusion.

4.1.3. SATISFACTION WITH CURRENT SIGNAGE

Regarding the degree of difficulty in navigating the settings by using only the signage available, the majority of the respondents from hospital A- Santa Luzia (Viana do Castelo) and B – Santo António (Porto), selected the values 2 and 3, while in hospital C – Infante D. Pedro (Aveiro), the majority selected the values 3 and 4 (Figure 99), in a differential scale from 1 to 5, with 1: Very Easy, 2: Easy, 3: Neither easy or difficult, 4: Difficult, and 5: Very difficult.

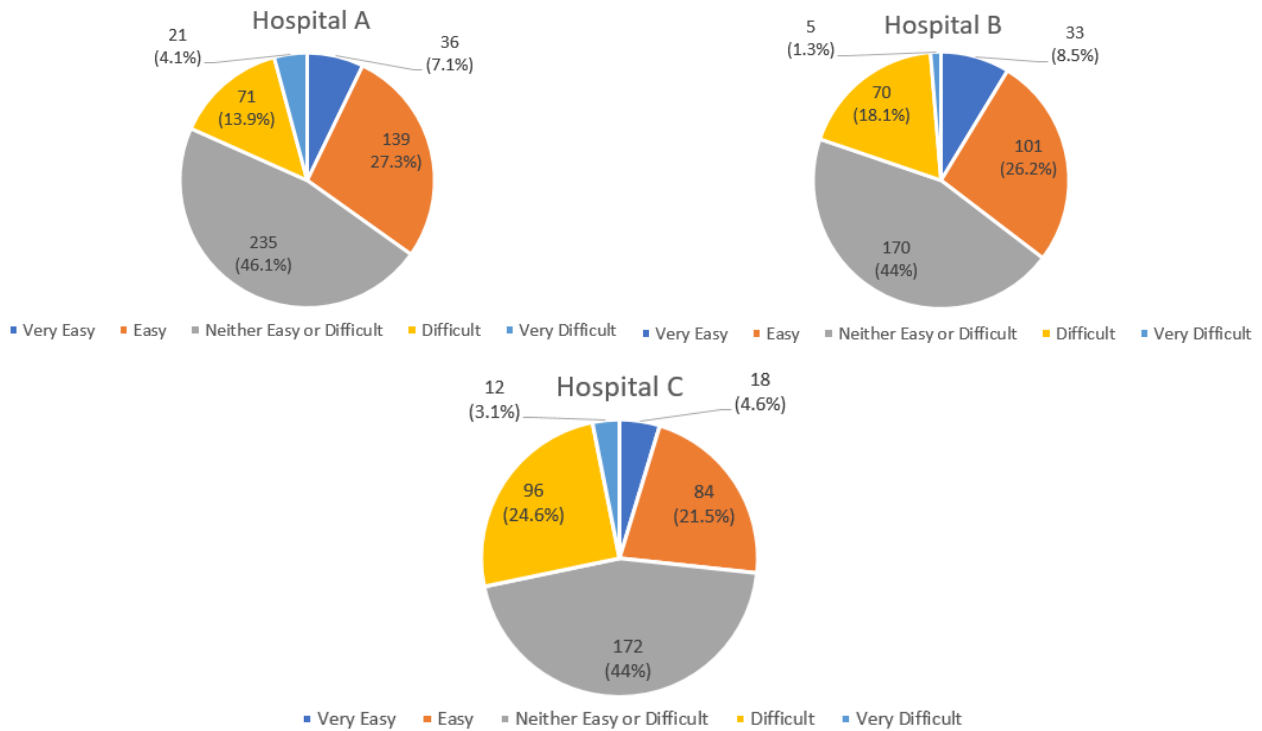


Figure 99 - Answers of the samples from hospitals A, B, and C to the question: "How do you evaluate the difficulty in navigating inside the hospital through the signage available?"

In hospital A (SD = 0.914), no statistical relationship was found for age, gender or educational level. On the other hand, in hospital B (SD = 0.895), no statistical relations were found for age or gender. However, with a Kruskal-Wallis test, influence from the educational level was observed ($p = 0.024$). Significant statistical relations were observed between several groups: between the group of "3rd cycle of basic education" with the groups of "secondary school" and "bachelors' degree or higher"; and between the group of "primary school" with the group of "bachelors' degree or higher". The group with the highest level of education ("bachelor's degree or higher") had evaluations between 2 and 4, while the remaining educational mentioned groups, evaluated the difficulty between 2 and 3.

For hospital C (SD = 0.887), the Kruskal-Wallis test to the variable educational level, revealed statistical differences ($p = 0.005$). The significant differences were found between the group of "bachelor's degree or higher" with "primary school", "2nd cycle of basic education", "3rd cycle of basic education" and "secondary school". The group with the highest level of education ("bachelor's degree or higher") made evaluations between 3 and 4, while the remaining lower educational groups evaluated between 2 and 3.

The results in these two hospitals, can mean that people with higher educational levels seem to have a perception that the signage is more difficult to follow than the ones with lowest education. This does not necessarily mean that the users with lowest levels of education

experience less difficulties, but it can mean that people with higher education can be more aware of problems that lead to a less functional signage.

When asked if the signage available satisfied or not their wayfinding needs, in all hospitals the majority of the respondents answered “Yes” (Figure 100).

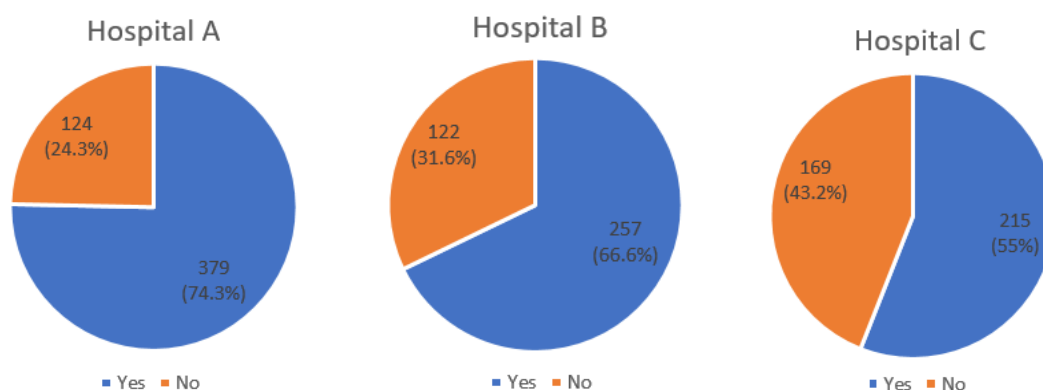


Figure 100 - Answers of the samples from hospitals A, B, and C to the question: "Do you consider that the current signage system meets your needs as a hospital user?"

In hospital A – Santa Luzia (Viana do Castelo), relationship was found between educational level and the answers of the respondents ($SD = 0.431$). The chi-square test with a result of $p = 0.027$, showed that people with “3rd cycle of basic education” or lower education were more satisfied with the signage available than the ones with higher educational levels, like for example the respondents with “bachelor’s degree or higher” which had the strongest relation with the answer “No”. From the 3rd cycle of basic education forward, the tendency was for the frequencies of answers “No” to increase, with 16% (18) for level of education of 3rd cycle of basic education, 28% (56) for secondary school and 32% (39) for bachelors’ degree or higher. Hence, **it is possible to say that, the higher the educational level, the greater will be the awareness of the people for existing issues on the signage and navigational needs that the current signage does not satisfy.**

In the case of hospital B – Santo António (Porto), through a chi-square test, statistical relations were found for educational levels with a result of $p = 0.010$ ($SD = 0.468$). The test revealed strong relations between the 2nd and 3rd cycle of basic education with the answer “Yes”, and between people with bachelor’s degree or higher with the answer “No”. The frequencies in the answer “No” revealed an increase from the 2nd cycle of basic education forward, with 16% (5) of “No” for the 2nd cycle group, growing to 22% (15) in the 3rd cycle of basic education, to 33% (40) in the secondary school level and finally to 44% (53) for people with bachelors’ degree or higher.

Likewise, for hospital C – Infante D. Pedro (Aveiro), statistical relations were found on educational levels ($SD = 0.497$). With a result of the chi-square test of $p = 0.000$, the groups of “3rd cycle of basic education” and “Secondary school” had the perception that the signage available satisfies their needs. while the group of “bachelor’s degree or higher” had the opposite opinion. As in hospital A, the frequency of answers “No” increased from the 3rd cycle of basic education forward, with 31% (28) for the 3rd cycle of basic education, 36% (47) for secondary school and 68% (68) for bachelors’ degree or higher. In this last educational group (bachelors’ degree or higher) the frequency of “No” was higher than “Yes”. Thus, **people with lower education seemed to be more satisfied with the signage available than the ones from higher education levels. Like in hospitals A and C, it can be concluded that people with higher educational levels are possibly more demanding regarding the signage and the impact it has on their wayfinding than the ones with lower education.**

4.1.4. FINDINGS AND DISCUSSION FROM THE QUESTIONNAIRES CARRIED OUT IN THE HOSPITALS

The results from the questionnaires implemented in each of the three hospitals (Santa Luzia, Viana do Castelo; Santo António, Porto; and Infante D. Pedro, Aveiro) suggest that there are common aspects in the way users perceive the available signage. Moreover, the findings show identical wayfinding behaviors in all the studied hospitals and identical evaluations of the signage characteristics.

One of the most important finding in this study is that the default behavior of the users, in all hospitals, was to directly ask the staff for directions when they arrive to the buildings without consulting the signage available. This is in line with existing studies that concluded that people tend to see the verbal message as more reliable than the written message, and **“sometimes [people] need the reassurance that can be obtained only from another human being, regardless of the extent and quality of the overall wayfinding system”** (Carpman & Grant, 1993, p.87). Even when the signs available are explicit and visible to the users, they prefer to ask the staff or the available volunteers for directions, as they feel more secure and confident with information provided by someone that knows the facilities well. **Although this behavior was more common on the elderly people, besides the age factor, it can also be related to the difficulty experienced by some of the users in interpreting and understanding the nomenclature used on the signs.**

When suggesting improvements to the available signage, several users referred that many times the designations on the signs are too scientific for them to understand if that is the service they are looking for or not. According to the results, highly educated users claim that the use of colors or symbols on the signage could be helpful to guide the people and could attract the attention of the users to the signage available, which will reduce the behavior of ignoring the signs and ask the staff for help. **The creation of a standardized set of symbols and colors associated with each of the services available, such as claimed by Lee, Dazkir, Paik, & Coskun (2014), to be used at a national or regional level, would be an interesting way to get people to start using the available signage more instead of interrupting the staff to inquire information.** Although there are different cultural and demographic characteristics that should be considered, the creation of standard symbols and colors at a national or local level could be a good starting point.

It was also observed that the previous number of visits to the same hospital did not influence the way people perceived the signs and neither their wayfinding behaviors. However, there are studies in the literature that state that the users' familiarity with the setting can be the reason why people tend to ignore the signage available. With that in mind, as the sample of people that were visiting the settings for the first time was small in this study, it would be important to conduct a study in which the number of this sample was the same as for the people that already visited the settings before.

The study performed in the three hospitals reveals that the signage was serving its purpose poorly and also that the staff was spending a lot of time in guiding the users to their destinations. **Through conversations with the staff and volunteers available, they confirmed that even when they provided directions to the users and told them to follow specific signs, many times the users returned without being able to reach the service. The volunteers referred that the signage available is not easy to follow, even when they provided verbal instructions to the users, mainly due to the lack of a logic placement of the signs that creates confusion among the users, and most importantly, due to its inadequate design or nomenclature, especially for the elderly patients and viewers.**

Concerning the influence of age, gender and educational level on the answers given by the users, the characteristic that has the biggest influence is the level of education. Although gender have also influenced the results, the analysis cannot be considered valid since the sample of men and women was not equal like in the study conducted by (Devlin & Bernstein, 1995).

The users with a higher degree of education seemed to have a more negative perception of the signage characteristics than the ones with a lower educational level. This can mean that people with higher education tend to be more perceptive of problems of the signage design and functionality problems than people with lower educational levels. Through the answers given, it was

found that people with lower educational levels were less demanding with the characteristics of the signage and with the conditions offered by the hospitals. Also, in the interpretation of the symbols, findings indicated that interpretation rates decreased with higher education levels, contrary to other studies like the one conducted by Potter (2017).

To sum up, in all the studied hospitals, the signage systems were generally classified as good. However, the users tended not to use it while navigating the settings, preferring the verbal indications of the available staff or volunteers. Many of the users that classified the signage as good, ended up giving important recommendations and suggestions for improvements on the signage in the last question, which was of non-mandatory answer. The provided suggestions were mainly related to improvements on the signage design to make it more simple, functional and more attractive to the users by capturing their attention in a way that could lead them to notice and use it. However, these findings should be interpreted in light of the study's limitations. Firstly, the defined sample to complete the questionnaires, is not obviously representative of the overall population and of the two genders, as the number of women was always higher than men in all the hospitals. Secondly, although the study was conducted in a real environment, the analysis and the application of the methods was only made by one investigator *in situ*. This could result in behaviors of the users missed throughout the observations and with less questionnaires applied than if there were more researchers on the site.

This study revealed the importance of consulting the voice of the users of healthcare settings, and of considering their perspectives and perceptions in the design of the signage systems. While most studies investigated the signage systems in what concerns their financial impact and their impact on the service, this study has shown that the users' perceptions of these systems go beyond those aspects and are more centered with its functionality and impact on their experience of the service.

It is also possible to conclude that the impact that signage design and functionality can have on the users' stress rates and on their wayfinding behaviors is immense, and this indicates a need to consult the users during the process of signage design, development and implementation. **There is an enormous need of integrating the users in the development process in the interest of answering their demands and needs regarding signage. Only through their engagement will it be possible to reach their desired service experience and provide them with positive perceptions in their navigation experiences.**

4.2. QUESTIONNAIRES – HOSPITAL D

Two years ago, hospital D – São João (Porto), has renewed the signage of a part of the outpatient department, and have implemented a new signage system with a new design. The questionnaires conducted in this hospital had the intention of seeing if the users evaluated the new signage better than the old version in order to see if the improvements made had benefits for the users experience of the setting or if they made the user wayfinding in that hospital even worse (Rodrigues et al., (2017) and Rodrigues, et al., (2016)).

4.2.1. DESCRIPTIVE STATISTICS

The data retrieved from these questionnaires were analyzed using IBM SPSS Statistics 24 and through descriptive statistical analysis to quantitatively describe the users' evaluation of the new signage available. In terms of the gender of the respondents, the sample was constituted mainly by female respondents (Figure 101).

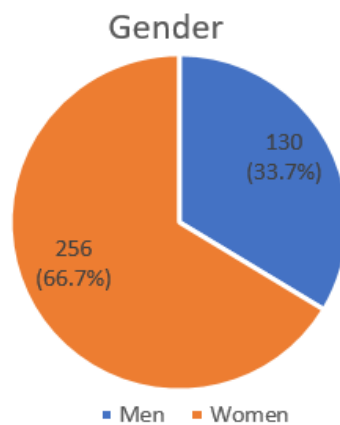


Figure 101 - Gender of the respondents from hospital D

The mean (μ) age of the respondents was 42.44 years old ($SD = 1.435$) and the age distribution is the one presented in Figure 102.

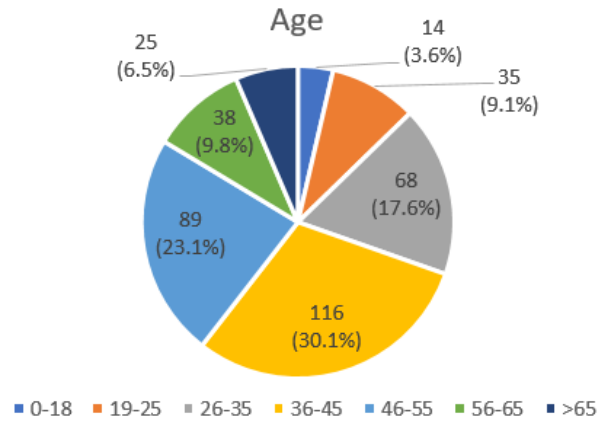


Figure 102 - Age distribution of the respondents from hospital D

Regarding the educational level, the majority of the respondents had an educational degree, and most of them had the secondary school or a higher degree (Figure 103).

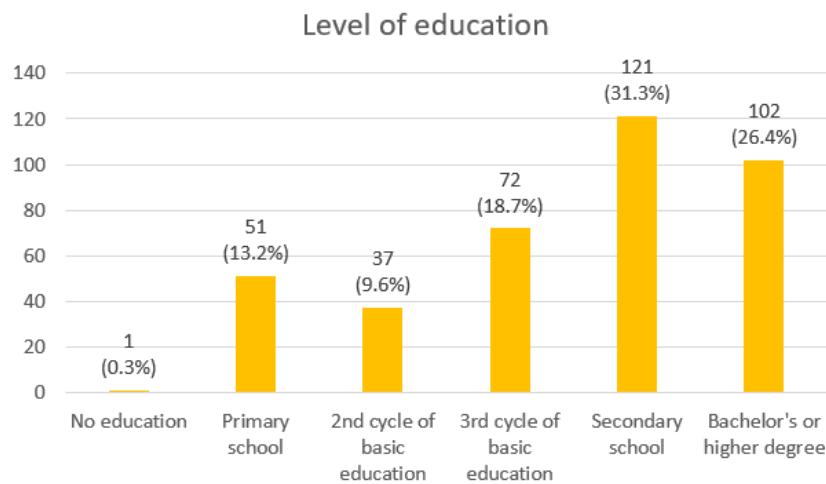


Figure 103 - Educational levels of respondents from hospital D

One of the users' characteristics that can profoundly affect their capabilities to read and interpret the signage available, is the vision acuity. If the users suffer from any kind of visual disability, this will certainly cause them difficulties in reading, interpreting and following the signage available. In hospital D, most of the respondents declared not to suffer from any visual disability (Figure 104).

Do you have any kind of visual disabilities?

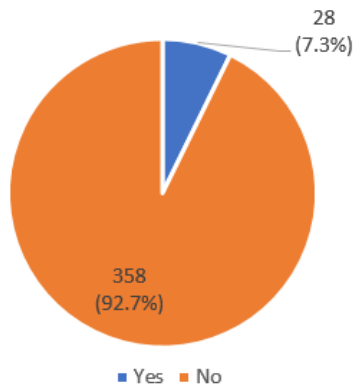


Figure 104 - Visual disabilities of the respondents from hospital D sample

In question number 5, the respondents were asked to rate the new signage system compared to the old one - photos of the old version of the signs were presented on the questionnaire available at Appendix A. Figure 105 presents the evaluations made by the respondents, in which is visible that they consider the new signage much better than the old version.

How do you evaluate the new signage available compared to the old one?

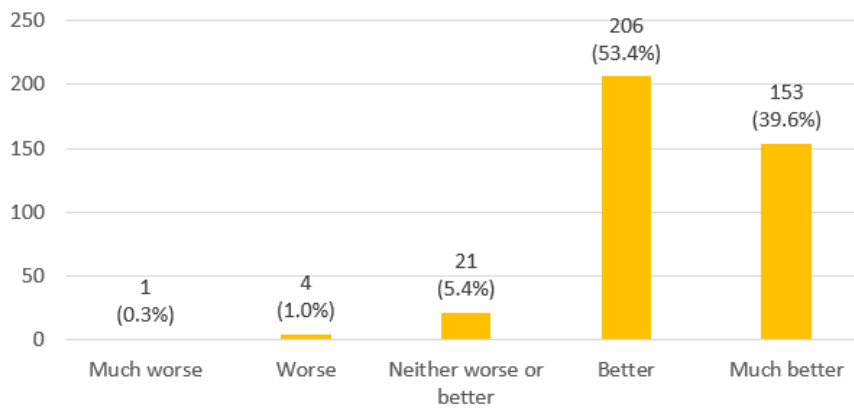


Figure 105 - Educational level of the respondents from hospital D sample

In question 6, the respondents were asked to evaluate specific characteristics of the new signage when compared to the old one, in order to see if the new signage performed certain functions in a better way than the old one. The answers for each of the characteristics or functions of the new signage system are represented in Figure 106 to Figure 111.

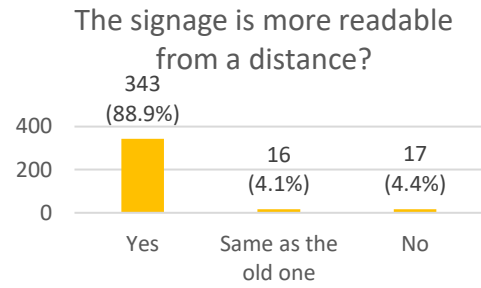
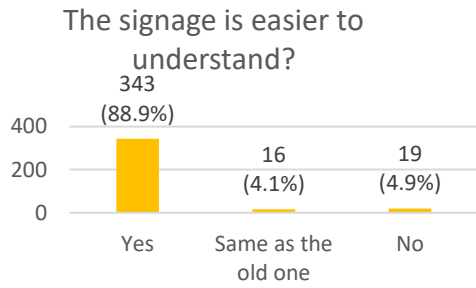


Figure 106 - Evaluation of characteristics 1 and 2 of the new signage from hospital D

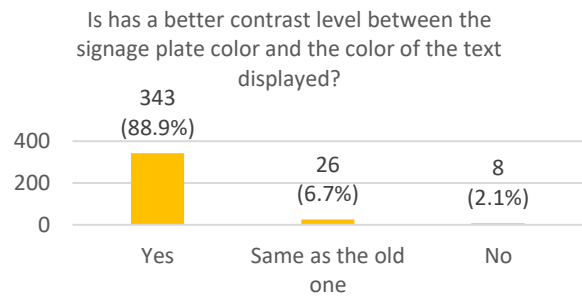
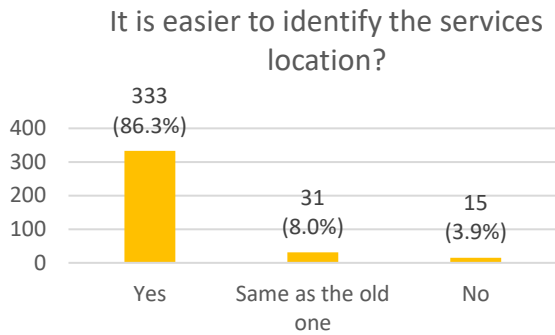


Figure 107 - Evaluation of characteristics 3 and 4 of the new signage from hospital D

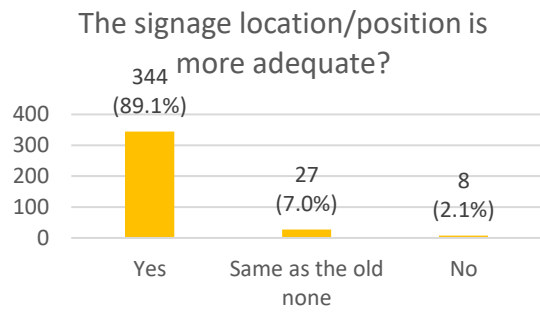
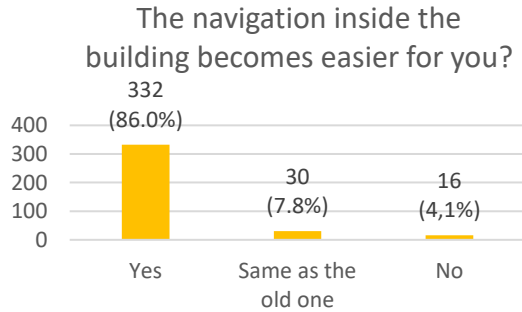


Figure 108 - Evaluation of characteristics 5 and 6 of the new signage from hospital D

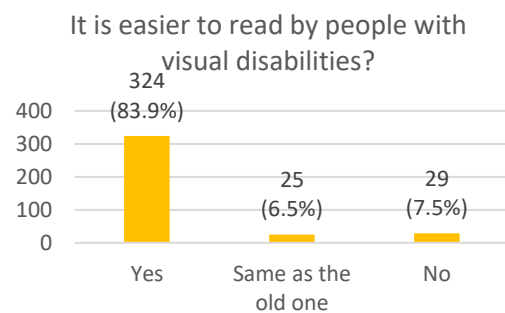
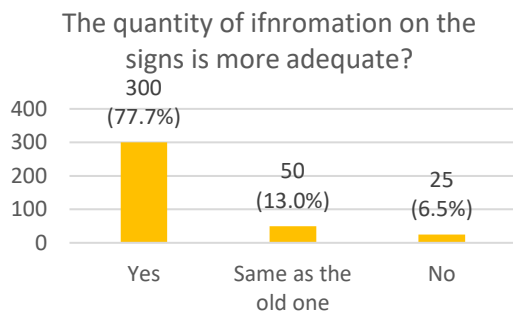


Figure 109 - Evaluation of characteristics 7 and 8 of the new signage from hospital D

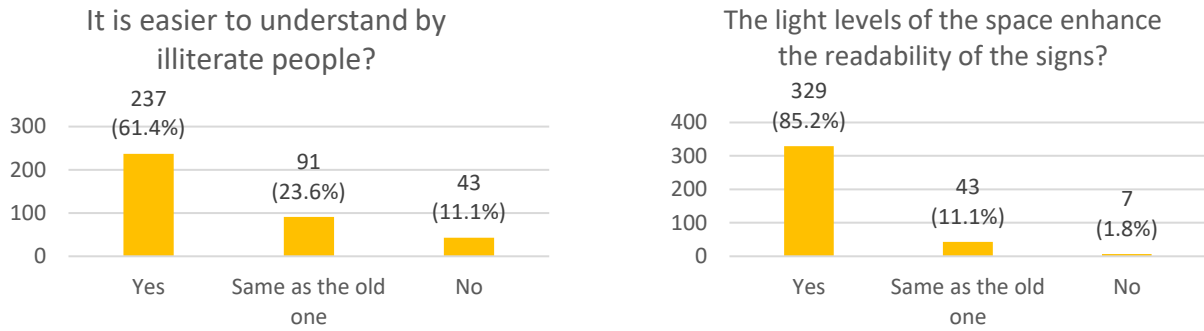


Figure 110 - Evaluation of characteristics 9 and 10 of the new signage from hospital D

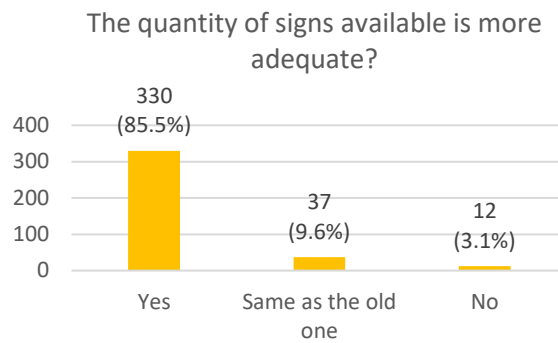


Figure 111 - Evaluation of characteristics 11 of the new signage from hospital D

On the following question, the respondents were asked if it was easier for them to find the destination they were looking for through the new signage available. The majority of the respondents answered Yes (SD = 0.380), Figure 112.

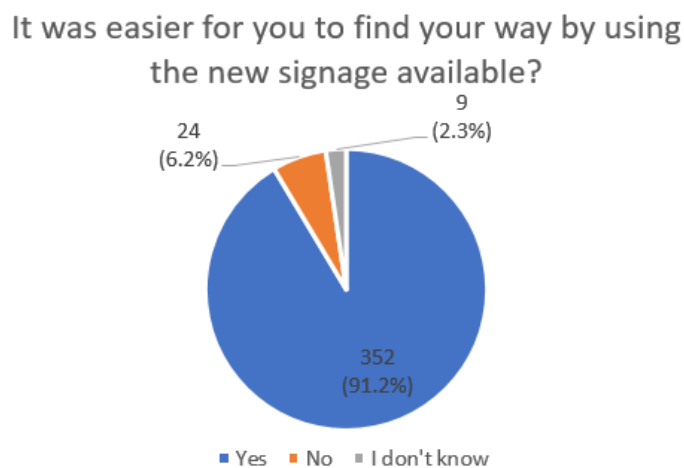


Figure 112 - Respondents answers to the question: "It was easier for you to find your way by using the new signage available?" in hospital D

The last question was about the implementation of the new signage system throughout the all buildings of the institution. In this question, the intention was to know if the users think that it would be benefic to apply this system of signs throughout the all setting or not. The majority of the users answered that for them it would be benefic to have this type of signage system available (Figure 113).

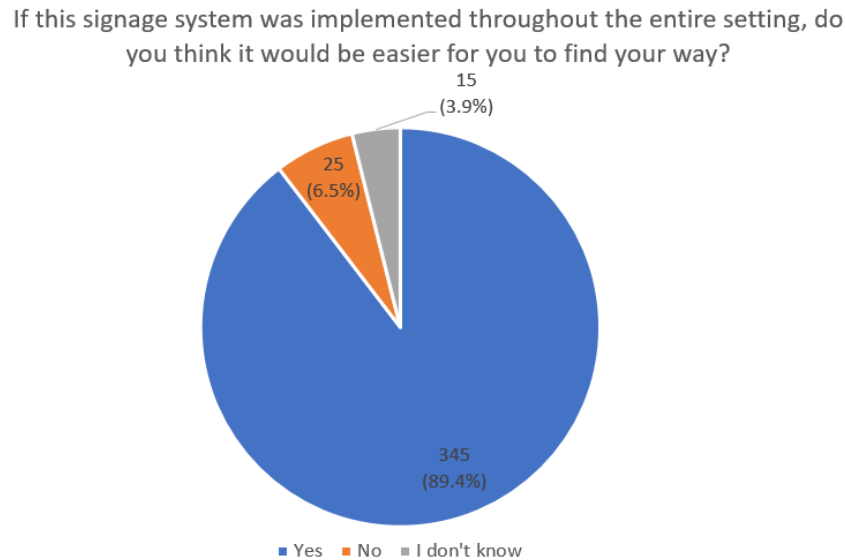


Figure 113 - Respondents answer to the question: "If this signage was implemented throughout the entire setting, do you think it would be easier for you to find your way?" in hospital D

4.2.2. FINDINGS AND DISCUSSION FROM QUESTIONNAIRES OF HOSPITAL D

Regarding the data collected in hospital D – São João (Porto), it was found that the new signage system available is making the users feel more autonomous and comfortable with their navigation inside the setting. The old signage system had numerous problems that led the users to frequent difficulties on their wayfinding tasks, mainly due to (Figure 114 and Figure 115):

- **lack of signage indicating the services location throughout the facilities and their reduced visibility from specific places;**
- **the mix between signage plates and paper sheets on the doors and walls indicating the services;**
- **the lack of maintenance of the signage;**
- **the small dimensions of the signage and their unappropriated locations;**

- **and finally, the colors used, and the size of the text used that was not adequate to the variety of users using the facilities.**



Figure 114 - Old directional signage displayed in the Gynecology and Dermatology areas of hospital D



Figure 115 - Old signage indicating the Gynecology service in hospital D

In the new adopted signage system, the hospital was able to improve the interpretation and visibility of the signage system, through the use of letters and numbers instead of the scientific designations of the services that many users considered much more difficult to interpret and follow.

The new signage available is displayed in bigger dimensions and with colors that stand out from the remaining features of the environment. The new colors used, the bigger dimensions and the easily to interpret nomenclature, together with the natural light on the spaces, makes it easier for most of the users to visualize and follow the new system with less wayfinding difficulties and with more autonomy (Figure 116 to Figure 118).



Figure 116 - New signage indicating the services through letters and numbers in hospital D



Figure 117 - New signage indicating the medical offices and reception desks of the K3 area at hospital D



Figure 118 - New signage indicating the main reception desk of the outpatient area of hospital D

4.3. SUGGESTIONS FOR IMPROVEMENTS FROM THE OPEN-ENDED QUESTION OF THE QUESTIONNAIRES

On the questionnaires applied, the last question was an open-ended non-mandatory question. In this one, the users could give their opinions regarding improvements to the signage.

In all the hospitals, the answers provided by the respondents were related to similar or equal problems existing in the signage available on the settings. Although the hospitals analyzed differed in size and layout, the problem of the signage systems seemed to be equal or similar from hospital to hospital. This section tries to provide a summary of the recommendations and suggestions given by a total of 1673 respondents inquired in this research.

The suggestions provided, comprised seven different topics as presented in Figure 119. As the answers were analyzed, they were translated into requirements to simplify its interpretation.



Figure 119 - Topics in which the respondents from the questionnaires made their suggestions for improvements



PHYSICAL AND GRAPHICAL CHARACTERISTICS:

1. Associate complementary wayfinding systems, including colored lines on floors or walls, service areas by color, lines or arrows on walls, floor, or ceilings, color-add system, interactive maps and emergent technologies – Mentioned 158 times.
2. Associate pictograms, symbols or images to the text on the signs – Mentioned 152 times.
3. Use of colors to differentiate services or units of services, including on plates, textual descriptions and symbols – Mentioned 141 times.
4. Increase signage visibility by taking into account dimensions of signage plate, mounting locations, light levels, colors used and plates height – Mentioned 103 times.
5. Use of colors on the signs and text to reinforce information and capture the users' attention – Mentioned 57 times.
6. Increase the visibility and legibility of the text displayed on the signs, i.e. issues related to typography and font size – Mentioned 32 times.
7. Increase signage contrast with the background wall, for example, more appropriated use of colors, light levels and position – Mentioned 27 times.
8. Use colors that have no specific meanings, for example, red is used mainly on emergency signs, and that transmit positive emotions – Mentioned 1 time.
9. Differentiate primary from secondary information, by using typography and text colors – Mentioned 1 time.



DENSITY AND QUANTITY:

1. Increase the number of signs and information displayed, for example, by repeating information on key points or intersections – Mentioned 108 times.
2. Clear exterior identification of the buildings and entrances, together with directories and maps at key points, i.e. hospital and building designations – Mentioned 76 times.
3. Strategically place the signs in key spots and intersections, including maps and directories showing those key spots with letters, numbers, symbols or colors – Mentioned 58 times.
4. Place informational signage on buildings entrances, service entrances, or reception desks, for example, maps and directories with the services and units available, identified by letters, numbers, symbols, or colors – Mentioned 58 times.
5. Maps and directories showing services available, like floors and units, and paths available to the most required ones using colors, symbols, or numbers for areas – Mentioned 56 times.
6. Avoid information overload on the signs and other information supports throughout the settings, i.e. by displaying only the needed information – Mentioned 4 times.



SIGNAGE STANDARDIZATION:

1. All signage should follow a standard design across the all setting, i.e standard designations and nomenclature, same colors and symbols, same graphical layout, etc. – Mentioned 13 times.
2. Create standard symbols and sets of colors to be used on signs for healthcare settings – Mentioned 2 times.
3. Signage should follow the existing laws and regulations for healthcare signage – Mentioned 2 times.



CLARITY AND SIMPLICITY OF INFORMATION:

1. Signage for inclusive purposes, including disabled, elderly, illiterate, visually impaired people, suggesting the use of complementary technologies and systems – Mentioned 112 times.
2. Signage with clear, simple, and functional design, for example, simple designations of services, departments, amenities and doctors' offices, which are clear, easy to interpret, and to remember – Mentioned 107 times.
3. Use simple terminology on services designations, i.e. avoiding the use of scientific terms and abbreviations and using bilingual signs – Mentioned 66 times.

4. Implement a ticketing system that is easier to use and to understand, for example, by using only numbers or letters on the tickets, associate the patients name to the ticket called, which should be written or audible – Mentioned 29 times.



TEMPORARY INFORMATION:

1. Information regarding changes in services location or rearrangements to the settings, should be always available and visible to the users – Mentioned 16 times.
2. Temporary signage should follow or be similar to the design of the permanent signage established throughout the facilities – Mentioned 5 times.
3. There should be a specific area to place the temporary information or other like warning information – Mentioned 5 times.



HUMAN AND PHYSICAL RESOURCES

1. Increase the number of volunteers and staff members available to guide the users, which can include trained staff and volunteers – Mentioned 47 times.
2. Renew, redesign, and improve signage quality – Mentioned 30 times.
3. Improve the letters sent to the patients regarding the medical consultations, which should include symbols or colors to follow when arriving to the hospital, map of the buildings, etc. – Mentioned 20 times.
4. Information desks available to the users at the entrances, which can be digital or managed by the staff or volunteers – Mentioned 14 times.
5. Create a simple layout and logical location of services, departments and amenities – Mentioned 12 times.
6. Keep signage in good maintenance conditions – Mentioned 11 times.
7. Keep signage updated, by including information available regarding changes in services locations, changes of reception desks, and changes of departments – Mentioned 10 times.
8. Waiting rooms should be specific for each service or units of services and patients with different pathologies should not be mixed – Mentioned 4 times.
9. Areas reserved for children – Mentioned 4 times.

4.4. DIRECT OBSERVATIONS

Most of the times, when humans are performing a specific task, they are unaware or do not notice some of the difficulties that they have to overcome, i.e. they just get over the difficulty unconsciously.

During this research, one of the goals was to capture the unconscious wayfinding and navigation difficulties of the users when using the available signage.

In order to do it, direct observations were performed during the time the investigator spent in the facilities. Although the investigator was not able to video record or photograph the users when performing those specific tasks, all their difficulties were annotated by the investigator, and photographic records of the elements that led to those difficulties were made. These direct observations were conducted in the outpatient area and in the visitors’ atriums of the hospitals.

Table 3, Table 5, Table 6, Table 7, Table 9, and Table 11, present the findings obtained through the direct observations of the outpatient areas, and Table 4, Table 8, Table 10, and Table 12, obtained through the visitors’ atrium observations.

Table 3 - Findings from the direct observations in the outpatient sector of hospital A

OUTPATIENT SECTOR – Hospital A			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Signage missing or located in places with no visibility	The signs available are not enough for the users to understand the space, to know where they are, and where they must go. Some signage is poorly located in places in which the visibility is reduced or affected by other elements.	The users’ possible journeys were not studied and the number and typology of signs available is not adequate.	The users get lost inside the building and they are not able to situate themselves to know the way to go to enter or leave a specific service.



2 Signage is not inclusive and some directional elements are missing

The users said that the signage should be adapted to the elderly and people with disabilities. Mainly the elderly show extreme difficulties in reading the signage available, as the text dimensions and colors used are not the most adequate. Some signs do not have arrows indicating the direction of the destinations.

The study of the population characteristics and their needs was not conducted in a proper way, or worse, it was not conducted at all. The graphic characteristics of the signage are not designed for the population of the hospital.

Mainly the elderly end up lost in the building and with many difficulties in knowing which way to go. Many users do not know how to read and so they end up lost, or interrupting the staff work to ask for directions before noticing the volunteers available.



3 Lack of maintenance of the signage and poor location of some signs

Some signage is not in good maintenance conditions, and the hospital tried to solve this problem with temporary sheets of paper on the walls. The lines on the floor and the directory of services has letters and colors missing. The location of the medical offices is not visible from the waiting rooms, it is only available in the interior corridor where the rooms are located.

Lack of maintenance of the existing signage, or lack of investment in new adequate signage. Lack of planning of temporary information and where to place it. Poor location of signage due to lack of study of the facilities and the users' needs.

The users feel lost and with lack of autonomy since they are not able to follow the signs by themselves. They feel confused with all the paper sheets taped on the doors and walls and end up asking for information.

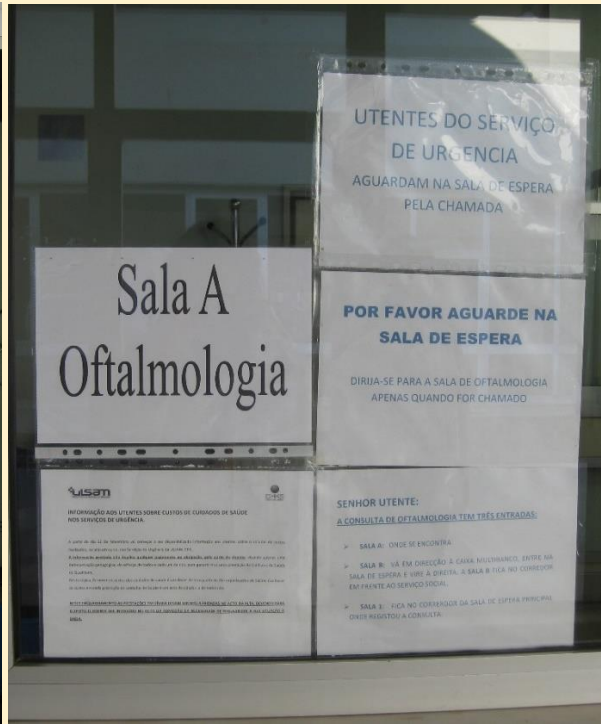



Table 4 - Findings from the direct observations in the visits' atrium of hospital A

VISIT'S ATRIUM SECTOR – Hospital A			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Signage located in places with no visibility	Some signs are in places in which they are not visible, for example, behind the television available in the atrium, and so they are not noticed.	Poor planning of signage location in an early stage of the facilities development process.	The users do not notice those signs, and in specific cases they end up lost and without knowing in which floor they are.
			
2 The signage is in poorly maintenance conditions	The signage available is not well mantained. Some are missing a few letters of the text and some information, such as the number of the floor in which a specific service is located on the directory.	Lack of maintenance or investment in new signage to replace the signs that are not in good conditions.	Some of the users are not able to understand the signage available and they can not understand the information displayed. The users get lost or have to ask to the staff or volunteers for information.

PISO	1ª FASE	2ª FASE	PISO
3	Farmácia	Cardiologia	4
3	Aprovisionamento	Cons. Ext. Medicina	4
4	Ortopedia 1	Esterilização	4
4	Ortopedia 2	Fisiatria	4
4	Cirurgia 1		4
4	Bloco Operatório	Bloco Ambulatório	4
4	U.C. Intensivos		4
5	Obstetrícia Bl. de Partos	Cuidados Intermédios	5
5	Ginecologia	edi na	6
	Fsp Cirúrgicas	Medi ina	7
	C rurgia	Medicin	
7	Pediatria		
	UC Neonatais		
	Administraç		
	Estomatologia	Hospital de D a	2
2	Orl	Cons. Externas	2
2	Gastrenterologia	Radiologia	2
2	Pneumologia	Lab Análises Clínicas	2
2	Urologia	Serviço de sangue	2

3 The maps available are not adequate to the users

The users that look to the map available at the atrium to know where they are or the location of the destinations they want, end up giving up, as they are not able to understand the map.

The 3D map is not easy to understand, mainly for the elderly. Maybe, a 2D map could be more adequate and easier to read.

The users end up not using the map and try to find other elements that help them navigate through the settings, such as the lines on the floor or the verbal directions provided by the staff and volunteers.



Table 5 - Findings from the direct observations in the outpatient sector of building Luís de Carvalho at hospital B

OUTPATIENT SECTOR OF LUÍS DE CARVALHO BUILDING – Hospital B			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
<p>1 Poor design of the graphical and physical characteristics of the signage</p>	<p>The signage indicating the reception desks and the restrooms, is positioned extremely high and the dimensions of the letters and the plates together with the colors with low contrast with the wall, end up confusing the user. Some users stand near the signage to be able to read it, and most of them end up choosing the wrong check-in line because they did not read or did not noticed the plates. The same happens with the signage indicating the waiting rooms. The number of the medical offices is not visible from a distance due to the color's palette.</p>	<p>Dimensions of the signage and the text are not adequate. The colors selected have almost no contrast with the wall where they were settled: the signs are white with light grey letters and the wall is also white. They are located above the reception desks with almost no space between them and the ceiling. There was a lack of study of conditions and space available before implementing the signage.</p>	<p>Users end up waiting on the wrong check-in line and they will interrupt the staff working at the reception desks to ask in which line they should wait. The waiting time for the check-in increases. Users end up lost and asking for information to the staff, or they stand below the signs to be able to read them. Some users end up displeased and frustrated with the service.</p>



2 Innadequate temporary signs

Some services of the hospital are only signalized through sheets of paper taped on the doors or walls. And that information was not properly designed, for example, services are written in black letters in a grey background.

Lack of planning of the signage and typology of signs needed. The intention of overcoming the lack of information leads to temporary information poorly design and located.

The users have difficulties in reading some of the information that is placed inside a plastic support to protect it, and many times, frequently taped on glass doors. The illumination projected makes the information difficult to read from a “normal” distance.



3 The language used on the signage can be difficult for some users

Some of the signs available make use of scientific terms and also abbreviations.

Lack of previous planning of the language to use considering the population that will use the hospital.

Some users do not understand the signs and ask for information to the staff. Patients end up misinterpreting the signs and can get lost inside the building.



4 The illumination conditions are not adequate

The lights reflect on the signage available, plates and sheets of paper taped on doors and walls. In some areas the illumination levels are not enough to facilitate reading.

Certain signs are placed too high and really near the lights. The plastic protection creates reflexion and ends up difficulting the visibility and legibility of the information. It seems that signage and lights were not tested together before implementation.

The users have to go near the signs or papers to be able to read the information. They do not notice some of the signs due to the lack of illumination, and miss the service they were looking for.



Table 6 - Findings from the direct observations in the outpatient sector of building Neoclássico at hospital B

OUTPATIENT SECTOR OF NEOCLÁSSICO BUILDING – Hospital B			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
<p>1 Poor design of the graphical and physical characteristics of the signage</p>	<p>Locational signage of the Ophthalmology service is not very visible and legible from a “normal” distance. In the Ophthalmology service, there are letters placed in glass doors, which for people with low visual acuity brings even more difficulties of reading. Some warning signs are poorly designed and located.</p>	<p>The text and signage plate have low contrast and should be of bigger dimensions. Maybe if the identification of the service was above the door it would be visible. The colors selected for the text and the plates do not stand out from the walls. Poor planning of signage dimensions, colors, and placement.</p>	<p>The service is not very visible from the upper corridors, which is the path most used to reach this service. Users end up going straight-ahead without turning left as they should. The users feel frustrated when seeing transparent text placed on frosted glass. Signs for the existing ramps are placed right on the ramps, which means that users do not notice these warning signs before reaching the ramps. Some users end up in restricted areas due to bad placement of restriction signage. In a service where the users have vision acuity problems, they end up disgruntled with the signage.</p>





<p>2 Innadequate temporary signs</p>	<p>The temporary information is poorly designed and placed. Some of it was obviously made without considering aesthetic and functional purposes.</p>	<p>Its placement and design seem to be made without caring for the aesthetical and mainly for the functional purposes. The lack of planning at the initial stages of the development may have not considered those signs at that time.</p>	<p>The users see these signs with frustration and disappointment as they feel that it is a lack of professionalism and shows lack of caring for the patients. Users stated that the sheets of paper are so many that end up confusing them even more.</p>
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Table 7 - Findings from the direct observations at the CICAP building of hospital B

OUTPATIENT SECTOR OF CICAP BUILDING – Hospital B			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
<p>1 Poor design of the graphical and physical characteristics of the signage</p>	<p>The exterior directional signage of the services of Urology and Orthopedics is only visible near its entrance. The exterior signage identifying the campus as CICAP is not very visible. The signage placed inside these services, in the reception desks and in the remaining signage is not visible or legible from a “normal” distance, not responding to its purpose.</p>	<p>The colors selected for the signage do not offer the contrast needed and the placement is not the best. The signage has small dimensions and the use of paper sheets inside the plastic supports do not benefit its visibility. The number of signs indicating those services should be higher and be repeated along the path.</p>	<p>The users end up not using the signs and ask for directions to the staff or volunteers available. Since the reception desks are not well-signalized the users end up wasting more time in identifying the respective reception desk and increasing the check-in times. The security guard at the CICAP campus is many times the one who helps the user reaching these services.</p>



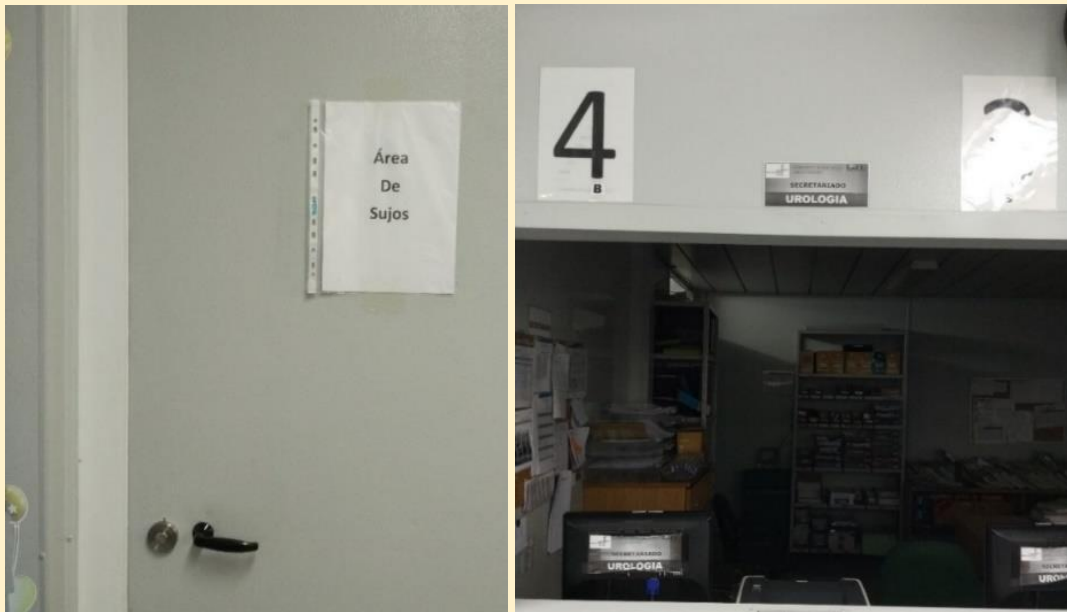


2 Innadequate temporary signs

The staff tried to overcome the lack of signage with paper sheets taped on the doors or walls.

Lack of planning of the signage needed and the fact that those facilities were temporary may also influence. The need for solving the users' navigation problems fastly led to placement of information in an innadequate way.

The users see this as a lack of concern of the hospital with its image and reputation, and also with lack of professionalism. Many users complain about the difficulties in reading the messages on the papers due to dimensions, colors and contrast.



3 Illumination conditions not adequate

Some signage is placed right below the existing lights. Both services are identified in a glass door with red letters that are not so visible with the light levels of the space.

Bad placement of the signage or lights. Poor planning of the signage placement together with all the other elements of the environment.

The users are not able to read the messages and many times they have to get really near the signs to be able to read them.





4 Material Resources

There are three ticket machines at the entrance of the services.

Lack of concern in removing the machines that are no longer used.

The users feel confused about which machine is working, and go to the reception to ask which one they should use. This leads to frustration of some users and an increase of the waiting times.



Table 8 - Findings from the direct observations in the visits' atrium sector at hospital B.

VISITS ATRIUM SECTOR - Hospital B			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Poor design of the graphical and physical characteristics of the signage	The directory that provides information regarding the existing services and their location on the buildings is located behind the security guards at the entrance of the visitors' area. These directories are not noticed by the users and the ones that notice them, end up with difficulties in understanding them.	Bad placement of the directories, probably if they were placed before the entrance and in the middle of the atrium, people would notice. The informational layout on the directories is not well designed and many users have difficulties in distinguish in which floor the service is settled. The use of dark colors in a space that is not well lighted was not a good choice.	The users do not know in which floor the services are settled and many times they end up delaying the waiting line to ask for information.



<p>2 Lack of signage</p>	<p>There is no map available regarding the layout of the hospital and the location of its services. The reception desk for the visits is not well identified.</p>	<p>Lack of planning of the signage and typology of signs needed.</p>	<p>Even with verbal directions provided by the staff or volunteers, the users feel lost because they have no basis for creating the mental map of the building. If a synthetic map was available, users would be able to create a mind-map of the building to guide and locate themselves in the space. As the reception desk is not well identified many users end up on the line to enter the building without making the check-in for the visit.</p>
<p>3 Lack of maintenance and updating of the signage</p>	<p>The signage indicating the direction of almost all the services, which is located after the entrance door to the visits, is poorly designed and organized, and many information is in need of maintenance and updating.</p>	<p>Bad design and layout of the information displayed. Lack of maintenance and update. The later addition of some elements to the sign created an information overload.</p>	<p>The users end up lost, while looking for services that do not exist anymore or that are located in a different place. They get confused because the updated information given by the staff is different from the one presented on the signs, which is outdated. This leads to waste of users' time, frustration and a feeling of dissatisfaction with the service.</p>



Table 9 - Findings from the direct observations in the outpatient sector of building number 7 at hospital C.

OUTPATIENT SECTOR OF BUILDING NUMBER 7 – Hospital C			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Ticketing system is misleading	The ticketing system is organized through the reception desk number that is associated with specific services. Only reception numbers 1 and 3 are working; however, the calls of the tickets are only made for desk number 3. Some services designations on the signs differ from the ones displayed on the tickets.	Lack of updating of the ticketing system available. There was no updating on the information indicating the services for each reception desk displayed above the ticket system. There is inconsistency in the designations given on the signage.	Users get confused about which reception desk they should go to when called. This leads to an increase on waiting time for check-in. Some users do not know the meaning of the scientific nomenclature, or they get confused if the service that is mentioned on the ticketing system is the same they want. This leads to users questioning the staff working on the reception desks, and consequently, to delays in the check-in process.



2 Lack of signage

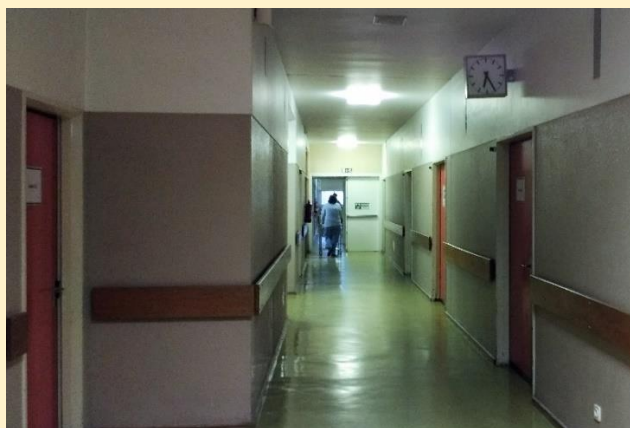
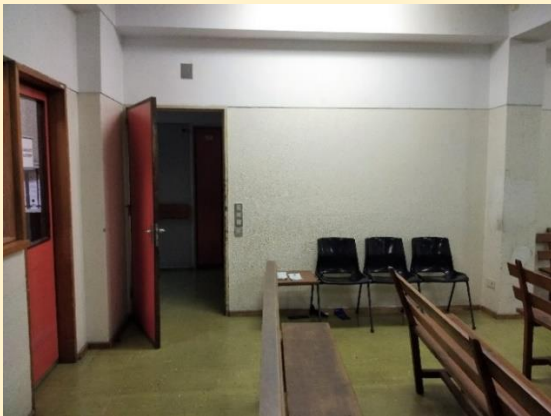
The numbers of the medical offices are indicated through paper sheets taped on the doors or at the entrance of the service. There is no indication of the location of the medical offices in the waiting room. The illumination levels are extremely low which causes even more difficulties in reading the information on the paper sheets.

Lack of an adequate signage system, that should be placed perpendicular to the medical offices doors. The medical offices location should be indicated through directional signage, not only at the entrance of the services, but also in the waiting rooms and main connections. The light levels should be higher, the space is

The users get lost while trying to find the medical offices, and many of them go directly to the reception desks, when they are called for the consultation, to ask the location of a specific office. This leads to waste of time not only by the patients, but also by the doctors and staff working on the reception desks. Some users end up in different areas of the

extremely dark, which makes it even more difficult to notice the signs available. It is obvious that an adequate signage is missing and that a study of which signs and where they should be placed was not made.

building looking for the medical offices, which creates dissatisfied users.



<p>3 Graphics and placement</p>	<p>The majority of the users have extreme difficulties in reading the paper sheets placed above the ticket system. Some users have to get really near the signs to read the information displayed. In the main corridor there is no indication of the waiting room, it is only placed inside the waiting room.</p>	<p>The dimensions of the letters used on the signs are extremely small and jointly with their location and illumination conditions, it ends up creating difficulties for the users. The signage indicating the waiting room should be available at the main entrance of the services and not inside the waiting room.</p>	<p>Most of the users end up in the corridor of the medical offices because they think that it is the place where they should wait. This results in difficulties in the circulation of people and resources in this area, and users end up frustrated as they do not have a place to seat and as, there is no benches on those corridors, people have to wait standing. The majority asks for informations to the staff and volunteers.</p>
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<p>4 Exterior Signage</p>	<p>The locational signage indicating the buildings numbers is extremely small and not placed correctly.</p>	<p>The colors selected for the identification signage are not functional, and the fact that these signs are</p>	<p>The users get lost looking for the right building, and most of the times end up entering the wrong one.</p>
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Some of the buildings do not have any visible designation. The signage, for example indicating the outpatient area, is extremely small and in poor maintenance conditions.

suspended but extremely near the ceiling, does not help its legibility. There is a lack of informational and directional signage on the exterior of the buildings, the implementation of a directory could be a way to overcome those problems. Furthermore, there is a lack of maintenance of the few signage available.

Many users come back to the main entrance to ask the security guard where the building they are looking for is. This causes delays to the users and the waiting times increase. Some of the signs, as they are not visible, go unnoticed by the users.



Table 10 - Findings from the direct observations in the visits' atrium sector at hospital C

VISITS' ATRIUM SECTOR – Hospital C			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Lack of orientation signage available	There is no map of the hospital layout for the users to create a mind map of the space. Some services do not appear in the directory at the entrance of the visitors' atrium. Many people do not notice this directory. Only in the first floor the information regarding the services working in each floor is provided.	Lack of planning of signage and typology of signs needed. There is an absence of information update. The directory location is not the best as it is located on the right side of the entrance of the visitors' atrium instead of being in front of it or suspended on the ceiling. Inconsistency of the information presented.	The users have no idea that this building is where the visits are settled. Users frequently end up in other sectors of the building asking for directions, which leads to waste of time not only for them but for the staff as well. They feel confused and frustrated with the lack of information available and end up lost in the hospital campus looking for the visits area.





2 Floor
identification of
services

On the ground floor there is no signage indicating the services that are settled on the remaining floors. On the first and remaining upper levels this indication is made through a paper sheet taped next to the elevator or on the elevator doors, together with plates on the outside of the elevator as well. The signage at the entrance of the area that provides access to the floors is cramped and with small letters.

There is a lack of a directory after the door that provides access to the stairs and elevators. The design of the graphic elements and the location of the signage is not the best one. Lack of planning of the locational and directional signage needed.

The users do not know which floor to go for the visits of a specific service. They have to come back to the entrance to ask for directions to the security or in the information desk. The users end up associating these problems with a lack of professionalism and mindfulness of the institution. They have to spend more time to go to their destinations, since there is no indication of what floor it is. On the ground floor as well.

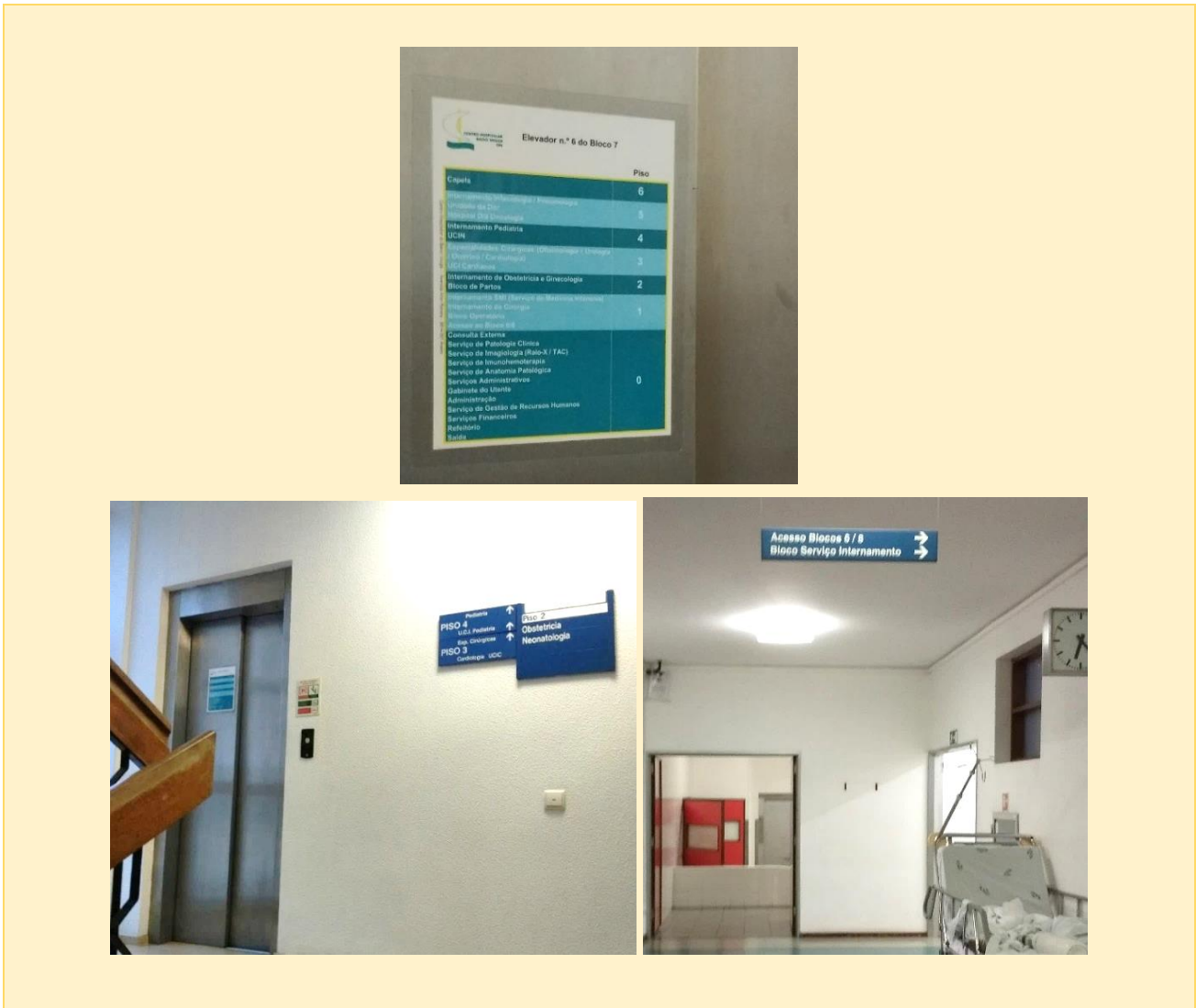


Table 11 - Findings from the direct observations in the outpatient sector with the new signage system at hospital D

OUTPATIENT SECTOR WITH THE NEW SIGNAGE SYSTEM – Hospital D			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
1 Graphical and location characteristics of the signage	The designations of K1, K2 and K3 seem to help people navigate in that area of the building; however, some elderly people seem to get even more confused because there is no identification of	There is no identification of the services available in that area concomitantly with the designations K1, K2 and K3. This new signage is only available in a specific area of the outpatient department,	Some users, mainly the elderly, seem to have even more difficulties in understanding this new signage system, and many times they go to the reception desk to ask in which area a specific service is settled.

the medical services available in each area. The K1 area is only for check-in; however, almost all the users do not know this and go straight to K2 or K3 to check-in. This results in users waiting in the line of the reception desks of the K2 or K3, when they should go to K1 waiting lines in the first place.

which can lead to some difficulties of the users in learning and interpreting the new system. There is a lack of information and signs indicating that the users should go to K1 before to check-in in the machines. The only one that exists is placed right beside the registration machines and the users seem to not notice it when they enter the outpatient area.

Some users go directly to K2 or K3 as they think they should do the check-in there. Commonly they are sent back to K1 for registration in the machines. Some users feel confused due to the fact that the old signage has the services designation and the new one does not. One possible solution would be to provide the information about the procedures to take in the day of the appointment to the users when scheduling the medical appointment.





2 Ticketing and check-in system

The elderly seem to experience a lot of difficulties in understanding how the ticketing system works and in understanding the ticket.

The ticketing system is electronic. Although most of the times there are volunteers available to help, for the elderly this system is extremely complex. Maybe the availability of the volunteers in this area should be bigger. The ticket is a conjunction of letters with numbers, with no logical sequence of call.

Most of the elderly people end up in the reception desks of K2 or K3 areas asking for the staff available to make their registration, as they are not able to use the machines. When waiting for being called, the tickets make the users extremely confused as they do not know if its them who are being called, or if they were called already. Maybe the call of the users should also be audible through their names.



<p>3 Location of information</p>	<p>Some of the users that have to leave the waiting rooms for small periods of time, for example, to use the restrooms, when they come back they do not know if they were called already or not.</p>	<p>The monitor indicating the tickets already called is extremely fast due to the quickness with which the patients are called by the many doctors that work in each sector. These monitors are only available in the waiting rooms; however, some of the amenities, like the restrooms, are in the main corridors, where these monitors are not visible.</p>	<p>The users have to go to the reception desk again when they come back to the waiting room, stand again on the waiting line, to ask if they were already called or not. This leads to delays in the reception desks and in some medical consultations to which the users arrive late, since they do not know if they were called already.</p>
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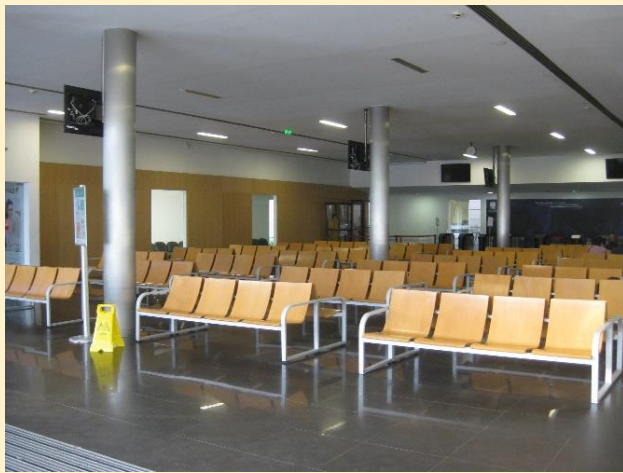
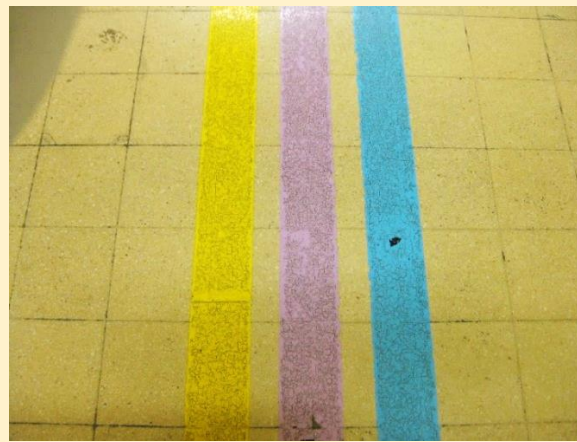
Table 12 - Findings from the direct observations in the visits' atrium sector at hospital D

VISITS' ATRIUM SECTOR- Hospital D			
PROBLEM	OBSERVATION	CAUSE	CONSEQUENCE
<p>1 Complementary wayfinding systems</p>	<p>The lines on the floor serve well the purpose of guiding the users; however, they are already in need of maintenance.</p>	<p>There is a lack of maintenance of the lines used to guide the users. The planning of the signage needs, and its</p>	<p>Although these lines provide more autonomy to the users in their navigation, they end up asking for information to</p>

Some users that enter for visits look for something that will give them more information like, for example, a directory or more directional signage.

typology missed the need of a directory at the entrance of the visitors' atrium not only for the people that go there to visit someone, but also for many people that use that entrance to go to the outpatient area.

the staff available as the directional and informational signage of this space is scarce. At first, the users feel autonomous in their tasks, but then, they have to lose that autonomy when asking for directions.



2 Lack of exterior locational signage

The entrance has no indication that it is where the entrance is made for the visits. Some users use also this entrance to go to the outpatient area. The only indication that this

Lack of informational and locational signage. There is a lack of a more inclusive signage, mainly, for many elderly users that come alone to the hospital.

The users that go to the outpatient area through this entrance, have to make a most extensive path. And the opposite also happens, as there are people arriving to the outpatient area and

entrance is where the entrance for the visits is made, is already inside the waiting room for the visits.

looking for the entrance of the visits. The users end up asking for information and frustrated to have to walk a bigger path.



<p>2 Adittional information</p>	<p>The atrium has a screen that shows some adittional information regarding the public transportation schedules and the waiting times for those transports. There is a lack of signage indicating the services that the hospital provide together with their locations.</p>	<p>The availability of this information is extremely useful for most of the people, as the majority uses the available public transportation. The atrium should have a directory together with a map in order for the users to create a mind-map of the layout and to facilitate their wayfinding inside the building.</p>	<p>The users consider the availability of the information regarding the public transports as a sign that the hospital cares about their wellbeing and their needs. Although they feel a little bit lost when they arrive to this building entrance as they do not know were the services they want are settle or the procedures to visit someone in the inpatient sector.</p>
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The findings from the direct observations seem to be in accordance with the opinions collected from the questionnaires, as the users' difficulties result mainly from problems in the physical and graphical characteristics of the signage, its placement locations, the quantity of information that is displayed, and the maintenance conditions of these elements.

With the direct observation method, it was possible to perceive that sometimes the signage is not the problem. Many of the users prefer to ask for directions instead of following the available signs, and many of them, even if they consult the signs available, they need the reassurance of the verbal information provided by the staff and volunteers. So, it is possible to confirm that this is a natural and common behavior among the users of healthcare settings, since this behavior was observed in all the hospitals.

Although this was a common and recurrent behavior among the users, the observations allowed to verify that many of the users were able to autonomously find their way inside the settings with the help of the available signage. However, even when they were able to find the intended destination, they were faced with a lot of challenges and difficulties resulting from problems in the signage system.

The biggest problems and difficulties were related to the physical, graphical and placement characteristics of the signs, and they were mainly observed among people that were stressed or in a hurry to arrive to their destinations, and among the elderly. Those users experienced several difficulties in reading and interpreting the signs due to:

- **Lack of legibility and visibility of the signage caused by typography, letter size, colors used on the plates and on the text displayed.**
- **Placement of signage in places with lack of visibility resulting from the lack of planning in the placement of the signs and the overload of information that some places have due to, for example, the temporary signage placed after the permanent signage.**
- **Lack of use of other methods to enhance reading and visibility, mainly colors to reinforce textual descriptions or directional symbols, use of symbols, and colors to differentiate the services.**
- **No usage of complementary wayfinding systems like, for example, based on colors for each service or units of services, lines with different colors on the floor or walls to guide the users, and availability of maps or directories in specific paths and intersections of corridors.**

The improvement of such characteristics will provide the users with a much more pleasant journey and experience of the service, as they will feel more autonomous and confident of their own navigation capabilities. Other important result from the observations was the difficulty that the users felt in following the signage that was placed in locations where other temporary signage or advices were placed after. The placement of temporary information can be made due to numerous reasons, but the

main cause is to place it to overcome the lack of signage available. The staffs' intentions when placing the signage that is missing through papers taped on the doors or walls is good. However, most of the times, the result is that these paper sheets indicating directions end up being mixed with other typology of information, for example, information of advices or procedures.

Through the observations, it was possible to perceive that many users end up confused about this temporary signage or ignoring them as they think the paper sheets are related to other types of information rather than directional information. Most of the users claimed that these types of information should not be mixed, and that there should be specific places and design typologies for placing temporary warnings or information about procedures rather than the paper sheets indicating directions. Some of the users have also seen these problems as a lack of care and professionalism of the institution, as they feel that a mindful planning of the information was not made by the hospitals.

Other extremely important observation was the lack of maintenance of the signage available that brought many problems to the users. This gap resulted in many users finding themselves lost in the buildings because they were following information of the signs that was outdated, or because the signage was missing information that was once there, or also because complementary systems such as the lines on the floor were already worn out and end up leading nowhere.

Through the observations, it was possible to conclude that the main problems on the signage result from two main gaps.

The first one is the lack of planning in the early stages of the design process of the signage system to apply. In this planning, a careful organization of the layout of the building should be made together with a complete study of the signage needs, the typology of signs, the type of information that should be displayed and most importantly, the locations in which those signs should be placed. This early planning will save considerably money to the institutions in a long-term and will help reduce the users' navigation and wayfinding problems. At this stage, including users and testing solutions with them, can be a good way to reassure that the planning is done correctly.

The second gap is the maintenance of the available signage systems. All the hospitals at some point, revealed problems that resulted from the lack of maintenance of specific signs available. The regular maintenance of such signs is not only important due to the problems of wayfinding of the users using the settings, but also due to costs to the institution. A regular maintenance of these systems will allow the institution to save money, as maintaining a signage system is cheaper than if the hospital has to replace the all signage available due to outdated or degradation conditions of the existing one.

These two main problems observed through the direct observations, seem to be the ones that most impact the users' journeys and wayfinding capabilities, and the ones that make most impact on the financial and reputation aspects of the institutions.

4.5. WRITTEN INTERVIEWS

At the beginning of the study, the aim was to perform written interviews with members of the staff or volunteers. However, during the study in the first hospital (hospital A – Santa Luzia, Viana do Castelo), it was perceptible that most of the wayfinding difficulties of the users were solved by the volunteers available, as the staff members often referred the volunteers to solve the users' problems.

Thus, the written interviews ended up being applied to the volunteers available at the hospitals as they were the ones dealing directly with the users' wayfinding difficulties.

The interviews were constituted by six questions, which were the following:

1. In which area of the hospital do you perform your volunteer work?
2. Considering your role at the hospital, what are the most common wayfinding difficulties in which the users most require your help?
3. In your opinion, in the area in which you perform your duties as a volunteer, what are the most critical areas in terms of the signage systems available?
4. What is your opinion regarding the signage system implemented in the place where you perform your duties? What problems do you think that exist?
5. Given the difficulties that sometimes the users experience in finding certain destinations, and considering the characteristics of most of the users that come to the facilities (elderly users), what suggestions would you make to improve the signage system?
6. Do you consider that the existing signage system meets the needs of the users visiting the settings?

In hospital A – Santa Luzia (Viana do Castelo) we gathered a total of seven interviews from the members of the volunteers, hospital B – Santo António (Porto) provided also seven interviews, hospital C - Infante D. Pedro (Aveiro) delivered only four, and finally hospital D – São João (Porto) provided a total of eight fully answered interviews. The opinions retrieved from the written interviews were translated into requirements, which are presented from Figure 120 to Figure 123.

4.5.1. RESULTS FROM THE INTERVIEWS

HOSPITAL A – Santa Luzia, Viana do Castelo, PORTUGAL

Clarity and Simplicity of Information

- Signage for inclusive purposes (disabled, ageing, illiterate, visually impaired – use of complementary systems like colors or symbols).
 - Clear and simple information identifying services/departments/amenities (simple nomenclature, easy to interpret).
- Clear identification of the current floors and services available in those floors.

Signage Standardization

- Renew, update and redesign the existing signage available.
- Create consistency among the signage and information displayed (standard design of the signs across the all hospital setting).

Physical and graphical characteristics

- Improve signage visibility (location, illumination, dimensions, colors).
- Improve visibility and legibility of text (typography, font size, text style).



Density and Quantity of Information

- Maps and directories available along the settings (“your are here maps”, directories of services in each area, colors and symbols).
- Improve signage at the entrances (locational and orientation signs, maps and directories with paths to follow and services locations).
- Increase the number and repetition of signs (key decisions points).

Complementary Graphical Elements

- Signage that captures the patients attention (colors, dimensions, illumination, graphic features).
- Colors associated to each floor , sector, or service/units of services).
- Use of complementary systems (lines or arrows on the walls, ceilings, or floors, areas painted with specific colors per services, color-add systems for color blind, emergent technologies).

Human and Physical Resources

- Information and help desks should be available throughout the hospital.
- More staff and volunteers available to help the users (in their guidance and on the new technologies available).

Figure 120 - Diagram of the opinions obtained from the interviews performed at hospital A

HOSPITAL B – Santo António, Porto, PORTUGAL

Clarity and Simplicity of Information

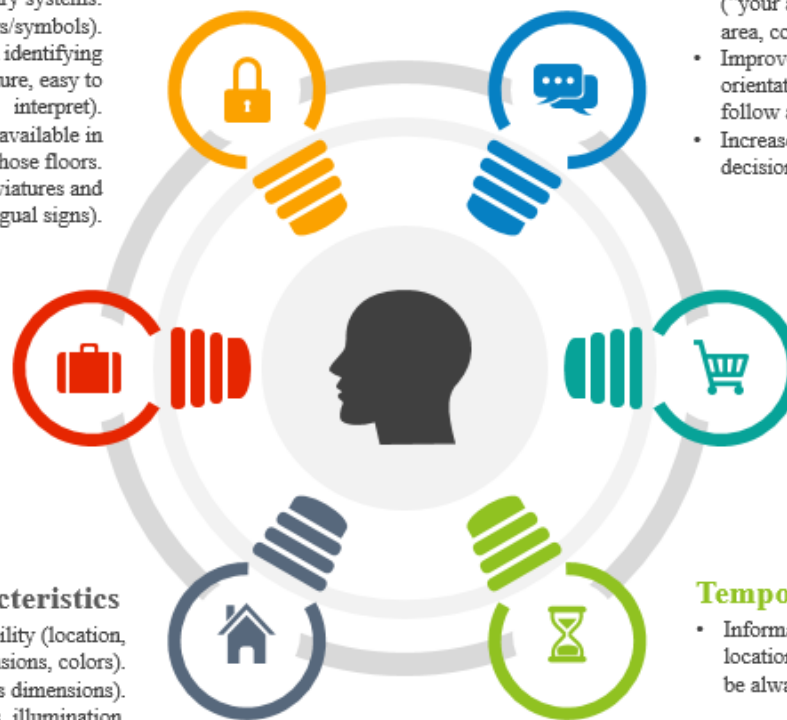
- Signage for inclusive purposes (disabled, ageing, illiterate, visually impaired – use of complementary systems: colors/symbols).
 - Clear and simple information identifying services/departments/amenities (simple nomenclature, easy to interpret).
- Clear identification of the current floors and services available in those floors.
- Simple terminology and designations (avoid abbreviations and scientific terms, bilingual signs).

Signage Standardization

- Renew, update and redesign the existing signage available.
- Create consistency among the signage and information displayed (standard design of the signs across the all hospital setting).

Physical and graphical characteristics

- Improve signage visibility (location, illumination, dimensions, colors).
 - Increase signage size (plates dimensions).
- Improve signage contrast (colors, illumination, text font and size).



Density and Quantity of Information

- Maps and directories available along the settings ("your are here maps", directories of services in each area, colors and symbols, complementary systems).
- Improve signage at the entrances (locational and orientation signs, maps and directories with paths to follow and services locations).
- Increase the number and repetition of signs (key decisions points).

Complementary Graphical Elements

- Signage that captures the patients attention (colors, dimensions, illumination, graphic features).
- Colors associated to each floor, sector, or service/units of services).
- Signage with symbols associated to services and other areas of the hospital.

Temporary Information

- Information regarding changes in service locations and other changes on the settings should be always available and visible to the users).

Figure 121 - Diagram of the opinions obtained from the interviews performed at hospital B

HOSPITAL C – Infante D. Pedro, Aveiro, PORTUGAL

Clarity and Simplicity of Information

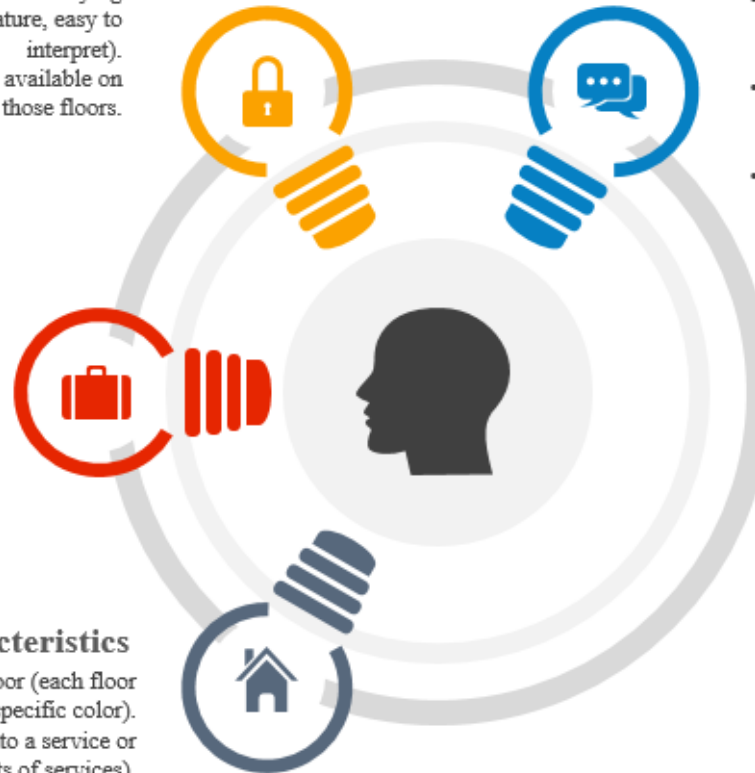
- Clear and simple information identifying services/departments/amenities (simple nomenclature, easy to interpret).
- Clear identification of the current floors and services available on those floors.

Signage Standardization

- Renew, update and redesign the existing signage available.

Physical and graphical characteristics

- Colors associated to each floor (each floor with a specific color).
- Colors on the signs associated to a service or units of services).



Density and Quantity of Information

- Maps and directories available along the settings (“your are here maps”, directories of services in each area, colors and symbols, complementary systems).
- Improve signage at the entrances (locational and orientation signs, maps and directories with paths to follow and services locations).
- Increase the number and repetition of signs (key decisions points).

Figure 122 - Diagram of the opinions obtained from the interviews performed at hospital C

HOSPITAL D – São João, Porto, PORTUGAL

Clarity and Simplicity of Information

- Signage for inclusive purposes (disabled, ageing, illiterate, visually impaired – use of complementary systems: colors/symbols).
 - Clear and simple information identifying services/departments/amenities (simple nomenclature, easy to interpret).
- Clear identification of the current floors and services available in those floors.
- Improve letter sent to the user (give emphasis to information that can help them navigate inside the settings).

Signage Standardization

- Renew, update and redesign the existing signage available.
- Create consistency among the signage and information displayed (standard design of the signs across the all hospital setting).

Physical and graphical characteristics

- Improve signage visibility (location, illumination, dimensions, colors).
 - Increase signage size (plates dimensions).
- Improve signage contrast (colors, illumination, text font and size).



Density and Quantity of Information

- Maps and directories available along the settings (“your are here maps”, directories of services in each area, colors and symbols, complementary systems).
- Improve signage at the entrances (locational and orientation signs, maps and directories with paths to follow and services locations).
- Increase the number and repetition of signs (key decisions points).

Complementary Graphical Elements

- Signage that captures the patients attention (colors, dimensions, illumination, graphic features).
- Complementary wayfinding systems (lines or arrows on the floors, walls, or ceilings, areas painted with colors per services, color-add systems for color blind, emergent technologies).

Temporary Information and Human Resources

- Information and help desks available throughout the hospital settings.
- Technological systems should be 100% functional (ticketing system, check-in, etc.).
- More staff or volunteers available to help the users (on their guidance and on the use of new technological systems).

Figure 123 - Diagram of the opinions obtained from the interviews performed at hospital D

4.5.2. FINDINGS AND DISCUSSION FROM THE WRITTEN INTERVIEWS

The interviews conducted in the four hospitals, seem to corroborate the findings from the questionnaires and direct observations performed. Like the other users of the facilities, the volunteers also stated the same problems and suggestions for the signage systems available.

The interviews revealed, that the problems pointed by the volunteers were related to seven main topics:

1. The physical and graphical characteristics of the signage;
2. The need for standardization of the signage features;
3. The need for clear and simple information displayed on the signs;
4. The concerns with the density and quantity of information displayed;
5. The use of complementary systems of wayfinding;
6. The temporary information;
7. The human resources available.

As these volunteers are more familiar with the settings, they do not experience difficulties in such a high level as the remaining users. However, sometimes they have huge difficulties in guiding the users, due to the problems on the existing signage that difficult the accuracy of the verbal information given to the patients and visitors.

Similarly to the results obtained from the questionnaires and observations, the volunteers corroborate that the main wayfinding difficulties come from the physical, graphical, and placement characteristics of the signage available, from the density and quantity of information displayed, and also from the maintenance and updating conditions of the signage.

4.6. PHOTOGRAPHIC RECORDS

In this section, a comparison grid is presented that shows the similarities of the problems or best-practices regarding the existing signage of three analyzed hospitals (A, B and C). Hospital D was not included in this analysis as the study performed in this hospital was related to the new signage implemented on a specific area that was renewed. Photographic records, also the ones associated to hospital D, through which the comparisons were made available in Appendix B.

Table 13 - Comparison grid of three of the analyzed hospitals regarding some of the best-practices for designing signage systems

Text Formatting		Hosp. A	Hosp. B	Hosp. C
1	Use of a sans serif or with non-obstructive serif typeface	+	+	+
2	Use of a typeface with a large x-height	+	+	+
3	Use of a typeface with distinguishable upper and lower cases	+/-	+/-	+
4	Use of a typeface with appropriate height	+/-	+	+/-
5	Use of a typeface with consistent thickness of stems	+	+	+
6	Use of a Regular style typeface	-	+	+
7	Use of a consistent and suitable letter and word spacing	-	+	-
8	Use of a typeface color that stand out from the background	+	+	+/-
Alignment and Grouping		Hosp. A	Hosp. B	Hosp. C
1	Left aligned text	+/-	-	+/-
2	Text aligned according to direction and number of destinations	+	-	+/-
3	Arrows/symbols consistently positioned and associated with text	-	+	+
4	Ordered or grouped by alphabet/function/direction/floor/etc.	+	-	+
Hierarchy of Information		Hosp. A	Hosp. B	Hosp. C
1	Present info in a logical and sequential layout	+/-	-	+/-
2	Key destinations at the top or highlighted	-	+/-	+
3	Secondary info lower on the sign	-	+/-	-
Emphasizing Information		Hosp. A	Hosp. B	Hosp. C
1	Colors to highlight groups of info	-	+/-	-
2	Larger typefaces to give emphasis to important information	+	+/-	+
3	Emphasis through variations in scale	+/-	+/-	+
4	Emphasis through position of elements	+/-	-	+/-
5	Lighter colors to less important information	+/-	+/-	+/-
Quantity of Information		Hosp. A	Hosp. B	Hosp. C
1	Directional signs with a maximum of 5 destinations	+	-	-
2	Number of signs available is adequate	+	-	+/-
Language and Terminology		Hosp. A	Hosp. B	Hosp. C
1	Avoid long and difficult to pronounce terms	+/-	-	-
2	Descriptive plain names are used	+/-	-	-
3	Avoid acronyms or abbreviations	-	-	-
4	Symbols together with textual explanations	+	-	-
5	Use of common terms instead of scientific	-	-	-

6	Terms used consistently in all signs	-	+/-	+
Symbols		Hosp. A	Hosp. B	Hosp. C
1	Makes use of symbols/letters/numbers (not only for amenities)	-	+	-
2	Arrows and symbols are clearly linked to the terms they refer to	-	+	+
3	Simple symbols, legible, high contrasting colors, similar design	-	+/-	-
4	Larger than the textual descriptions	-	+	-
5	Symbols with consistent styles, colors, shapes, and backgrounds	-	+	-
6	One symbol per message	-	+	-
7	Combined with text	-	+	-
Colors		Hosp. A	Hosp. B	Hosp. C
1	Consider the colors of the institution	-	-	+/-
2	Contrast between colors of text and background	+	+/-	+/-
3	Stand out from the environment	+	+/-	+/-
4	Not confused with colors for regulatory or safety signs	-	+	+
5	Consistent from sign to sign	-	+/-	+
6	Red only on emergency signs	-	+	+
7	Colored lines on the floor with high contrasting colors when more than 2 directions are displayed	+	+	-
8	Used for departments or differentiation of service units	-	+/-	-
9	Use of no more than 5 colors on signs	-	+	+
Position and Dimensions		Hosp. A	Hosp. B	Hosp. C
1	Clearly visible from direction of approach	-	+/-	-
2	Surroundings of sign area free of visual clutter	+/-	+/-	+/-
3	Viewing angle comfortable on all signs and above head height	+/-	+/-	+/-
4	Do not place them directly above stairs/ escalators/ ramps	+/-	-	+/-
5	Consider vegetation growth	+	+/-	-
6	Over-head or eye-level position	+	+	+
7	Primary or secondary information should be overhead	+/-	+	+/-
8	Detailed or lower hierarchy information should be eye-level	+/-	+	+/-
9	Signs with a lot of information in places that allow its legibility	+/-	+/-	+/-
10	Double-sided or multiple-sided for signs approached from more than one angle	-	-	-
11	Position near the eye-level (1400 - 1700 mm from the ground)	+	+	+
Illumination		Hosp. A	Hosp. B	Hosp. C
1	Ensure glare is not produced on the signs	-	-	-

2	Ensure shadows do not degrade legibility	-	-	-
3	Ensure light does not obstruct or obscure vision	-	-	-
4	Avoid over lighting	+	+	+
5	Illuminated text increases legibility and visibility	-	-	-
6	Do not position signs in front of windows or similar sources	-	+	+
Materials and Finishes		Hosp. A	Hosp. B	Hosp. C
1	Use a matt finish or a gloss factor of no more than 15%	+/-	+/-	+
2	Allow for easy maintenance, removal, and replacement	+/-	+/-	+/-
3	Rigid or semi-rigid materials	+	+	+
4	Waterproof materials on outside signage	+	+	+
5	Opaque or semi-opaque with no bright materials	+/-	+/-	+
6	Allows message changes	-	-	-
Total of +		19	26	24
Total of -		30	20	25
Total of +/-		18	21	18
Total of categories		67	67	67

4.6.1. FINDINGS AND DISCUSSION FROM THE PHOTOGRAPHIC RECORDS

According to the analysis performed, it is possible to say that the problems in the signage systems of the three analyzed hospitals A, B and C, are particularly similar, as the results do not differ deeply from each other. Hospital B – Santo António (Porto) is the hospital with more positive correspondences with the guidelines evaluated, followed by hospital C – Infante D. Pedro (Aveiro), and finally by hospital A - Santa Luzia (Viana do Castelo). The signage available at hospital A is the one with more negative evaluations.

As hospital B is a bigger hospital when compared to hospitals C and A and has already suffered a lot of rearrangements and expansions over the years, it was expected that the users would find it to have a less functional and effective signage system. However, hospitals A and C have more negative points in their signage design and implementation than hospital B. Conceivably, this is due to the fact that they are smaller hospitals, with less population visiting the settings, and so they are more unaware of their users' needs in terms of wayfinding. Through the photographic records of each hospital (in Appendix B), it is possible to understand the reasons that led to the evaluations made.

4.7. SUMMARY

The current chapter presented the findings obtained from the quantitative and qualitative methods used in this study. The main purpose of using these methods was to gather the users' opinions and perceptions regarding their experience about the available signage systems, and to gather their behaviors when interacting with the signage available. Also, through the use of such methods, the investigators tried to see if the demographic characteristics, such as age, gender, and educational level, had some influence on their evaluations of the signage and on their behaviors when using that signage.

Through the questionnaires applied in **hospitals A, B, and C**, it was possible to verify that there were many similarities in the evaluations and perceptions of the users of each hospital regarding the signage available. The main findings are that, the majority of the users evaluate the signage as good, but in the end, almost all of them provide suggestions for improvements related to characteristics that they previously evaluated as good. Gender, age, and educational level, were found to influence some of the answers given by the respondents, which indicates that certain graphical and physical characteristics of the signage have to be tested in a real-context and with real end-users in order to better understand how the users with different demographic characteristics will react to the design.

In hospital D, the questionnaire applied was different since this institution has already developed a redesigned signage system that was already implemented in one of the sectors of the outpatient area. When comparing the new signage available with the old signs, the users evaluated the new signage as better than the old signs in almost all the evaluation criteria, which were based on the ones used for the questionnaire of hospitals A, B, and C. It can be concluded that the new signage design of this specific hospital is following the correct direction as it seems to have solved many of the wayfinding problems of the users.

The direct observations allowed to identify many of the difficulties of the users when interacting with the signage. The main difficulties found were due to: lack of legibility and visibility caused by the poor design and placement of the signage, which resulted in users going in wrong directions or having to stand right below the signs to read them correctly; temporary information, which in many cases is outdated, placed right next to the permanent information and that caused a lot of confusion in the users that do not know which information they should follow; and lack of differentiation between the spaces of each medical unit, that many of the users referred that will help them know if they were in the right place or not. Besides these difficulties, the observations revealed a default behavior on the majority of the users, that even when the signage was available and visible, they asked for directions to the staff. This is a common behavior already referred in other literature,

which leads one to believe, that even when the information is available, people like to have the reassurance of the verbal information.

The written interviews with the volunteers and the grid of comparison of photographic records conducted of each of the institutions, were found to corroborate the findings obtained by the previous two methods.

The volunteers pointed out the huge difficulties that they have when guiding the users throughout the settings, mainly due to the poor location, and to the physical and graphical characteristics of the signs that do not help their work. They also referred the lack of consistency of the signage design, and mainly the problems that arise from the lack of updating and maintenance of these structures. The comparison grid built concerning the studied hospitals, also corroborate the findings from the previous methods as it is possible to confirm that many of the negative evaluations given in the previous methods, i.e. by the respondents of the questionnaires, the volunteers, and the behaviors observed in the direct observations, are visible in the photographic records obtained from each of the hospitals studied.

The findings from these methods together with the literature and guidelines available on the topic, constituted the basis from which the guidelines presented on the next chapter were developed and created.

CHAPTER 5 • THE GUIDELINES

This chapter presents the expected main outcome from this study: the guidelines developed throughout this project. It is divided in ten subsections, each one related to specific characteristics of the signage or with specificities of the elements that can influence the signs available.

In the beginning of each subsection regarding each specific aspect of the signage, general information regarding the element or characteristic under analysis is presented. Following this general information, recommendations on what to do and what to avoid are provided, and some examples are presented to enhance the comprehension of the established guidelines.

5.1. INTRODUCTION

The guidelines presented in this chapter were developed with the aim of providing a broader perspective of the signage development in the healthcare settings, not only due to their importance for the wayfinding system of such institutions, but also due to the impact that they have on the users' perspectives of the overall service experience, as observed in the questionnaires and observations conducted to the users in the four studied hospitals (chapter 4) and through the literature review presented in chapter 2. These guidelines try to answer the ongoing needs for signage systems, specifically for the healthcare sector, in order to cater for all the users that make use of these facilities. The resultant guidelines were based on existing guidelines, regulations, literature on the topic, and most importantly, on the users' opinions extracted through the research conducted during this project.

The developed guidelines are not a strict prescription for the design in all healthcare institutions signage systems, rather they are intended to provide a full scope of the best-practices and key considerations when designing those. Each institution has its own specific needs of signage, and therefore, this chapter should be consulted as a guideline to be adapted to each case, and not as a specific rule to be followed strictly. These guidelines are intended to assist on the improvement of the users experience of these types of services. Their purpose is to:

- Provide a resource to assist the design and development of effective signage systems through theoretical and practical information gathered in literature available regarding the topic and through the results of a research study conducted in four healthcare settings in Portugal;
- Provide a framework to understand the good practices for designing and implementing a signage system for healthcare;

- Give specific information and guidelines to enable the developers of these systems to create solutions that suit their particular situations – these guidelines should not be seen as a strict rule, but as tool to adapt to each specific case;
- Establish the steps and characteristics that should be considered in the design of the physical and graphical elements of the signage;
- Identify existing useful guidelines to use together with these recommendations – standards, regulations, guidelines created for specific healthcare institutions, etc.;
- Presents the users perceptions and opinions on what constitutes a good signage system that helps satisfy their wayfinding needs and demands, through the results of the research study conducted in four healthcare settings of Portugal.

These guidelines were developed for every professional involved in the design and implementation of signage systems for healthcare settings. Amongst these professionals, it can help support the work of decision-makers and people working with signage systems for healthcare facilities on a daily basis, whom are responsible for managing patient experience or health outcomes, building maintenance, etc. The main stakeholders which could be interested in using this guideline include: Administrators; Planners; Architects; Engineers; Interior designers; Landscape architects; Healthcare delivery staff; Estates and policy makers; Patient service managers; Sign manufacturers; Institutions interested in improving their users' wayfinding experience and in reducing wayfinding costs; Other people involved or interested in the design and implementation of effective signage systems.

These recommendations and guidelines can be used in more than one situation and with more than one purpose, including the following situations:

- When the intention is to build a brand-new healthcare facility, and the overall signage system needs to be planned, developed and implemented from root;
- When redesigning, upgrading or modifying an existing healthcare setting which can benefit with improvements or modifications (planning renovations or small-scale changes);
- When conducting a quality auditing to identify possibilities of improvements;
- When checking if the signage system complies with the existing legislations;
- When planning ongoing management and maintenance of the overall signage system.

As these guidelines can be applied in many situations, they can be a useful resource in many stages of the process: During the early design, during construction and when making changes in the

facilities. It does not cover recommendations for specific complex areas of the healthcare facilities, such as emergency and inpatient areas which recall for different signage specifications and needs. It is focused on the signage systems for outpatient areas, such as the ambulatory, in which the users, i.e. patients, visitors, staff, etc., are free to circulate inside and outside the building. Also, the guidelines do not cover the signage that is not part of the wayfinding system, such as regulatory, safety, prohibition and advisory signs.

5.2. GUIDELINES ON TEXT FORMATTING

5.2.1. SELECT A TYPEFACE AND A TYPE STYLE

The efficiency and efficacy of the signs depends, among other factors, on the legibility and easiness of interpretation of the displayed written messages. When planning the information content of a sign, the text and the way it is displayed to the users, becomes a crucial aspect to plan as it will affect the overall efficacy of the written message.

For the text to be correctly interpreted and read by the users, its design should study the typeface style that is adequate to the sign and to its legibility by the user, the appropriate size of the selected typeface and the design of an adequate layout and alignment of the information. The text should be styled in a clear and consistent format through all the settings and changes in these characteristics should be considered only when enhancing the delivery of the written message.

A careful choice of such characteristics can make all the difference between delivering a poor wayfinding information to the users that will leave them lost and confused inside the settings or delivering a well-designed message that will make them feel autonomous and confident of their navigation capabilities.

The typography and type style are one of the most important elements of signage design, mainly because, nowadays, most of the information is still presented through words rather than just through symbols or images. For that reason, the selection of a specific typeface is key to the visual appearance of any sign program. There is no single prescription for selecting a typeface or a type style. Some typefaces or type styles provide more legibility than others, but other may be more convenient to a signage system due to other characteristics. Many typefaces that are very readable with an adequate font for extended reading are not very legible with individual characters uneasily recognizable.

When selecting a typeface that is appropriate for the signage system of a specific setting, there are four factors that can be used to help this selection, such as the formal fittingness, i.e. how well the typeface suits the project, visually and stylistically, the stylistic longevity, mainly the suitability and

longevity of the style over the years – some typefaces are timeless, the legibility, i.e. the easiness to read with characters that are quick to recognize and interpret, and the compliance with specific guidelines such as guidelines for inclusivity of disabled users.

Each typeface and type style has its own character and suggest certain associations that have to be compatible with the purpose and facility typology to which the signage system is being developed. Many of the default typefaces and type styles available in a computer are easily readable in other formats rather than signs, since in a signage system the written message needs to be readable from a distance. For this reason, a testing period of the selected typography is advised, together with a control and evaluation of its style and of the entire system to verify its interpretation and legibility rates by the users, which means testing its efficacy.

All types of typefaces can be divided in two main groups: “serif” and “sans serif”. Serifs are defined as the saliences or ledges at the top, bottom and/or termination of the letters, that provide them a more classic design.

Regarding the type style, each typeface can have different weights and styles, different thicknesses of the letter’s rods, and different “x-height”. The “x-height” is the distance between the baseline and the mean line of the lower-case letters, and it is called that way because is typically the height of the letter “x” in the font, Table 14.

Table 14 - Existing weights, type styles, and text styles of the existing typefaces

<u>Weights of the typefaces</u>			
• Regular	• Light	• Bold	• Extra Bold
<u>Type styles of the typefaces</u>			
• Regular	• <i>Italic</i>	• Condensed	
<u>Text styles of the typefaces</u>			
• UPPERCASE	• lowercase		

5.2.1.1. RECOMMENDATIONS AND AVOIDANCES

Select a sans serif or non-obstructive serif typeface:

- Typefaces with prominent serifs are less legible on signs than sans serif typefaces, Table 15.

Table 15 - Example of a serif and sans serif typeface

Serif typeface	Sans serif typeface
Garamond	Arial

Select a typeface with a large x-height:

- Typefaces with smaller x-heights are less legible on signs as the difference between the upper and lower characters is not prominent, and they make the text look smaller, Figure 124.

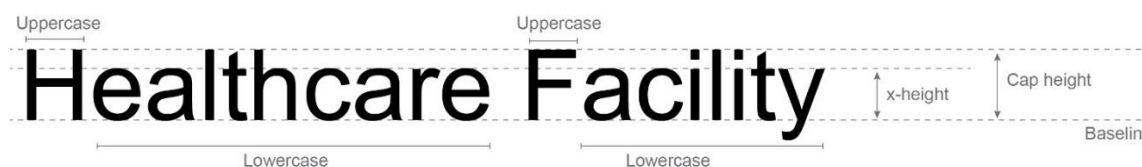


Figure 124 - Example explaining the x-height of typefaces

- The distance at which the sign will be observed, and the possible visual impairments of the users, will influence the selection of a typeface with a big or small x-height, Table 16.

Table 16 - X-height to each specific viewing distance

Viewing dist.	8	12	1	24	36	48
x-height (mm)	20	30	4	60	90	120

*Based on a x-height: viewing distance ratio of 1:400.

Select a typeface with distinguishable upper and lowercase characters:

- In some typefaces, the characters are extremely similar and so they are less legible on the signs:

Arial typeface: Letter “I” in uppercase is “I”, which is similar to the letter “L” in lowercase: “l”

Select a typeface with an appropriate weight:

- Light weights are more difficult to read from long distances, particularly when the light levels of the settings are low, Figure 125. Too bold weights can be confused with black blocks on the signs which difficult the identification of each character.
- Use bold for primary information and regular for secondary information.

Healthcare (Calibri Light) Healthcare (Calibri)

Figure 125 - Light and regular weights of a typeface

Select a typeface with consistent thickness of the stems:

- Thinner stems are more difficult to read.
- Select a typeface with consistent thick stems as they are more legible, Figure 126.

Health **Health**
Franklin Gothic Typeface: Thick stem more legible Corbel Typeface: Thin stem less legible

Figure 126 - Example of consistent thickness of typefaces

Select a regular type style for your typeface:

- The use of italic or condensed type styles reduces the legibility of the sign messages.
- The italic style is particularly difficult to read by people with visual impairments.
- A selection of the regular style is preferable, Figure 127.

Regular *Italic* Condensed

Figure 127 - Type styles of the typefaces

Use uppercase for the first letter of the word, lowercase for the remaining:

- Use of all letters in uppercase is not advised as it reduces the speed and easiness to read the word.
- For emphasizing information first consider other methods rather than capitalizing all the information.
- Use uppercase for the first letter of the word, and the remaining letters in lowercase because it creates more distinctive character shapes.

Select a typeface with consistent and suitable letter and word spacing:

- Typefaces with irregular spacing between letters and words will be more difficult to read than typefaces with consistent spaces between these elements.
- Some examples of typefaces suitable for signage, and ubiquously used in effective systems are: Franklin Gothic, Frutiger, Myriad Pro, Arial Regular, Helvetica and Univers, Figure 128.

Franklin Gothic Arial Regular
Frutiger Helvetica
Myriad Pro

Figure 128 - Examples of typefaces suitable for signage

Select a color for the typeface that stand out from the background color of the sign:

- Analyze the levels of light (natural or artificial) and the glare on the locations where the signs will be implemented in order to select colors that will contrast and provide maximum legibility to the text message.
- Characters and signs should be eggshell, matte or any other non-glare finish.
- Characters in a light color on a dark background or in a dark color on a light background are recommended.
- Ensure maximum contrast between the text color and the color of the signage plaque, Figure 129.



Figure 129 - Example of contrast between the text color and the background color of the sign

- Consider the symbolic meanings of certain colors when selecting the colors to use on the signs.
- Consider the following good and bad examples of typefaces legibility, Figure 130.

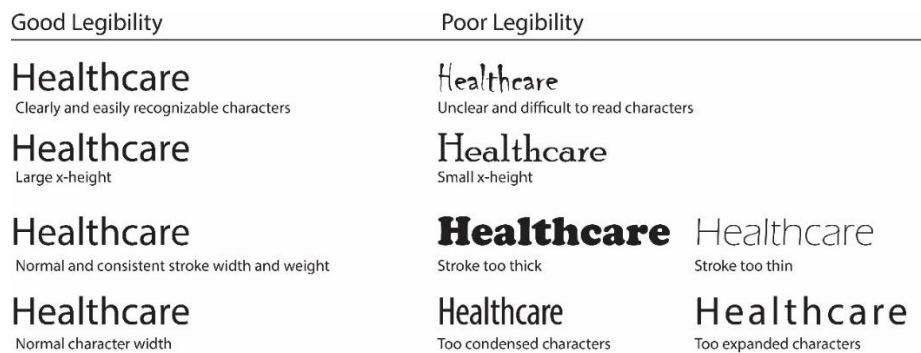


Figure 130 - Examples of good legibility and poor legibility of typefaces (adapted from Cooper (2010))

5.2.2. SELECT AN ADEQUATE SIZE TO THE TEXT

There are many factors that influence the selection of the adequate size of a chosen typography. The text size is commonly influenced by the typology of sign in which the text will be implemented, whether it is a directional, locational/identification, or orientation sign, the typology of users reading the message, i.e. visual acuity, the legibility of the selected font and also the implementing location in relation to the viewers of the signs and its illumination conditions.

As already mentioned, one aspect that is fundamental when selecting the appropriate size of an elected typeface is the typology of sign in which it will be used. Each type of sign has different orientation purposes, and for that reason it will be used in many different viewing distances and angles. Therefore, there is a need to analyze the types of signs and how they will be implemented, and in which locations they will be settled before selecting the typeface size.

Other major aspect is the typology of the users that will use the facilities and that will look for information on the signs. The visual acuity and other visual and mobility disabilities must be considered, as for example, one user with visual disabilities may need a larger font that other users with a healthy vision.

As with the typology of users, the context in which the text will be inserted and the purpose it will serve, will also be a factor in the size decision. The letterforms can be categorized in four different contexts or purposes: reading, driving, walking or environmental.

The reading letterforms are those used in text or captions for orientation map kiosks or for interpretative signs, and so they do not need to have a large size format. The driving letter forms are those suited for drivers, and so they need to be large enough to be seen when driving and looking for easy to read information. The walking letterforms are those used in signage for pedestrians, mainly in directional signage in exterior or interior public spaces. Last, but not least, the environmental letterforms are the ones scaled at an extreme level in order to have a maximum effect in busy public areas like for example the highways.

It is extremely important that the mentioned factors are analyzed to help selecting an adequate size for the chosen typography, and also critical is testing its legibility and size in the real context of use.

5.2.2.1. RECOMMENDATIONS AND AVOIDANCES

Select a sans serif typeface with a large x-height:

- A regular and clearer font can accommodate smaller text sizes, while condensed fonts need larger text sizes to be read from a distance.
- Different typefaces have different x-heights and viewing distances. Ensure that the typeface selected is tested for legibility before implementation, Table 17.
- With the same text size, a sans serif typeface with a large x-height is recommended since it is more legible than a serif typeface with a small x-height.

Table 17 - Examples of viewing distances for Health Alphabet typeface

x-height	Viewing distance (healthy vision – acuity of 6/9)	Viewing distance (partially sighted – acuity of 6/60)	Recommended sign typology
15 mm	Up to 7.5m	No more than 0.5m	Directories
30 mm	Up to 15m	No more than 1m	Door identification
40 mm	Up to 20m	No more than 1.5m	Internal identification and directional signs

x-height	Viewing distance (healthy vision – acuity of 6/9)	Viewing distance (partially sighted – acuity of 6/60)	Recommended sign typology
60 mm	Up to 30m	No more than 2m	Internal and external signs
90 mm	Up to 45m	No more than 3m	External identification and directional signs
120 mm	Up to 60m	No more than 4m	Identification signs
200 mm	Up to 100m	No more than 7m	Fascia signs

Select a typeface with a consistent stroke weight and width:

- Typefaces with light strokes will need larger font sizes to achieve the same legibility of a typeface with thicker strokes or of a bold one.
- Typefaces with rounded lowercases are preferable because they are bigger than nonrounded typefaces, so they require smaller text sizes.

Consider the users’ speed travel:

- According to the typology of sign and the purpose it serves, the signs will need bigger or small letters.
- Consider that, for example, a sign for drivers will need larger letters than a sign for pedestrians, as the speed of travel and the need for information is different.

Analyze the illumination conditions of the site:

- Poor lighted areas will need larger text sizes on signs to achieve the same viewing distances as the signs in properly illuminated areas.
- Ensure that the site is properly lighted in all stages of the day, whether by natural or artificial lights.
- It is extremely important to test the light levels on the site before deciding the type size needed.

Consider the position at which the signs will be implemented and the typology of signs:

- Suspended signs normally need larger text sizes than those at the eye level.
- The typology of the signs demands different viewing distances and so they may need different text sizes in order to be read properly, Table 18.

Table 18 - Recommended dimensions for Arial typeface

Viewing distance (m)	Type size (cm)
8	4
10	5
15	7,5
20	10
30	15

Select high contrasting colors:

- High contrasting colors will require smaller font sizes as they will provide more legibility at common viewing distances.
- When the contrast between the text color and the sign plaque is minimum, a larger type size will be needed to achieve the same result as with high-contrasting colors.
- High contrasting colors are also important for inclusivity of users with visual impairments, as the contrast helps these users to differentiate the elements on the sign. Ensure that you test the colors with these types of users, or that you use available tools to test the colors before implementation.
- The *Palleton* webpage² provides a tool that helps select a color palette for different purposes, and it can simulate how the colors are viewed by people with different visual impairments.

² <http://palleton.com/#uid=72W0u0ko0D5aNSPihKjT-Uuy-o3>

5.2.3. CREATE AN APPROPRIATE ALIGNMENT, GROUPING, AND LAYOUT

Not only typology of typeface, type style, and the text size, but also layout and grouping style of the text is crucial to convey the needed clarity and legibility on healthcare signage. The arrangement of the information layout and the use of ways to group information into simpler layouts, is the way to achieve a signage system that is comprehensible and flexible enough to accommodate as many messages as possible without becoming chaotic or confusing to the users. The layout format and arrangement of information should, therefore, account for the maximum quantity of information planned to any given sign type.

When programming the layout and arrangement of information on a given signage type, the most important aspect to study in the early stages is the amount of information needed on that sign. Each type of sign has limitations in terms of the space available and consequently the amount of information that it can entail.

When looking for information, users want to spend the least time possible finding their destinations on the signs and therefore, they tend to quickly examine the information available. The speed with which the user finds the information he needs depends on the alignment, grouping and layout of the information content which influences this task. When they do not find the information they need, users tend to look for an alternative source of information, for example, by asking the staff available for information, which increases costs with time spent by the staff in providing directions instead of doing other work.

The text alignment concerns the way the text is lined up with the vertical axis. There are four types of possible alignments of the text, such as: left aligned, right aligned, centered or justified in the support. The layout of the information content is not only concerned with the text but also with the symbol's alignment with the text available, such as arrows or pictograms.

5.2.3.1. RECOMMENDATIONS AND AVOIDANCES

Select left aligned text arrangement:

- The majority of the people read from left to right, which is why left aligned text is a better choice for signage within public services such as healthcare.
- Sentences with less than five words should be aligned left.
- Be consistent with the arrangement of the text in all signs available (left or right aligned, justified or centered), Figure 131.

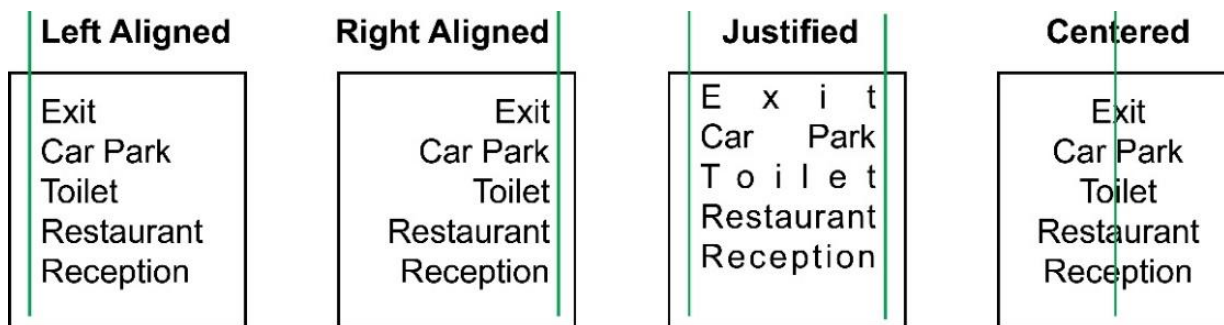


Figure 131 - Possible arrangements of text on the signs

Align the text according to the destination’s direction and to the number of destinations:

- If the destinations are at the right of the sign, align text to right, which emphasizes the direction that people need to follow; If destinations are at left, align at the left side of the sign – Align the text or arrows to the travelling directions, Figure 132.

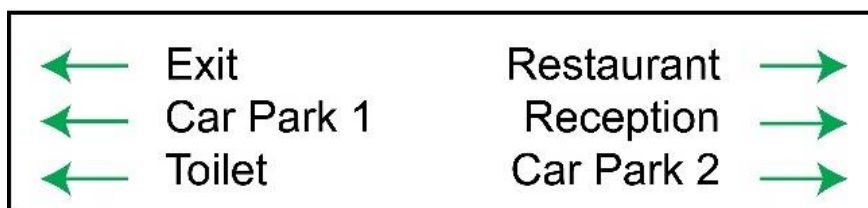


Figure 132 - Alignment of the text on the signs

- Align the text or arrows with the travelling direction: Arrows placed at the left side of the sign when pointing to left and on the right side when pointing to right.

Position arrows or symbols consistently throughout the all signs and clearly associated with the information to which they refer to:

- Place arrows or symbols consistently in all signs at same locations and in the same style/format.
- Positioned side-by-side: in line with the typography.
- Positioned stacked: above or below the textual elements, Figure 133.

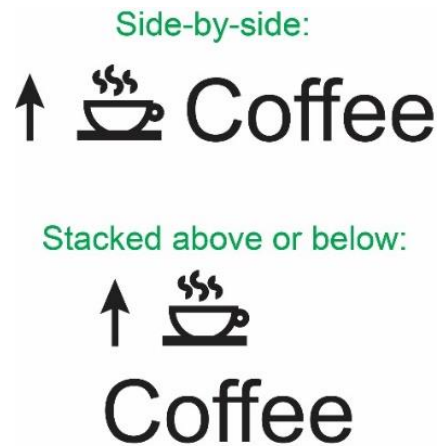


Figure 133 - Position of symbols relative to text

The information layout should account for the space of the sign:

- The layout format proportions need to account for the maximum quantity of information that is programmed for each specific sign.
- In the horizontal alignment, the graphic and typographic elements can be arranged at left, right, or centered.
- In the vertical alignment, the elements can be at the top, center, or bottom of the sign.

Grouping the information:

- For longer lists of destinations, group them by alphabetical order, function or priority, direction, by floor, by affinity of services, for example, related departments in the same unit under one name.
- Elements like space between the information, the typology of lines, or the colors used can be used to help grouping the information.
- This grouping should be in a consistent order, for example, alphabetical, and with a consistent method of grouping, for example, by function. This method for grouping should be consistent throughout the all settings.

5.3. GUIDELINES ON INFORMATION HIERARCHY AND DENSITY

5.3.1. EMPHASIZING INFORMATION

When there is information to be communicated, there are different degrees of importance related to each piece of information. On signage, the information that the users make more use or need the most is the most important for them, and so it has to be highlighted and extremely noticeable for them to find it quickly and easily.

The emphasis of this most important piece of information leads to a hierarchy of the information displayed that is extremely important to settle the primary and secondary information available, and that can be highlighted through many elements.

To develop an effective method for emphasizing the information, the first step is to identify the key decision points of the settings, the information that is most important on those specific points, and also the information that is not so needed and so should not be so prominent. The most important part when defining the hierarchical system of a specific signage program is to identify the information that needs to be more prominent to answer the users' informational needs.

In a hospital setting in which the speed of understanding is critical, the way the information is organized and highlighted can make the difference on the users experience of the settings. Further the highlight and organization of information, the methods used to do this should be consistent along the settings in order to maintain the good and quick interpretation of the signs by the users.

5.3.1.1. RECOMMENDATIONS AND AVOIDANCES

Use of colors:

- Use of colors to reinforce information. One more prominent color for primary information and lighter color for secondary information.
- Different colors can improve organization and clarity of information.
- Lighter colors on text imply less importance.
- Brighter combination of colors for key information, like for example black and yellow, however, one should be careful with the meaning of some colors; for example, yellow is associated with hazards, Figure 134.

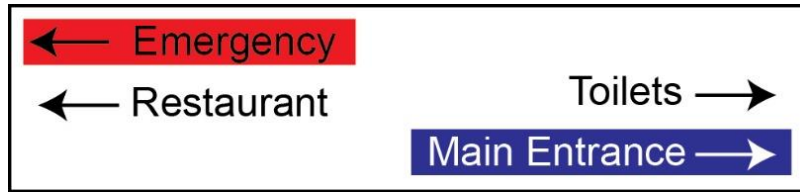


Figure 134 - Use of colors for key information

- White text on dark background or black text on white background.
- Use colors to highlight specific groups of information, for example, the amenities of the setting under one color combination.
- Black or colored text on a block of white.
- Use colors with high contrast between them to create contrast between the text and the background. This will emphasize key information.

Increase or reduce the text size:

- Larger text sizes imply more importance.
- Larger text sizes can give emphasis to key information, Figure 135.



Figure 135 - Different text sizes to emphasize key information

Create importance of information through:

- Variation of scales of the elements.
- Different positions of elements of information related to one another.
- Similar information with the same importance of degree grouped together.
- Symbols next to the destinations to emphasize it.
- The use of bold typeface for key information and regular weight of type to destinations which is less prominent, Figure 136.

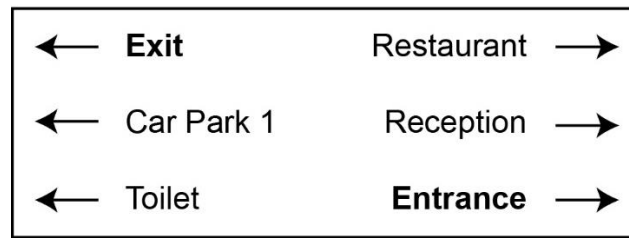


Figure 136 - Use of bold style on the text to emphasize key destinations

- Consistency of the selected method to emphasize the information.
- Key destinations should be listed at the top of the sign and highlighted as primary information. Secondary destinations lower in the sign.

5.3.2. HIERARCHY OF INFORMATION

In almost all the facilities, people need to find certain destinations, some that are more important and other less important for the users. The way this information is provided to the users, determines the quickness and easiness with which the users find the information they need on the settings.

The most important destinations or the ones that are most required by the users, need to be more prominent to be notice, while secondary information that is not so requested can be less prominent in the signage system. To highlight or create an emphasis on the most important information to the users, there are a number of methods and tools that can be used.

When developing the signage system for the facilities, a study of the importance of the information provided to the users, should be made and the key information should be identified. As already mentioned, this key information needs to be more prominent, and to be effectively emphasized, the method to do it needs to be consistent across all settings.

As people usually navigate from general to specific destinations, the signage system needs to be organized in the same way. To develop a sign information hierarchy, a review and analysis of the various destinations that will exist inside the settings needs to be made, and then a ranking of the degree of importance of the information is specified. This ranking will allow the developers to know which information should be highlighted to the users and which information should be less prominent.

5.3.2.1. RECOMMENDATIONS AND AVOIDANCES

Layout of the information:

- The key destinations should be listed at the top of the sign and highlighted as primary information.
- Secondary destinations should appear lower on the sign.
- The hierarchy of information should be logical, sequential, and consistent throughout the all setting.

Ranking of information:

- The first step is to make a list of the existing destinations and their degree of importance, according to the users.
- Rank destinations by order of importance to the users; to know this, the most common journeys of the patients should be studied, and the most used services should be identified.
- The degree of importance should be settled from general to specific destinations.

5.3.3. QUANTITY OF INFORMATION

In institutions such as healthcare settings, where the number of areas and services provided is usually high, the amount of information needed by the users to easily navigate within the settings can be extensive. When developing the signage system that will display the needed information, developers need to analyze the amount of information that has to be displayed, along with the types of signage needed and which information should be included or not.

The first step to take is to identify the number of services and areas of the hospital that require being displayed in the signage, and in which way they need to be displayed: primary or secondary information. Secondly, the typology of signs that will be implemented should be identified in order for the designers to know the space available and the typology of information that should be displayed.

Finally, the selection of the information to display should be made according to the degree of importance, the typology of information, i.e. identification, directional or informational, and the amount of information needed by the users.

5.3.3.1. RECOMMENDATIONS AND AVOIDANCES

Consider the information needed on the sign:

- Including all the amount of information can lead to information overload and communication breakdown, which requires the analysis of the needed information and its degree of importance.
- There is a limit of how much information a person can absorb while circulating inside the settings.
- Consider the amount of space available on the sign and the factors that can constraint it, such as the ceiling heights.
- The message should be clear and concise to communicate the essential information needed by the users.
- Investigate the users' needs of information such as the maps of their common journeys, the common paths used, and the services more required.

5.4. GUIDELINES ON LANGUAGE AND TERMINOLOGY

Nowadays, readiness of circulation and travelling around the globe, has brought considerable challenges to the service industry, and healthcare is no exception. The use of these types of facilities by foreign people brought difficulties in what concerns the language and terminology that is used on the current signage systems.

To overcome such issues, healthcare institutions already use more than one language on their signs, or other additional elements like symbols associated with the displayed message. There are many elements that can be used to overcome the barrier of language, and, although the use of a second language seems to be the most straightforward way to overcome the problem, it can be difficult in some places in which there are more than one language spoken by people and in which there are a large number of non-English speakers.

There are other elements that can be used to help with the language and terminology problem, and they can have less impacts on the dimensions, complexity, and costs of the signage system to develop.

5.4.1. RECOMMENDATIONS AND AVOIDANCES

General considerations for multiple language and dual term signs:

- With more information, the sign size will increase.
- The need for multiple languages or terms will increase the amount of information.
- Ensure the use of appropriate and precise translations.
- Differentiate the languages used or emphasize the most common language (native), Figure 137.

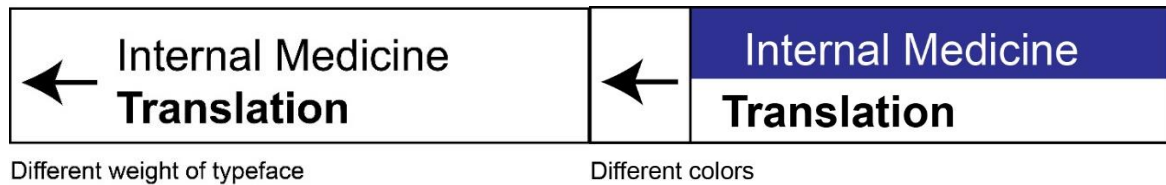


Figure 137 - Differentiation between languages used on signs: multi or dual-term signs

- The use of symbols, maps, and human assistance can help increase the signage communication.

Considerations specifically for dual-term signs:

- These signs can include both medical and common terms associated.

Considerations specifically for multiple language signs:

- Consider the simple and logical layout that these signs should have.
- These signs take up larger spaces than regular ones.
- They are more expensive.
- The native language should be more prominent and take prominence over the English language.
- Do not use more than 3 languages on these signs as it results in ineffective and confusing signs.

Terminology:

- The terminology used on the pre-visit information should match and be consistent with the one used on the signage and on the verbal information given by the staff.
- Avoid clinical names – result in extensive and difficult to pronounce words that can be easily confused and that the users cannot remember easily, for example, orthodontics and orthopedics.
 - Replace them with common terms, for example, the Ophthalmology department can be called Eye Clinic.
- Use plain English and descriptive names.
- Avoid using words and sentences from a high level of reading.

Acronyms and abbreviations:

- Avoid the use of acronyms or abbreviations on the signs as the people who are unfamiliar with the original terms will not recognize or understand them.

5.5. GUIDELINES ON SYMBOLS AND PICTOGRAMS

It is immensely common to see the use of symbols and pictograms on signage systems, and they are normally associated with a piece of textual information. These elements can provide an easily and recognizable form of communicating information since they do not require specific knowledge of reading a particular language. However, symbols are not yet a universal language as they can be interpreted in many different ways and its meaning can be different for different users.

Mainly in healthcare, the translation of medical terms to the form of a symbol is not easy, and even when they are able to be translated to a symbol they can be easily misinterpreted given the huge variety of users with different backgrounds on these settings. However, there are symbols that have already been used so frequently, that their meaning is now easily understood with almost no chance for misinterpretation, as for example the symbols for toilet, coffee, restaurant, and so on.

There are many studies proving that symbols are more effective and efficient than other wayfinding methods as they are easier to see and understand when well-developed and when related to familiar terms. As societies grow and the written languages are developing, the use of symbols seems to be a great method to overcome barriers posed by this evolution.

5.5.1. RECOMMENDATIONS AND AVOIDANCES

Typology of symbols to employ:

- Representational symbols – those that are recognized as the object, term or element they represent.
- Abstract symbols – use an abstract representation of the object, and their meanings usually have to be learned before implementation.

Guidelines and regulations on symbols:

- British Standard 8501:2002.
- ISO 7001:1990 – Public information symbols.
- AIGA/DOT symbol system.
- SEGD and Hablamos Juntos project – Universal Symbols in Health Care Workbook.

General characteristics to consider:

- Symbols should have a simple design.
- Composed by solid areas of color instead of just lines, Figure 138.



Figure 138 - Symbols with solid areas of colors vs symbols with lines only

- Legible from the intended viewing distances.
- Its colors should have high contrast with the colors of the sign.
- Consistent design style throughout the all settings as to color, line weights, alignments, etc.
- Positioned before or after the textual description.
- Avoid using arrows in other signs rather than directional signs.
- They should appear on the pre-visit information given to the users.
- Larger than the text size.

Non-standard symbols design and implementation:

- Some healthcare departments are extremely difficult to translate to a symbol, which leads to associate them with a textual description.
- Symbols can help in understanding the meaning of an unfamiliar term or designation, Figure 139.



Figure 139 - Use of symbols to help explain the meaning of a specific symbol

Test the symbols before implementation:

- Symbols must be tested for recognition and legibility from the intended viewing distances and with a sample of the real users.
- Symbols should conform with the usual understood visual characters.
- Test if they are easy to translate in the verbal directions given by the staff.

Factors influencing the effectiveness of symbols:

- Familiarity of the users with the symbols.
- How complex the symbol is and its meaning.
- The size of the symbol.
- The distance at which it should be viewed.
- The position of the symbol on the sign.
- Its similarity with other symbols.

Alignment and positioning of symbols:

- Always linked to the text to which they are associated.
- Do not use too much space between the text and the symbol.
- Symbols consistently positioned and aligned in all the signs available, Figure 140.

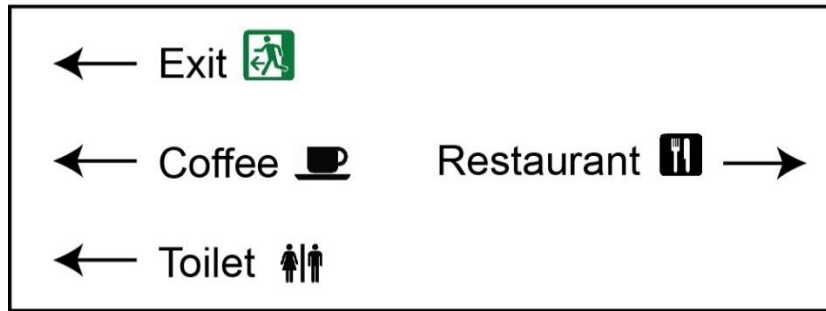


Figure 140 - Example of consistent positioning of symbols on the signs

Symbols usage:

- As complement or as a replacement of the typographic message to reinforce their message.
- In a limited number per sign; commonly, one symbol per message displayed.

5.6. GUIDELINES ON COLORS

Color can be a good element to explore on signage design, however, the colors used, their contrast, i.e. between the color of the text and background of the sign, will enhance or reduce their legibility, their visibility, and the possible reading distances. The use of color has to be done extremely careful in healthcare facilities given the typology and huge variety of users that circulate in the settings, and that possess different vision acuities.

If the developers consider the use of a color-coding system, there is no single prescription of colors combination to use, but there are colors that are more suitable than others to use on signage, mainly due to their high contrast. When considering the use of colors on settings such as healthcare, some elements have to be analyzed and considered.

5.6.1. RECOMMENDATIONS AND AVOIDANCES

Factors to consider:

- Use colors for the text and background of the sign with high contrast between them.
 - Black and white provides 100% contrast.
 - Use dark colors on white background, or light colors on dark backgrounds.
 - Yellow and black combinations are very visible to people with visual impairments.

- Never use yellow with white or other light colors combinations, Figure 141.



Figure 141 - Examples of low visibility combinations of light colors

- Never use black text on dark backgrounds, Figure 142.



Figure 142 - Examples of low visibility combinations of dark colors

- The meanings of certain colors should be accessed before considering them for signage usage such as red that is indicated for emergency purposes.
- Do not use more than 5 colors on the signs as it becomes extremely difficult to distinguish them and to distinguish the degree of importance of each one.
- Consider the users profiles and their visual acuity.
- Colors can be used to differentiate spaces, services, and areas of the healthcare settings.
- Colors can be used to emphasize destinations.
- If the color of the sign does not have enough contrast with the background environment, consider placing a contrasting border on the sign, Figure 143.

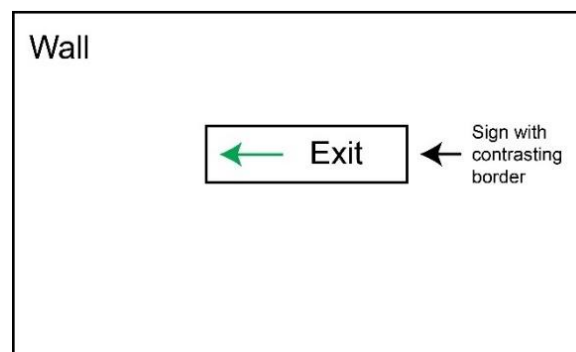


Figure 143 - Example of way to increase the contrast between the sign and the wall

Colors to emphasize information:

- Colors can be used to reinforce information, for example, darker colors on primary information and lighter on secondary.
- Colors can be used to improve organization and clarity of information.

Consistency in their usage:

- Colors used should be consistent from sign to sign, for example, for the people to understand where they should look to receive navigational aids.
- Colors should be consistently implemented and designed when used to highlight information.

Use of colored lines on floors, walls, or ceilings:

- Use them only for point to point navigation.
- Avoid the use of multiple lines with different colors than can look similar to the users.
- Use highly contrasting colors when indicating more than one destination through lines.
- Avoid the use of decorative colored bands on the floors, walls, or ceilings when they are used for navigational purposes.

General considerations:

- Building changes of layout and rearrangements of services, will require a complete change of the color-coding system used.
- Use consistent and limited, high contrast colors with white text on a dark background, or dark text on light color background.
- Use colors that are clearly different from each other to avoid confusion, and distinguishable from the ones used for non-navigational aids.

5.7. GUIDELINES ON POSITIONING AND DIMENSIONS

The positioning of the signage available can have huge impacts on the way users perceive the signs. Its placement can impact the legibility and visibility of the signs, the viewing distances, and the speed with which the message can be read by the users.

When poorly positioned, the signs will end up harming the overall wayfinding system and the navigation capabilities of the users. Its placement should begin with an analysis of the arrival, departure and decision points, circulation paths, and signing opportunities. Then a study of the message that should be connected with each sign should be conducted, and if necessary, a diagram of the positioning of the signs needed should be designed to effectively organize their placement in the existing settings.

5.7.1. RECOMMENDATIONS AND AVOIDANCES

Considerations on visibility:

- All the signs should be clearly visible and noticeable from the directions from which they will be approached.
- To increase its visibility, make sure the sign is not surrounded by visual clutter.
- Do not place the signs directly above stairs or escalators, unless they are intended to direct people to them.
- For the outside signage, consider the vegetation grow.
- Consider the human height angle of vision, Figure 144.

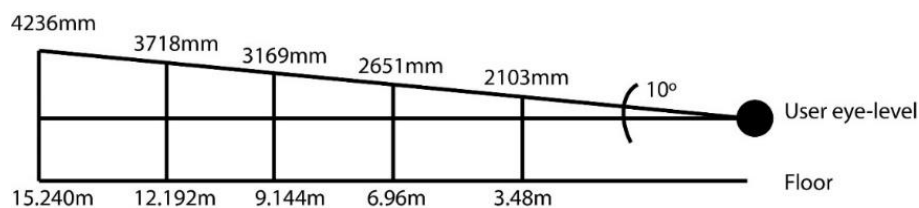


Figure 144 - Possible angles of vision of the user

Considerations on overhead and eye-level signs:

- Overhead signs that usually convey primary information should be placed 1700 to 2100 mm above the floor.

- Eye level signs that convey detailed or lower-hierarchy information should be positioned between 1400 to 1700 mm above the floor.
- In some situations, the repetition of the information can be needed in both overhead and eye-level signs.

Considerations on constraints influencing signage size:

- Can be restricted by the height from the ground to the top of the sign.
- Constrained by the area of the sign.
- Constrained by the hierarchy and quantity of information on the sign.
- Constrained by the viewing angles, distances, and mounting heights.

General considerations:

- Consider the height or space restrictions of the locations in which the sign will be implemented.
- Consider possible obstructions on the space.
- Consider potential illumination problems like insufficient light.
- Consider the distance at which the signs must be viewed.
- Consider the viewing speed at which the users will read the sign while walking.
- Consider the possible directions of approach.
- Consistently position all the signs throughout the environment.
- Consider the common heights of eye-level and overhead signs, Figure 145.

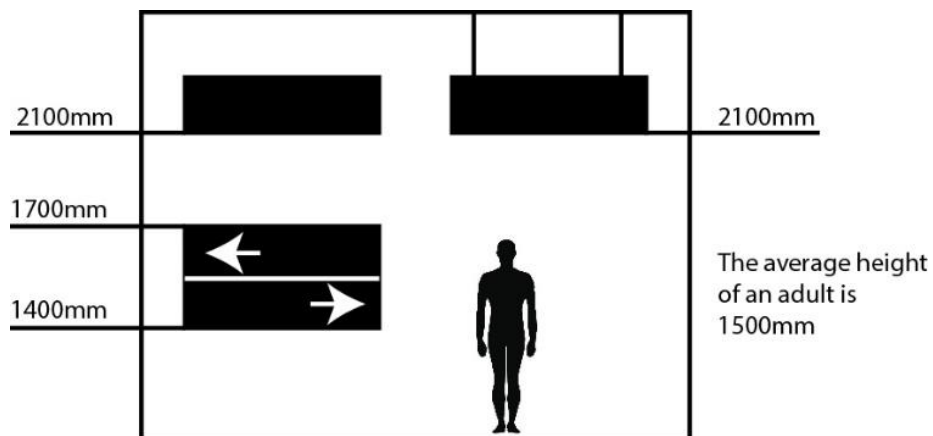


Figure 145 - Reference positioning dimensions for suspended, overhead, and eye-level signs

- Do not place them too high for the users to be able to read them comfortably, and not too low as they will be easily obscured.

5.8. GUIDELINS ON ILLUMINATION

The levels of lighting inside an environment are another aspect that influences the legibility and visibility of the signage implemented, and so it needs to be assessed when designing and positioning the signs.

In terms of the wayfinding system, this element can be extremely important to aid the use of circulation routes, and also to emphasize locations like the main entrances and decision points of a building. Despite its wayfinding function, the illumination levels also play an important role in the safety of the users, as they can harm or benefit the readability of the safety and regulatory signs that keep the users out of the danger zones.

In order to implement an effective illumination on the settings, the developers need to know the variations of the natural light in the areas of the healthcare settings during the day, and in which way it affects the light levels of the different areas. After this analysis, the developers will know the places that will need artificial lights or not.

5.8.1. RECOMMENDATIONS AND AVOIDANCES

General considerations:

- Over lighting areas of the building – the light levels should be consistent and not too bright that will harm the users' visibility inside the settings.
- Avoid over lighting the spaces, switch sides of light positioning from every 22.5 to 30 meters.
- Special lights with colors or with different intensities can be used to highlight important spaces of the services, such as the reception desks of the services or the key decisions points on the circulation routes.

Externally illuminated signs:

- When placing the lights, consider the reflection or glare that it can produce on the sign.

- Ensure that the shadows produced do not harm the sign visibility and legibility.
- Ensure that light does not obscure the users' vision.

Internally illuminated signs:

- Commonly an illuminated text on a non-illuminated background since the illuminated text increases visibility and legibility.
- Illuminating the background can harm the sign legibility as it can produce glare on the sign fascia.

Factors to consider:

- Consider the weather conditions as they will affect the natural light levels and, therefore, the light available in the settings during the day, i.e. the light levels should be consistent.
- Do not position a sign in front of a window or other source of direct light as it will produce bright on the signs and harm its legibility.
- The illumination system must be well maintained.
- Use a matt finish on the signs, or a gloss factor of no more than 15% to reduce the glare and reflections on the sign.

5.9. GUIDELINES ON MATERIALS AND CONSTRUCTION

The construction and materials selection for the signage system is a complex task, not only due to the variety of materials and methods of construction that exist in nowadays, but mainly due to the budgets available and maintenance aspects.

When selecting the materials and the construction and fixing methods, one of the most important aspects to consider is the frequency of maintenance and updating of information, as it will influence the type of fixing system that has to be selected. The material characteristics should also be considered carefully as it will influence the signs legibility and visibility throughout the settings, and it can also be impacted by the illumination selected.

In order to select the most appropriate materials and fixing methods, the involvement of designers and sign manufacturers in the process is extremely important.

5.9.1. RECOMMENDATIONS AND AVOIDANCES

Consider the four typologies of fixing methods:

- Suspended – usually from the ceiling and indicated for buildings with a ceiling height of 2500 mm or above.
- Projecting – Used to identify rooms or departments along the corridors.
- Wall fixed – Can be used internally or externally, with various sizes, and can include diversified information, mainly directional, locational, and informational.
- Post fixed – Usually externally for locational and directional signage.

Factors that influence materials and fixing methods selection:

- Whether the sign will be internal or external.
- Typology and quantity of information to include on the sign.
- Allow for easy maintenance, removal and replacement of information.
- The angle of approach.
- The intended viewing distances.
- The appropriate height.
- The existing budget and the number of signs that have to be implemented.
- The space available and the location at which the signs will be positioned.
- Consider the vegetation grow that can possibly obstruct external signage.
- Consistency needed between the new and the existing signs.

Types of construction methods:

- The single panel signs:
 - They allow more freedom on the layout, are cheaper than slats, can have any size and used on all types of signs.
 - When updating or changing information, the all signage has to be changed.

- The slat system signs:
 - It is easy to change the individual panels and can be used in all typologies of signs.
 - The individual panels size influences its layout, and the availability of standard slat heights can influence its size.
- The finger-post signs:
 - Allow easy changes of the information through changes on the individual slats and are used for directional signage.
 - The standard slat size influences the sign layout and the dimensions of the typographic and symbolic elements used.

5.10. GUIDELINES ON SPECIFIC SIGN TYPES

When developing an effective signage system, special considerations need to be taken into account regarding the typology of signage that is needed to implement, and to do that, its features or functions need to be known. The selection of the sign type must account for the purpose of the information that has to be displayed, and the factors that can aid or harm its legibility and effectiveness should be analyzed.

As it was already mentioned, there are three types of signs: Directional signs, Identification or Locational signs, and Orientation or Informational signs. Recommendations for each type of signage are provided in the next section in order to help selecting the signs and appropriate features that can lead to an effective signage system.

5.10.1. RECOMMENDATIONS AND AVOIDANCES

Directional Signage:

- The existing arrows should clearly indicate a specific direction.
- The arrows should be positioned near and before or next, depending on the direction to the textual designation with which they are related.
- Keep it in good maintenance and update conditions.
- The design style should be consistent throughout the all directional signage as people will easily recognize the directional signage through its design.

- Consistently position directional signage since people will recognize it as directional signage through its positioning.
- Consider that its size will depend on the possible viewing distances and speeds of users travel, Figure 146.

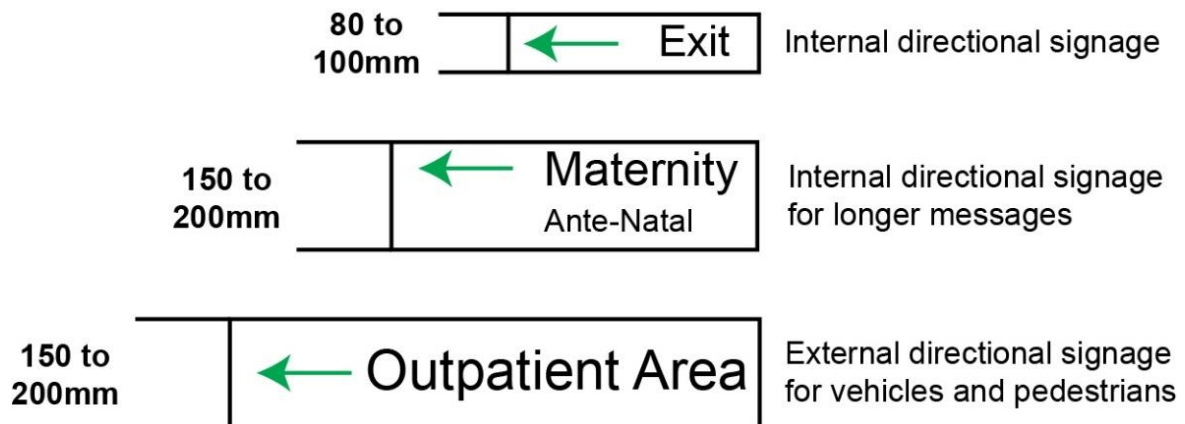


Figure 146 - Possible dimensions of directional signage

- The number of destinations on these signs should be kept to a maximum of 4 to 5 destinations.

Locational or Identification signs:

- Usually located at the destination location to identify it.
- They may have directional signage identifying them or not.
- Their positioning and fixing system should differ from the directional and orientation signage.
- Use colors, styles, and other visual elements, that are different from the ones on the other types of signs.
- The signs referring to doors, for example, as to Services, should be positioned on one side of the door and at eye-level, or perpendicular to the door to be seen from more angles and distances.
- The dimensions of the sign depend on the typographic elements, the viewing distance and the positioning of the signs, Figure 147.

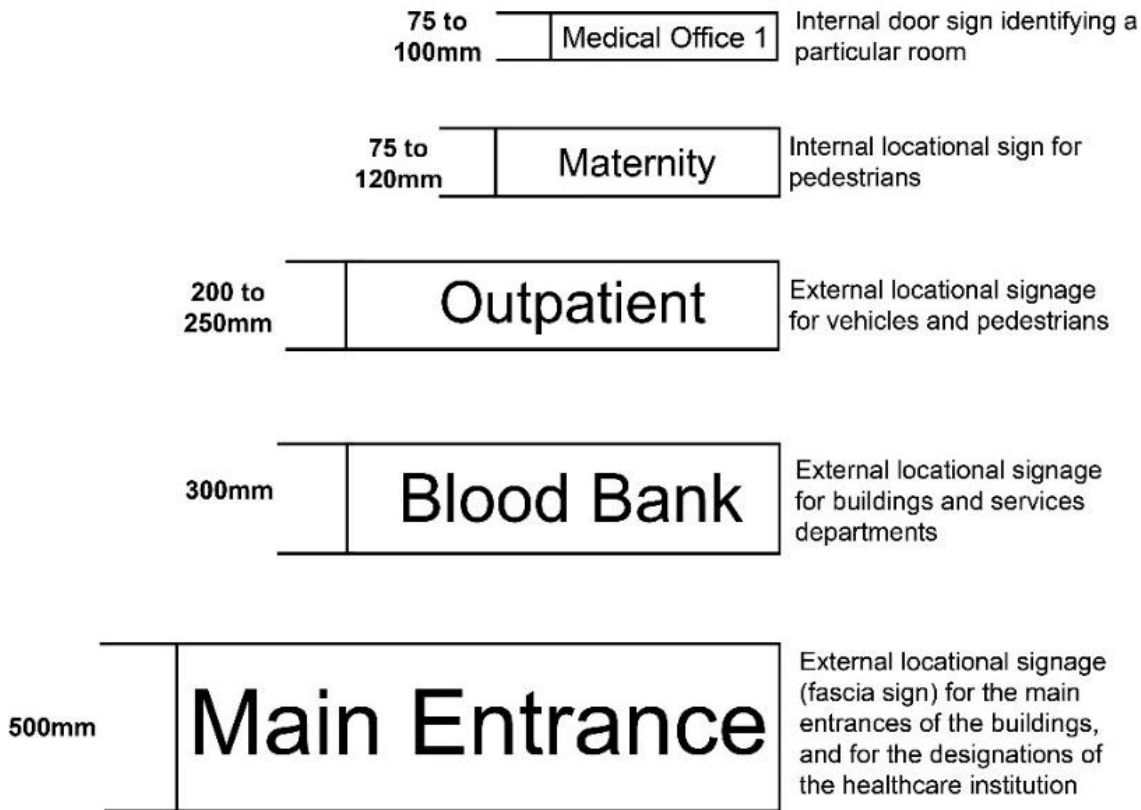


Figure 147 - Possible dimensions of identification/locational signage

Informational or Orientation signs:

- Directories – the most common informational signs:
 - The amount of information displayed is usually dependent on the number of floors and departments on each floor.
 - The information is usually grouped by floor, ordered alphabetically or by function, which helps the users find the information quicker and easier, Figure 148.

FLOOR 1
Emergency Dept.
Inpatient Dept. Wards 1 - 10
Blood tests
GROUND
Main Entrance
Coffee Restaurant Toilets
Outpatient Dept.

Figure 148 - Example of the appearance of a directory of information

- They should be positioned at key decision points such as the start of a circulation route, outside the lifts or near the stairs, and inside the lifts.
- Site Maps:
 - Help people create a mental map of the settings layout and its main circulation routes.
 - They can be implemented on the settings and can also be sent to the user together with the pre-visit information.
 - Factors to consider: the illustrative style, the use of color, the scale, the levels of detail, the text size, the inclusion of the existing landmarks and the level of light in its location.
 - They should be placed in places that allow its noticeability and legibility without obstructions.
 - It helps if they are located in key decision points.
 - Its position should be made with the same orientation of the building.

5.11. SUMMARY

This chapter presented the recommendations gathered from the literature and based on the information collected through the research methods applied in four Portuguese healthcare institutions, and that resulted in guidelines concerned with the following aspects:

1. Text formatting;
2. Information hierarchy and density;
3. Quantity of information;
4. Language and terminology;
5. Symbols and pictograms;
6. Colors;
7. Positioning and dimensions.;
8. Illumination;
9. Materials and construction; and
10. Specific sign types.

Concerning the information gathered throughout this work from which the guidelines presented on this chapter were created, it was obvious that the characteristics that most impact the users' experience are related to text formatting and symbols, pictograms, and colors. Hence, in order to effectively work and comply with its function, the signage system needs to consider the guidelines and recommendations presented here regarding each aspect of the signage.

Also important, as was mentioned throughout the guidelines presented in this chapter, is the need to evaluate the design developed in a real context of use with real end-users, as this will bring a more accurate perception of what is missing or over-considered in the design developed. These guidelines, as already mentioned, are not a strict rule and they should be adapted to each institution needs, and if needed, they should be modified to suit each site requirements.

To conclude, this chapter provided guidelines together with examples of what to do and what to avoid when considering each graphical or physical element that composes a signage system, and therefore, it can be used as a useful resource by developers and implementors of new or renewed signage systems.

CHAPTER 6 • CONCLUSIONS AND FUTURE WORK

6.1. FINAL CONCLUSIONS

Healthcare services are evolving at a very fast pace, and with this evolution, users are becoming more aware and more active in their healthcare experience. One of the elements that has influence on the users' service experience is the way they are involved with the service environment and the easiness with which they navigate inside that environment, which is mainly related to the wayfinding system. Currently, within this wayfinding system, one element that can aid or harm the users' wayfinding experience is the signage system, the way it is designed and implemented throughout the settings. Hereupon, **the present project aimed to contribute to the existing guidelines on designing effective signage systems for healthcare, now including the users' perspectives and opinions on the subject in order to provide the users with an active role in the development process.**

To reach the intended results, three objectives were settled at the beginning of the current project: I) Exploring the existing research articles, recommendations or guidelines, books, and other documents on the topic, concomitantly with other literature on related areas, such as graphic design, interaction design, and so forth; II) Conduct an on-campus research in exemplificative Portuguese healthcare settings to collect the users' opinions, perceptions, and suggestions for improvements on the existing signage; III) Develop a set of guidelines based on the literature reviewed and on the research conducted with those users.

The first phase of the **literature review** constituted an extremely relevant part of this project. This phase was fundamental to understand the dimension of the signage design topic and the major influence that its design can have on the service provision. Through this review and analysis of the existing information on the topic, it was possible to acknowledge the impact that signage systems can have on the wayfinding and navigation behaviors and difficulties of the users inside the healthcare settings. It has also allowed the absorption and deepening of areas, as graphic design, interaction design, and user experience design, that can and should influence the way these signage systems are designed and implemented on these services. At this stage, the goal to collect the maximum of information related to the topic. However, it should be mentioned that certain literature and guidelines may have not been included in the conducted study due to limitations in their access, as some were not free accessible to the public. Nonetheless, an effort was made to extend the research on the topic to the maximum possible, to include significant evidence.

The collected literature was equally imperative to the conception and implementation of the **research methods** used to collect the voice of the users, not only because it settled the basis for many

of the questions to answer, but also because it was helpful to understand and observe many of the problems and consequent user behaviors of these systems on the analyzed Portuguese healthcare settings.

The research conducted on four Portuguese settings, allowed not only to retrieve the users' opinions and perceptions, but most meaningfully to observe their interaction behaviors and difficulties when using these systems. The questionnaires implemented, and all the observations made, were crucial to the development of the resulting guidelines and additionally to provide a broader perspective of how the users interact and react to the problems on these systems. In addition to the theoretical information provided on the guidelines, perhaps the most interesting and enlightened part of the accomplished research is the direct observations conducted, as they show a different and more complete perspective of the existing problems of these systems.

The **resultant guidelines** are not intended to be a substitute of the existing theoretical information that already exists on the topic, but rather an addition and a compilation of the guidelines and literature that already exists. The contribution of this work is, besides the compilation of the guidelines presented in the end, the provision of the results obtained on the research conducted on the four Portuguese institutions that can be relevant for the readers to identify similar problems or deficiencies in their settings.

Together with the limitations on the access to specific literature, also the research conducted in the healthcare settings suffered with limitations posed by the institutions. Apart from the long time that it took to get the needed authorizations from the Ethical Commissions, the needed guarantees of confidentiality and anonymity from the users, posed constraints to the research.

As video records were not allowed during the direct observations, some of the behaviors may have been lost during the observations, and conceivably certain observations described could have been more complete and even more accurate, if was possible to look to video records of the conducted observations.

Nevertheless, **even with the limitations that were found during the overall development of this project, it should be emphasized that the objectives previously defined at the beginning of this research were successfully achieved.** Given the constraints of time that resulted mainly from difficulties in getting the authorizations to perform the studies on the institutions, there is additional research that can be considered for future works.

6.2. FUTURE WORK

Concerning the overall developed project, it is possible that the results obtained can be enriched by future work.

First, in pursuance of testing the guidelines that were created, one could consider action research. The development of a signage system mockup that would be based on the resulting guidelines from this project, and possibly implemented in one of the studied hospitals, could be a way to evaluate the guidelines. The aim would be to test and obtain feedback from the users through their opinions and behaviors when interacting with the developed signage and verify if it would bring more difficulties or benefits to the users.

Second, the development of the signage mockup to be tested in a real-time context, should involve real users. It would be interesting to create focus user groups to which the guidelines will be presented, and the gathered feedback and ideas could also be integrated in the final design of the signage system prototype to be tested.

Third, professionals from other areas of expertise could be involved in this project follow up in order to evaluate and improve the guidelines created. This was previously considered for the present project; however, the time constraints and difficulties in getting the experts involved had conditioned the accomplishment of this goal.

6.3. MAIN CONTRIBUTIONS

This project contributes with a promising resource for the designers and developers of signage systems, as for other professionals, involved in the development of such systems, mainly devoted to public services. Although the guidelines were created based on the opinions and experiences of users of healthcare settings along with the reviewed literature on the topic, they can be extended to other public services as some of the guidelines are suitable for other services as well.

The literature review conducted on this project is a major contribution for the experts involved in the area of healthcare signage design and implementation. The review is mainly important for the experts abovementioned; however, it can also be crucial for developers of signage for other typologies of public services. The analysis performed to the literature can also serve as a basis for the development of new studies regarding the same topic and aim to involve the users in the process of signage development, as the identified research methods used can be replicated to achieve goals like the ones defined in this project.

The developed guidelines are particularly useful for developers of new signage systems or involved in the renew of existing systems, to create better signs that meet, or even better, that exceed the users' needs and expectations in what concerns their wayfinding inside healthcare settings. Additional to the benefits for the users and developers, the created guidelines present potential benefits also for the institutions in terms of financial aspects. For example, the guidelines can help in reducing the costs by avoiding the need of the staff member help the users on their wayfinding difficulties.

The results obtained from the research methods used on the studied hospitals are also an important contribution as they allow to understand the reality of the Portuguese hospitals in terms of signage design and implementation. With the research methods applied and through the contact with the hospital administrations, it was possible to notice that the signage implemented in the studied facilities, do not followed many of the existing regulations or guidelines, as it was most of the times developed based on the common sense of the involved designers and developers. This aspect was particularly mentioned by the designer of the signage of Hospital Particular de Viana do Castelo in the interview conducted with him. Along with this fact, it was also confirmed that in any of the studied cases, the opinion of the users was not considered in the development process, as the majority of the users identified similar problems that were not solved by the signage currently implemented. Mainly, it was noticeable that the implemented signage systems were not planned in advance based on a proper study of the population to be served, the plants of the facilities, and principally with an analysis of the paths that would be followed by most of the users. This lack of study and planning in the early stages led to a bad placement of the signage elements that is inappropriate for the paths to be followed by the users, and to confusing signage systems due to common mixtures of the original signage elements with sheets of paper taped on doors and walls to help the users on their wayfinding difficulties. Also, in the studied hospitals, the majority of the signs available are in poor conditions of maintenance and also outdated relatively to the current facilities. These aspects, together with some inconsistencies on their graphical characteristics, is the cause of many of the problems observed during the users' journey inside the settings. Besides the experienced wayfinding problems, many of the users associated these deficiencies of the signage system to a lack of care of the institution relatively to their users which lead to a negative image of the institution.

It is worth to referring that, for example in hospital D – São João, in Porto, the implemented signage system was considered by the users as well designed and that satisfy their needs, as it was confirmed during the study conducted *in situ* on this hospital. On the other hand, in hospital A – Santa Luzia, in Viana do Castelo, during a visit to the settings six months after the study was conducted, it was observed that many of the signage elements had already benefited from maintenance and updating. Maybe this was a result of the final report delivered to the institution at the end of the study conducted

under the scope of this project. Actually, the reports developed during this project and delivered to each of the studied hospital can be a good way to reduce or eliminate the problems identified in their current signage systems. Mainly, hospitals A, B, and C, can benefit from improvements on their signage maintenance, updating, and in some graphical characteristics that were highlighted by the users as problematic for their wayfinding journey during their visits.

As this study was conducted in four hospitals settled in three different geographic areas of Portugal, maybe it can mean that these are not isolated cases, and perhaps the problems identified on these hospitals can be found also in other Portuguese healthcare institutions. Therefore, the results from the literature review conducted along with the results from the implemented research methods and the proposed guidelines should be taken into account by other Portuguese hospitals to reduce or even eliminate similar problems in their facilities.

Finally, during the development of this project, scientific contributions were also achieved through scientific publications:

Conference articles:

Rodrigues, R., Tavares, J. M. R., & Coelho, R. (2017). Healthcare Signage Design: What do the users expect?. In *2nd Doctoral Congress in Engineering, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal, 8-9 of June, 2017*.

Rodrigues, R., Coelho, R., & Tavares, J. M. R. (2016). Exploring the users' experience in healthcare services. In *CIDAG 2016: Livro de Resumos Conferência Internacional em Design e Artes Gráficas, 4.ª: Comunicação gráfica meeting points= Abstract book International Conference in Design and Graphic Arts, 4th: graphic communication meeting points= Libro de resumen Conferencia Internacional sobre Diseño y Artes Gráficas, 4.ª: comunicación gráfica meeting points* (p. 61). Instituto Superior de Educação e Ciências de Lisboa; Instituto Politécnico de Tomar; Salesians de Sarrià.

Rodrigues, R., & da Silva Tavares, J. (2016). Users emotions and experience in healthcare services. *Proceedings of UD15: Periphery and Promise 4TH PhD in Design Forum*. (pp. 60-66).

Journal articles:

Rodrigues, R., Coelho, R., & Tavares, J. M. R. (2018). Healthcare Signage Design: A review on recommendations for effective signing systems. *HERD: Health Environments Research & Design Journal*, DOI: 10.1177/1937586718814822.

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APPENDIX A

QUESTIONNAIRE: HOSPITALS A (SANTA LUZIA – VIANA DO CASTELO), B (SANTO ANTÓNIO – PORTO), AND C (INFANTE D. PEDRO – AVEIRO)

DADOS DEMOGRÁFICOS

1. **Idade:** _____ anos

2. **Sexo:**
Feminino Masculino

3. **Nível de Escolaridade:**
_____ (Ex: 12º ano/Licenciatura/etc.)

4. **É a primeira vez que visita este hospital?**
Sim Não

5. **Possui algum problema de visão que dificulte a sua compreensão dos sinais existentes?**
Sim Não

6. **Qual a razão mais frequente pela qual vem a este ao hospital?**
(selecione apenas uma das opções)

Consultas.....
Exames.....
Urgência.....
Visita de pacientes/familiares/amigos.....
Outra:.....
(especifique): _____

SINALÉTICA HOSPITALAR

7. **Acha que as entradas do hospital estão bem sinalizadas?**
Sim Não

8. **Já alguma vez se atrasou para uma consulta/exame/visita, porque teve dificuldade em orientar-se para chegar ao local que queria?**
Sim Não

9. Quando não sabe para onde ir dentro do hospital, o que faz (escolha uma das opções):

- Tenta encontrar sozinho o local recorrendo aos sinais e mapas disponíveis
- Pergunta por direções aos trabalhadores do hospital
- Ambas as opções

10. Como avalia as seguintes situações relativamente à sinalética existente no hospital (escolha apenas um número para cada situação):

(Escala de 1 a 5 – 1 (Discordo Totalmente); 2 (Discordo moderadamente); 3 (Não concordo nem discordo); 4 (Concordo moderadamente); 5 (Concordo Totalmente))

	Discordo Totalmente	Discordo Moderadamente	Não concordo nem discordo	Concordo Moderadamente	Concordo Totalmente
	1	2	3	4	5
Número de sinais disponíveis é suficiente (a quantidade de sinais é suficiente para o ajudar a chegar ao seu destino)					
Os sinais estão bem localizados (local onde os sinais estão colocados ajuda a chegar facilmente ao seu destino)					
A nomenclatura nos sinais é fácil de compreender (as palavras usadas nos sinais e o seu significado são fáceis de perceber)					
A visibilidade dos sinais é boa (os sinais são grandes e bem visíveis ao longe, não se encontram tapados por outros objetos, a luz não causa problemas na sua leitura)					
O texto dos sinais é bem visível (o contraste entre as cores das letras e dos sinais ajuda na leitura)					
O tamanho das letras nos sinais é adequado (as letras são grandes e bem visíveis de longe e de perto)					
Quantidade de texto/informação nos sinais está adequada (a quantidade de texto é suficiente e não causa confusão na sua leitura)					
A altura a que os sinais estão colocados é adequada (os sinais não estão demasiado altos ou baixos, estão colocados a uma altura adequada à sua estatura)					

11. Acha que se os sinais tivessem imagens/pictogramas associados, facilitaria a sua compreensão?

Sim Não

12. Acha que os sinais deveriam ter cores associadas aos diferentes serviços (cada cor associada a um serviço diferente)?

Sim Não

13. Relativamente a cada um dos símbolos apresentados, assinale se acha que se encontra adequado ou não a cada uma das especialidades:

Símbolo 1:



- 1. **Ortopedia**
(Doenças e deformidades dos ossos, músculos, etc.)
- 2. **Ambulatório/Consultas externas**
(atendimento sem internamento)
- 3. **Medicina Física e de Reabilitação**
(diagnóstico e tratamento de lesões)

Adequado **Não Adequado**

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Símbolo 2:



- 1. **Doenças Infeciosas**
(Doenças Contagiosas)
- 2. **Dermatologia**
(Doenças da pele)
- 3. **Unidade de Queimados**
(Tratamento de queimaduras)

Adequado **Não Adequado**

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Símbolo 3:



- 1. **Gastroenterologia**
(Sistema digestivo)
- 2. **Medicina Interna**
(Órgãos internos)
- 3. **Radiologia**
(Raio-X)

Adequado **Não Adequado**

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Símbolo 4:



- 1. **Endocrinologia**
(Diabetes; Tiroide)
- 2. **Hematologia Clínica**
(Doenças do sangue)
- 3. **Banco de Sangue**
(Doação de sangue)

Adequado **Não Adequado**

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

14. Indique por favor o nível de stress (nervosismo, ansiedade) que sente quando não consegue encontrar o serviço que pretende dentro do hospital - (Escala de 1 a 5 – 1(Nada stressado); 2 (Pouco stressado); 3 (Nem muito nem pouco stressado); 4 (Moderadamente Stressado); 5 (Altamente stressado):

○──────────────────○──────────────────○──────────────────○──────────────────○

□ □ □ □ □

Nada stressado

Muito Stressado

15. Como avalia a dificuldade em encontrar o local que pretende através dos sinais disponibilizados?

(Escala de 1 a 5 – 1(Muito Fácil); 2 (Fácil); 3 (Nem fácil nem difícil); 4 (Difícil); 5 (Muito difícil))

○──────────────────○──────────────────○──────────────────○──────────────────○

□ □ □ □ □

Muito fácil

Muito Difícil

16. Considera que o sistema de orientação (sinais existentes) satisfaz as suas necessidades enquanto utilizador do hospital?

Sim Não

17. Na sua opinião, o que poderia ser melhorado na sinalética do hospital?

Muito obrigado pela sua colaboração!

QUESTIONNAIRE: HOSPITAL D (SÃO JOÃO – PORTO)

1. Sexo:

Feminino Masculino

2. Idade:

_____ anos

3. Qual o seu ano de escolaridade?

4. Possui algum problema de visão que que lhe cause dificuldades na visualização das placas existentes?

Sim Não

5. Como avalia a nova sinalética (sinais existentes: K2, K3, etc.) disposta nesta zona do serviço de ambulatório (assinale o círculo correspondente)?



Muito pior Pior Nem melhor nem pior Melhor Muito melhor

6. Como avalia a sinalética atual (sinais existentes: K2, K3, etc.) relativamente à antiga?

EXEMPLOS DE SINALÉTICA ANTIGA:



- | | | |
|---|-----------------------|-----------------------|
| Mais fácil de compreender | <input type="radio"/> | <input type="radio"/> |
| Mais legível ao longe | <input type="radio"/> | <input type="radio"/> |
| Mais fácil identificar os locais dos serviços | <input type="radio"/> | <input type="radio"/> |
| Tem um melhor contraste entre a cor do sinal e o texto | <input type="radio"/> | <input type="radio"/> |
| Torna mais fácil a sua orientação dentro do Hospital | <input type="radio"/> | <input type="radio"/> |
| A localização dos sinais está mais adequada | <input type="radio"/> | <input type="radio"/> |
| Quantidade de informação nos sinais é mais adequada | <input type="radio"/> | <input type="radio"/> |
| Mais fácil para pessoas com dificuldades de visão | <input type="radio"/> | <input type="radio"/> |
| Mais fácil para pessoas que não sabem ler | <input type="radio"/> | <input type="radio"/> |
| O espaço está mais iluminado facilitando a leitura das placas | <input type="radio"/> | <input type="radio"/> |
| Quantidade de sinais está mais adequada | <input type="radio"/> | <input type="radio"/> |

7. Foi mais fácil encontrar o local que procurava com a nova sinalética?

Sim **Não**

8. Acha que se a sinalética de todo o hospital fosse alterada para esta nova sinalética facilitaria a sua orientação dentro das instalações?

Sim **Não**

9. Melhorava alguma coisa na nova sinalética? Se sim, o quê?

Muito obrigado pela sua colaboração!

APPENDIX B

PHOTOGRAPHIC RECORDS HOSPITAL A (SANTA LUZIA – VIANA DO CASTELO)

The impact of the natural light and reflection on the glass of the doors. The use of red letters on glass reduces legibility of the identification and locational signage. The overload of information created by the paper sheets posted on the doors and windows, Figure B1.



Figure B1 - Outpatient entrance of hospital A

The lack of maintenance of the navigational lines implemented on the floor of the hospital, Figure B2.

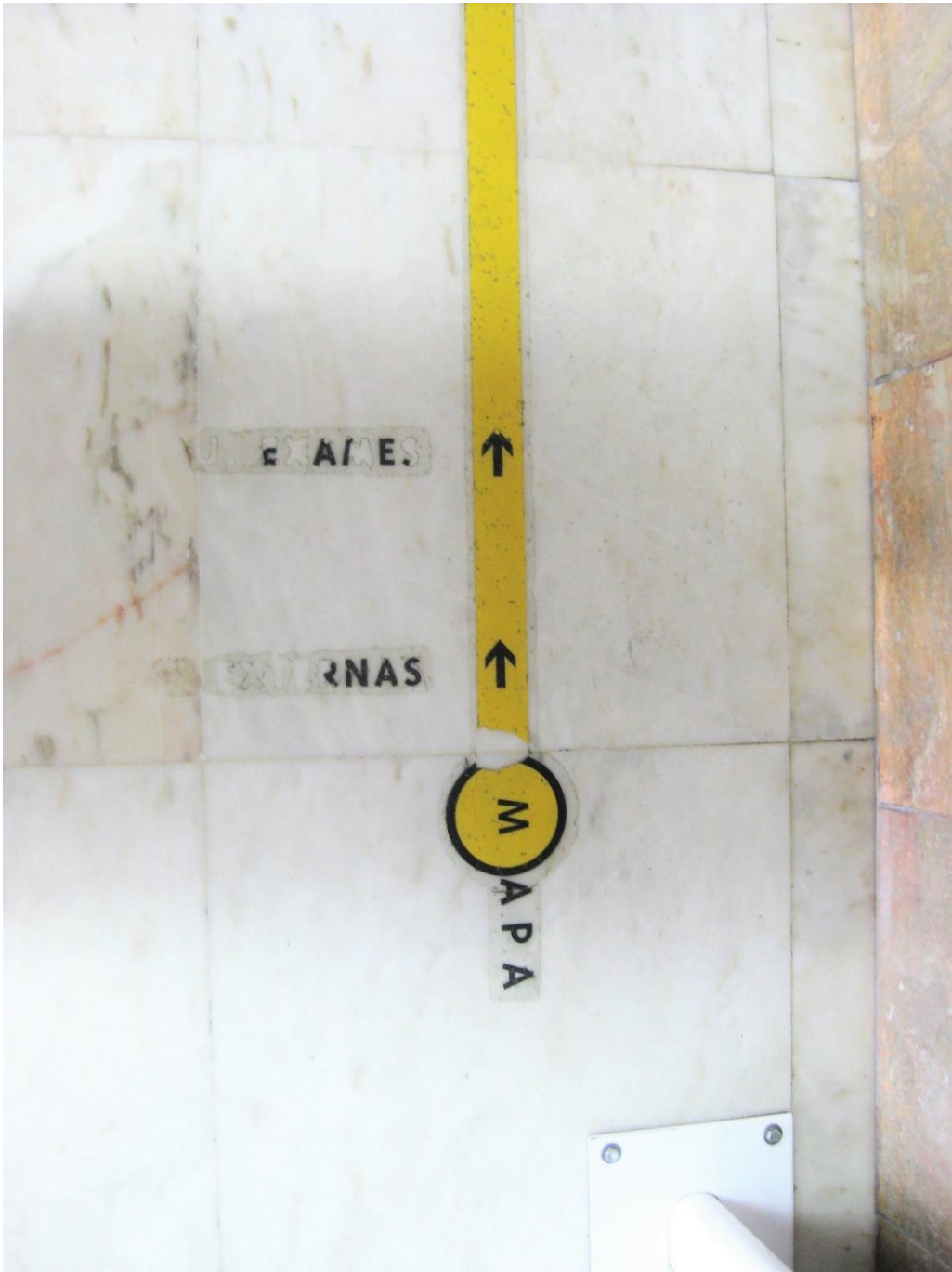


Figure B2 - Colored lines on the floor implemented at hospital A

The remaining photographic records can be found in the following link:

<https://drive.google.com/open?id=1ZIQNvC-1H0Hqu1yzOdmeGso7cPOULIMm>

PHOTOGRAPHIC RECORDS HOSPITAL B (SANTO ANTÓNIO – PORTO)

The use of transparent text on frosted glass degrades the text legibility and visibility. Its impact is even worse because this identification information is placed in the ophthalmology service where the users often suffer from low visual acuity, Figure B3.



Figure B3 - Entrance for the Pediatric Ophthalmology service at hospital B

The user of dark colors on dark backgrounds degrades the text legibility and diminishes the distance at which this sign can be seen, Figure B4.



Figure B4 - Directional signage indicating the cardiology service of hospital B

The remaining photographic records can be found in the following link:

https://drive.google.com/open?id=1zp39sXPSHawMrPPci9_nTc6FIIXFeFS4

PHOTOGRAPHIC RECORDS HOSPITAL C (INFANTE D. PEDRO – AVEIRO)

The medical offices indication is too complex, and the sign has an information overload. The organization and grouping of information should have been made in a different way.

The identification of the medical office's location is made only through this sign at the entrance of the corridor that provides access to the offices. In no other location the identification of the office's location is made, Figure B5.



Figure B5 - Directional signage indicating the medical offices location at hospital C

The identification of the medical offices is made through paper sheets taped on the doors instead of being perpendicular to the doors and placed on proper signs, Figure B6.



Figure B6 - Identification/Locational signage indicating the doors of the medical offices at hospital C

The remaining photographic records can be found in the following link:

<https://drive.google.com/open?id=1DhGxc2T2Jx373k9bgbBYH3uBq67eqVnp>

PHOTOGRAPHIC RECORDS HOSPITAL D (SÃO JOÃO – PORTO)

The medical offices and the letters signaling the area are extremely well identified and visible. The user of high contrast colors provides maximum and perfect legibility together with the big dimensions of the text and symbols, mainly arrows, Figure B7.



Figure B7 - Identification/ Locational signage indicating the medical offices location at hospital D

The new check-in system and the new system of ticketing calling is extremely complex for the elderly. Maybe, volunteers could be available at all times of the day or instructions could be provided regarding how to work with the machines, Figure B8.



Figure B8 - New check-in and ticketing systems of hospital D

The remaining photographic records can be found in the following link:

<https://drive.google.com/open?id=1JGdu-RFB1bvUGVszfDTV5HPddL-kXdvY>