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A Study of Service Touchpoints in the Design of Assistive Products Required by People with Visual Impairment

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Abstract:
This review investigates the problem of hospital orientation touchpoints for individuals with visual impairments. This paper aims to provide a framework for the service design considerations that designers and engineers of medical devices must consider to aid the visually impaired people in the hospital orientation. In addition, service design and design thinking techniques were utilized to synthesize the findings. Four-person focus groups were used to conduct semi-structured interviews. Using purposeful sampling, a group of Yinchuan, China, visually impaired people were chosen to be interviewed and guided through a series of fictitious medical crises. Using a user journey map and service touchpoint analysis, the service touchpoints encountered by the visually impaired population while using the guided care service were summarized and unified, yielding into several design recommendations. Based on the research provided in the research on assistive device design for the visually impaired population and the collected studies on hospital guidance services, current research on hospital guidance services is focused more on changing service design from the hospital perspective. The potential scenario applications of this wearable device have been largely neglected in previous studies on the design of assistive devices for people with visual impairment. Finally, the contact points that visually impaired people will encounter in the hospital alone were divided into three: before, during, and after the visit. These contacts were divided into eight categories. Although research on inclusive design and related topics from the perspective of the visually impaired has increased, very little has been done to examine this issue from the perspective of actual use cases. Despite the importance of the design and technology phases of product development, there is still a need for further research into the design of antecedent services in the context of what people with visual impairment require.

Keywords: Visually impaired people; Guided care; Service design; Assistive products; Touchpoint research.

1. Introduction

China has many visually impaired people (VIP). According to the WHO, 7.551 million Chinese people are blind and 8.248 million are visually impaired. 145,000 people belong to the Ningxia Blind Association. Blind people can enter and exit any building at any time [1]. Because of their many challenges, VIP find it difficult to go to a hospital alone to see a doctor. VIP often need family or medical staff to receive proper care. VIP often have limited mobility, vision impairments, and experience. This research aids VIP in self-treating. This study used service design thinking to provide VIP with hospital guidance touchpoints as a supplement to solo medical visits. Design and technology are crucial for product development, but pre-service design for VIP needs more research. This research supports future engineers and designers.

2. Literature Review

The academic community is rapidly monitoring and interpreting service design and VIP-assisted product findings, including those about VIP-assisted wearable devices. This literature review shows that academic and commercial researchers at the emergence stage focus on the following:

2.1 Service design concept development and research

Service design involves design thinking and human-centeredness, research shows and service design inform users [2]. Service design requires creative process thinking, focus on users, experiences, touchpoints, and perfection. User experience is gradual and multifaceted. App and website design are intangible, while merchandise and packaging are tangible [3]. "Service design" was born in 1982 due to system complexity [4], and Donald A. Norman introduced UCD to UC Berkeley in 1986. Angus and Jenkinson, who pioneered service design in 1991, founded Persona in 1993–1994. Until the 21st century, designers preferred product service systems. 2005's Double Diamond Service Design Thinking Basic-Tools-Cases presented five service design principles. Service Design updated its development in 2017, as shown in Figure 1.

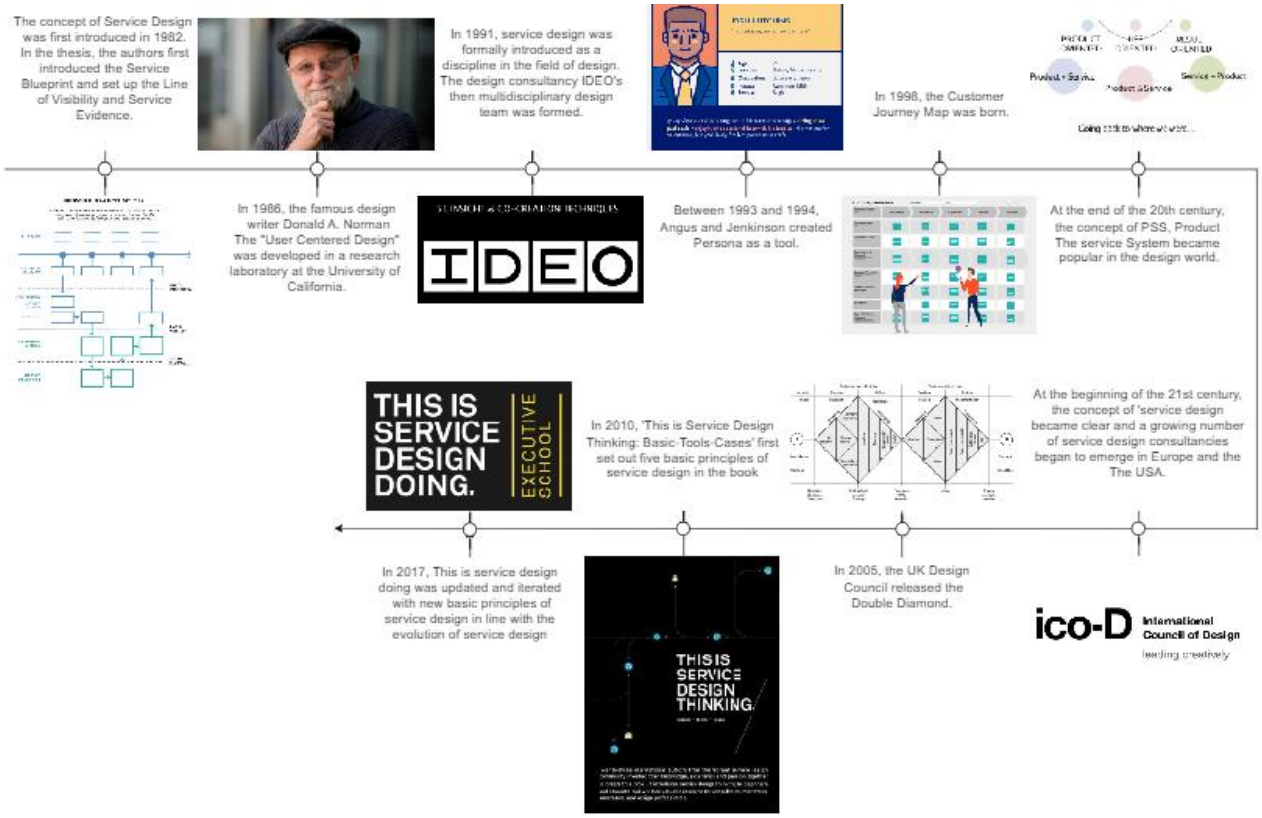

Figure 1. Service design evolution chart

2.2 Examine the basic principles of service design

Human-centeredness and design thinking are part of service design, according to research. User insights from service design [2]. Creative process thinking is needed for service design. User, experience, touchpoints, and perfection. User experience happens over time and at various contact points. Intangible touchpoints include app and website design, while tangible touchpoints include merchandise and packaging [3]. Due to system complexity, "service design" was born in 1982, and Donald A. Norman introduced UCD to UC Berkeley in 1986. Service design pioneers Angus and Jenkinson founded Persona in 1993 and 1994. In the late 20th century, designers preferred product service systems until service design became popular in Europe and the US in the 21st century. Double Diamond (2005) and 2010 SDT: Five service design principles were introduced by Basic-Tools-Cases. Figure 1 presents more information on Service Design's 2017 update.

2.3 Investigation of hospital direction systems

The hospital guidance system simplifies and ensures process guidance. Hospital informatization, medical construction, and the medical model have all changed due to the digital age. Medical consultations in modern hospitals are different. [5]. Scholars are studying guidance staff training, guidance APPs, and AI guidance [6-9].

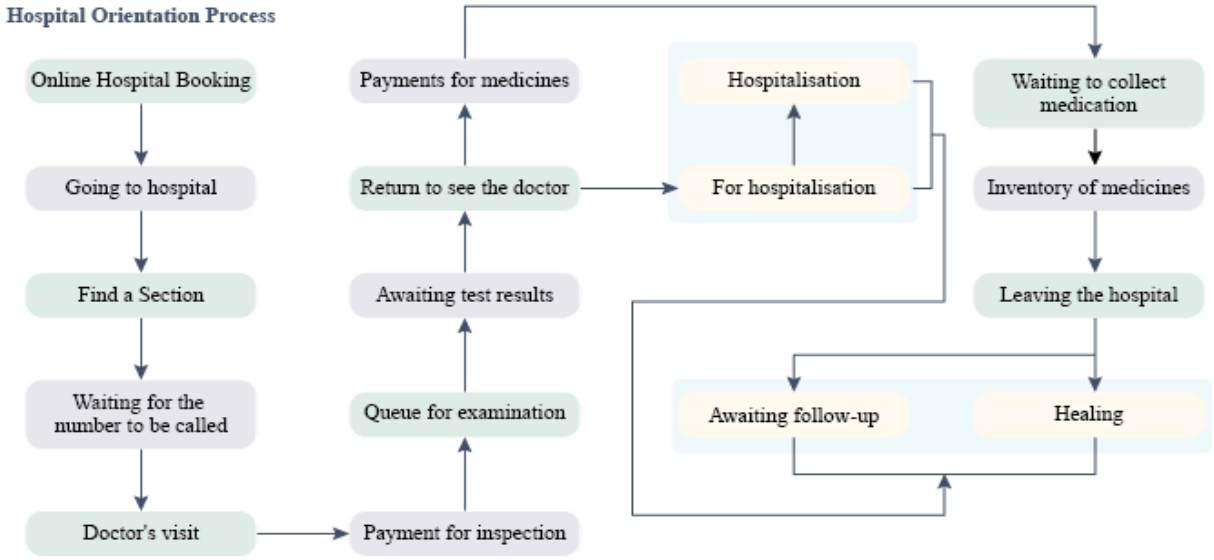

Figure 2. Service design evolution chart

Hospital procedures follow. Enter the outpatient hall, register for consultation at the department location, enter the waiting hall, wait, go to the outpatient doctor to be examined, the doctor prescribes treatment, the patient pays the fee, and the patient undergoes tests. The patient leaves the outpatient doctor's office and returns after test results for a diagnosis and medication prescription. Figure 2 illustrates hospitalization processes. Guide services include consultation and education.

2.4 Hospital orientation services from a service design perspective

WHO (2016) advises patient-centered care. Hospitals need human-centered design and innovation. Service design requires theory and practice. Sensitive topics, difficult issues, and cognitive limitations prevent limited mobility populations from participating and sharing knowledge. Hospital VIPs have mobility issues. Navigation, waiting, and examination are difficult. This study analyzes VIP needs through service design contact points and proposes balanced solutions for a complete and comfortable VIP patient journey. VIP-assisted product development is gaining popularity among designers and engineers.

2.5 An examination of the development of products aided by VIP

VIP assistive products are being researched by academia and industry from smart wearable devices and conventional assistive products. This section discusses VIP assistive product smart wearable device development and trends. Smart wristbands and watches are the most common smart wearable devices, followed by footwear and insoles, accessories like necklaces and belts, wearable smart clothing, products with sensors, products with wearable devices, and others. Sensors, machine learning, augmented, and mixed reality will accelerate smart wearables, increasing VIP use. Many disabled aids are wearable. Clint Zeagler *et al*. [10] created smart device body maps for disabled people. They believe wearable assistive technology could usher in a new era Numerous researchers are helping VIP and have developed a 51 microcontroller-based intelligent VIP navigation system [11], a compact convolutional network-based MobileNet V2 [12], a TL-recognizer traffic light recognition system [13], orientation and wayfinding aids [14], smart glasses [15], and belts with [16].

2.6 Problem statement

VIP assistive product intelligence and industry growth have followed the traditional VIP cane. Developers and designers found several issues. By consulting existing research and development materials, this study focuses on technical

issues (primarily in terms of technical limitations, expensive, complex operation, poor compatibility, and poor substitutability); product level (lack of research on application scenarios and user consideration, most products only remain erratically priced); and product level (lack of research on application scenarios and user consideration). Design often starts with the development of new or appropriation of existing technologies, which is not human-centered and can distract from user needs [1]. Thus, this study suggests that a technology-centric system cannot solve VIP's navigational issues. The VIP visit guide service is based on government and hospital research [5]. This research has included hospital guide robots and guide training [17]. To help VIP navigate hospital orientation, remove service design contact points from commercially available assistive products. This study investigated the following research questions:

Q1. How do VIP find orientation at the hospital alone?
After identifying VIP's hospital issues, the guide system's touchpoints can be determined. What problems do hospital patients struggle to solve?

Q2. Where do people interact most? VIP ones?
This question distinguishes VIP contacts from those of non-visually impaired people. The key is distinguishing contact issues. Hospital orientation for mobility-impaired people can also lead to contacts.

Q3. What hospital orientation suits VIP?
Convenience is psychological and behavioral safety. This study proposes three "safety" dimensions for hospital guidance system VIP service contact points. Behavioral safety includes obstacle avoidance, wayfinding, stairs, elevators, examination safety, and consultation precision. Self-identification, group or isolation psychology, self-confidence or inferiority complex, other people's perceptions, and VIP identification all contribute to subjective psychological safety or insecurity judgments in the second dimension of psychological safety. Finally, interaction safety refers to VIP-assistive device psychological and behavioral aspects that make them feel safe and secure. These three dimensions must be secure for the VIP to feel at ease. This is the first vision-impaired service product study. Hospital guidance conducted this study. Product design and technology are crucial to product development, but VIP front-end services need more research. This study's analysis can help engineers and designers recognize VIP' needs and reduce their workload and work time at the start of their projects. This research allows both.

3. Methodology

This research used user journey mapping and semi-structured interviews. By asking and prompting participants to discuss the hospital scenario's orientation challenges, their motivation to go alone, and the current assistive products' inconvenience, a descriptive report was created for future reference. This produced a descriptive report that will be a reference for this study. Contact point analysis, user journey mapping, and service blueprint are similar to snowball sampling's semi-structured interview technique. Journey mapping visualizes how a user interacts with a product or service using user journey mapping.

3.1 Interviews with semi-structured questions

An interview outline can help you focus on important questions and avoid forgetting anything. Ask the interviewee specific questions to find the root cause. After the interview, the questions are collected and analyzed to determine how users access healthcare, the issues they encounter, and the VIP experience.

3.2 Interviewees

To understand VIP admissions' challenges, this interview was conducted. The interview included six target users from Ningxia, China, most of whom were VIP. They were three men and three women. Two VIP are blind, but four others with Grade 1 disabilities could see in the dim light (vision from light to 0.02, or a radius of vision of 5 degrees.) Respondents worked in fields like massage and counseling, had more access to high-tech gadgets than the average VIP, and provided some insight into "smart medicine."

3.3 Interviewing technique

During the interview, the following data is collected: (1) the user's personal information, physical condition, frequency of medical treatment, etc.; (2) the registration method (internet, telephone, on-site registration), and registration department; (3) the challenging aspect of the medical treatment process and the specific reasons for it; (d) the user's opinion of the assistive device; and (4) the user's habit of using the assistive device. The interview lasts forty minutes and

records most of the conversation on these five topics. Before the interview, the VIP gave permission and agreed to use the interview for research. The study was voluntary, and no deception or manipulation was used to gain trust.

3.4 Collecting and analyzing interview information

Descriptive analysis summarized this study's interview results. Medical care was the main reason VIP visited hospitals. After an eye doctor advised against further treatment before adulthood, the patient rarely returned for follow-ups. Preparing for a three-day or 30-day hospital stay is crucial. Based on interviews with the people whose opinions were sought, this study found that VIP will face the following medical treatment barriers (Table 1). Based on these opinions: (1) there are more medical treatment sessions, and the information at each node is disorganized; (2) difficult situations will arise in almost every guidance session; (3) more difficulties are encountered when seeking medical treatment independently, and the atmosphere of medical treatment is tense, which affects the patient's exuberance; and (4) more difficulties are encountered when seeking medical treatment independently.

Table 1. Contact issues

Orientation process	Same issues as ease of movement	Not the same issue as ease of movement
Registration	Not sure which department to go to	Not sure if there is a queue
Find a Section	You will need to ask at the information desk for the exact location	No voice prompts for lift rides
Waiting to be seen	-	Queuing and not knowing when it's your turn
Visits to outpatients	-	Can't see the specific sign for the consultation room
Doctor prescribes treatment	-	Inability to remember exactly what the doctor has told you
Payment of fees	-	You cannot operate the self-service payment machine and you need to check if there is a queue at the manual payment gate
Doing a check-up	Need to find out where to do each examination room	Access to the inspection room, unaware of the exact process and the location of the inspection machine
Awaiting inspection	-	Don't know what number you are
Prescribe medicine	-	-
Pick up your medicine	-	Not sure if the correct amount of medication was taken
Further consultations	-	-

3.5 Method for user journey mapping

Research VIP visitors' actions before mapping the user journey. The service's planning and design are based on user needs and experience. Therefore, improving touchpoints improves service. VIP access before, during, and after the visit. Each stage examines the procedure and contact points. As shown in Table 2, patients leaving home for a hospital appointment have six main paths: identifying the hospital, queuing for payment, finding a registration office, finding a department, getting a number, and waiting for their number to be called. Patients leave home for hospital pre-visits. Table 2 shows that the entry and waiting phases involve choosing a hospital and scheduling an appointment. Six steps: paying, finding a registration desk, finding the right department, waiting for a number, and watching for one's number. Pre-visit behavior summarizes. a. basic hospital information inquiry; b1. queuing for registration; b2. choosing a department; b3-6. payment methods (mobile phones, cash, self-service devices, and medical staff are all touchpoints where patients are likely to use different payment methods); c1-4. hospital environment to find each department; and d1-2. picking up a number. Patients should always know the wait time and how many people are expected for their appointments.

In-person visits were examined. Table 3 shows pre-visit, testing, diagnosis, and implementation. These contacts needed improvement: f1-2. Electronic medical records, which improve physician diagnosis; g1-4. contact points extracted during a laboratory test (using a self-service machine or a manual window; both need improvement); h1-4. contact points found while searching for a department and using the hospital environment, especially the elevator. j1-4. contacts when encountering a self-service machine during a laboratory test or when a doctor is outside directing the patient using a

loudspeaker; k1-29. contacts after retrieving a laboratory test; l1-6. contacts when wayfinding and medical orders must be recorded; m1-2. contact analysis when retrieving a diagnostic slip.

Table 4 shows the post-visit process separated into a leaving phase and a repeat phase, with payment and medication queues as the main paths. This stage includes m1-4 navigating the hospital and diagnostic room and n1-4 picking up the medication with hospital staff or self-service machines. This phase includes confirming medical advice and medication information upon return to the consultation room, reading instructions, and repeating departure touchpoints.

Table 2. Pre-visit contact sheet

Pre-visit	**Entry phase**			**Waiting phase**	
User behaviour	Identify the hospital	Queuing for registration	Find a Section	Queuing for numbers	Waiting for the number to be called
Contacts	a. Basic Hospital Information Enquiry	b1. Queue for registration b2. Choose a department b3. Cash payment b4. Alipay/WeChat payment b5. Manual payment b6. Self-service payment	c1. Hospital environment c2. Navigation equipment c3. Taking the stairs C4. Taking the lift	d1. Self-service number collection d2. Manual collection	e1. Inform of waiting time e2. Inform of the number of people attending e3. Countdown before you get a number
User requirements	Browse information on the different hospitals and the number of registrations left.	Quick registration to simplify the process for users.	The ability to pinpoint the location of the section.	Get your number quickly.	Find out how many people are waiting in front of you and how long you have to wait.

Table 3. In-visit contact sheet

Attendance	**Pre-consultation stage**	**Inspection phase**			
User behaviour	Consultation	Pay the fee and collect the laboratory test	Find a Laboratory	Waiting for the number to be called	Laboratory
Contacts	f1. Doctor f2. Medical history	g1. Self-service machines g2. Manual service g3. Cash payment g4. Alipay / WeChat payment	h1. Hospital environment h2. Navigation equipment h2. Taking the stairs h3. Taking the lift h4. Choice of multiple laboratories	i1. Inform of waiting time i2. Inform of the number of people attending i3. Countdown before you get a number	j1. laboratory physician j2. Machines j3. Laboratory steps j4. Self-service laboratory equipment
User requirements	Quickly and effectively combine medical histories to identify the cause of the disease.	Pay your bill quickly and receive the correct documents.	Ability to pinpoint multiple laboratory locations.	Ability to pinpoint multiple laboratory locations.	You can follow the doctor's instructions to complete the tests correctly or you can use the self-service equipment on your own.

Attendance	**Inspection phase**			**Diagnosis and implementation phase**	
User behaviour	Pick up your labs after the test	Laboratory	Pick up your labs after the test	Return to the clinic and be diagnosed by the doctor	Take a diagnostic sheet
Contacts	k1. Self-service machines k2. Human services	j1. laboratory physician j2. Machines j3. Laboratory steps j4. Self-service laboratory equipment	k1. Self-service machines k2. Human services	l1. Hospital environment l2. Navigation equipment l3. Taking the stairs l4. Taking the lift l5. Laboratory tests l6. Doctors	m1. Self-service machines m2. Manual service
User requirements	Quick and correct collection of documents.	You can follow the doctor's instructions to complete the tests correctly or you can use the self-service equipment on your own.	Quick and correct collection of documents.	Find out the cause of the disease quickly and effectively in conjunction with the laboratory tests and remember the medical advice.	Quickly collect the correct documents.

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Table 4. Post-visit contact sheet

After consultation	Leaving phase			Follow-up phase
User behaviour	Queuing for payment	Queue for medication	Doctor-patient communication	Re-visit
Contacts	m1. Cash payment m2. Alipay / WeChat payment m3. Manual payment m4. Self-service payment	n1. Manual window n2. Self-service medication collection machines n3. Medication verification n4. Reading of medication instructions	p1. Return to the consultation room p2. Ask for medical advice again p3. Reconfirm	Repeat the above contacts
User requirements	Pay your bills quickly and efficiently.	Quickly pick up and check your medication.	Promptly confirm medical advice and drug information.	Make the patient experience a good one.

4. Results and Discussion

Three analyses—service blueprints, user journey maps, and ancillary product design—will guide healthcare delivery. VIP with individual medical visits and exams had four types of exposure issues. Wait, identify objects, and record medical advice. Hospital application scenarios led researchers to this conclusion. Data analysis shows how service design thinking can improve VIP-assisted offerings.

4.1 User experience map

User journey maps help visualize a product or service by showing how one interaction affects others [18]. At each stage, touchpoints include behaviors, emotions (pain and pleasure), and thoughts (Figure 3). Semi-structured interviews determined guide process and behaviors in the methodology section. Touchpoint analysis identified people and machine interactions during pre-, during, and post-visit and summarized pain points. This study identified pain points as opportunities. Most assistive products, including VIP selection, navigation systems, voice prompts (including basic prompts, lifts, number of people to wait, current time, and waiting time), drug recognition systems, and speech-to-text functions, seek opportunity points. Drug-recognition aids are other assistive products. Assistive products allow one to navigate a hospital without help from nurses, registration clerks, other patients, fee collectors, doctors, medicine collectors, or restaurant waiters. Avoiding other patients' help.

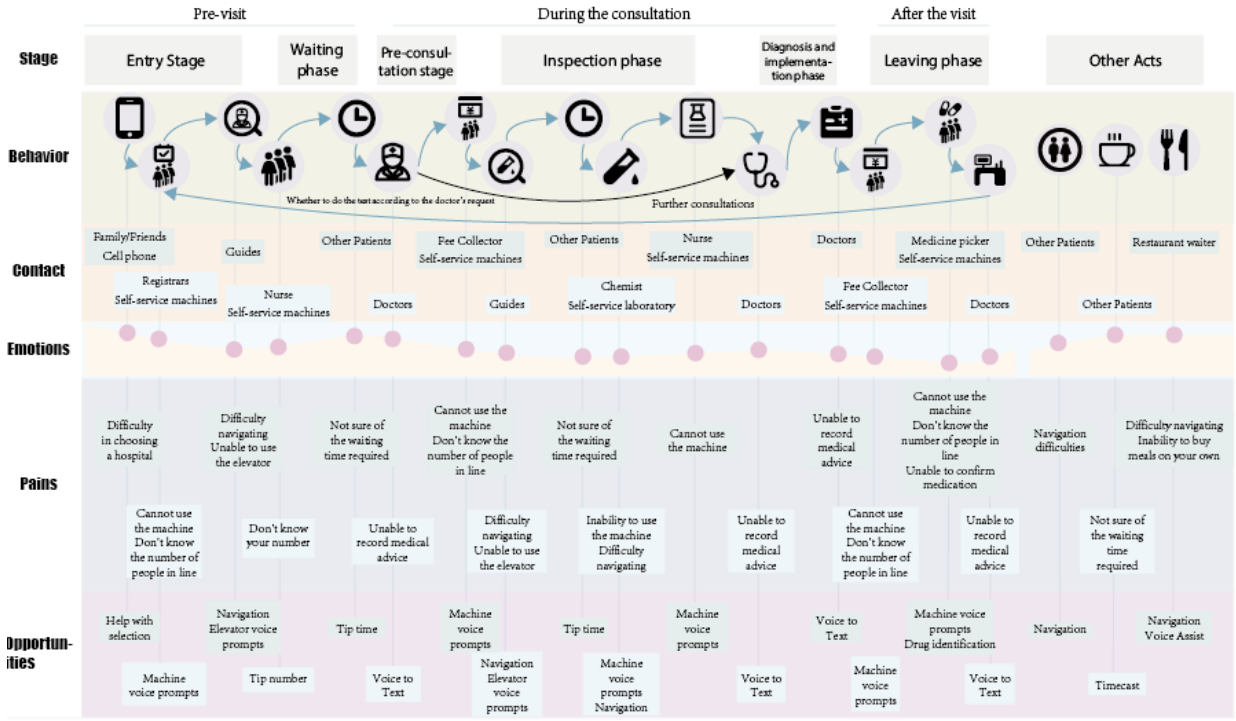

Figure 3. Post-visit contact sheet

4.2 Service blueprint

Service blueprints "prove" the organization's reality, while user journey mapping documents user experience. A service blueprint shows how the study delivers. Service blueprints aid designers. By dividing the access process into six stages, understanding it, and creating a stakeholder-based service blueprint, the service system can better co-create and manage resources and people. Service blueprint is shown in Figure 4.

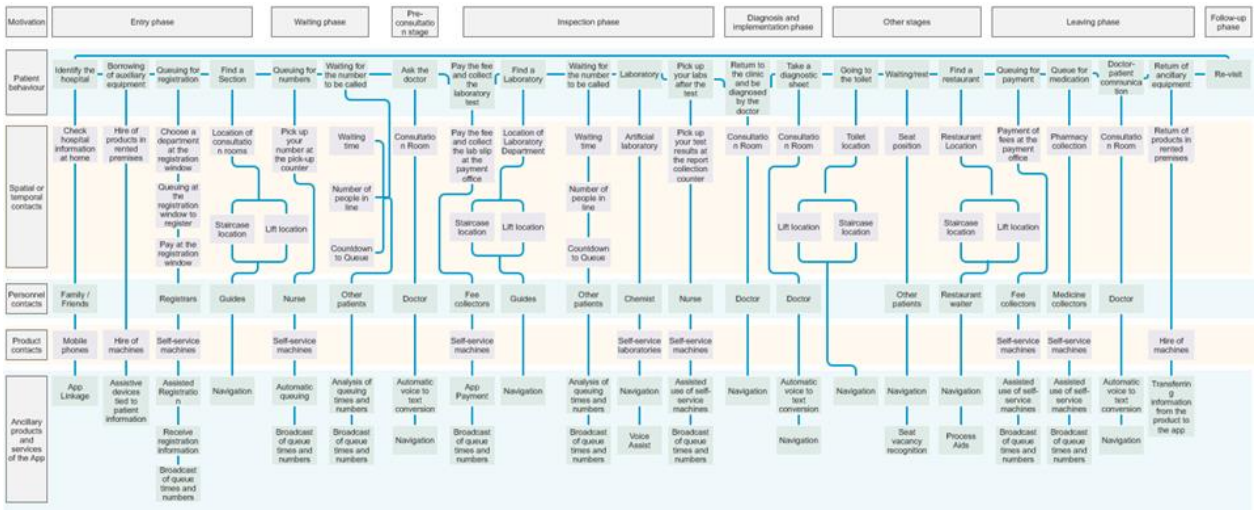

Figure 4. Service blueprint

4.3 Product design considerations for guided care service supplemental products

Iterative design prioritizes user needs [11]. When service design thinking is used to guide a VIP through a hospital, engineers and designers use visual user requirements, design supports, user processes, feelings, pain points, and innovation points to design VIP assistive devices. Service design thinking guides VIP through hospitals. Designers are more likely to start with VIP needs than technical or product considerations. Inclusive design principles like universality, inclusiveness, and others can greatly influence the final design. Based on assistive devices, this study relies on the second

dimension, supported by the product and VIP self-drive, indicating that the product is a more diverse and rapid method of updating. Products become active. Second, self-driven assumes that VIP who realize they can go to the doctor alone will want products to help them, generating consumer power.

VIP are a minority, but they make up a large portion of China's consumer market and have a wide support base, so their products cover a large area. This is the first study to examine VIP patient orientation services in hospitals. A user journey map and service blueprint can summarize service design thinking findings. This study helped engineers and designers finish preliminary user analysis and consider VIP-focused product design. This study contributed the most. The study contributed most here. Patients struggle most with hospital guidance systems' navigation, voice prompts, waiting, and medical order recording. Drug recognition, machine operation, and order are the next hardest. Researchers have mostly optimized the hospital guidance system from the hospital's perspective. These studies have examined guidance staff training, software, and artificial intelligence guidance [19, 20]. These studies are very relevant to the current design, but they all approach hospital guidance systems from the perspective of hospitals and governments.

This service design-based study examines VIP as an adjunct to hospital guidance systems in the context of the product-user relationship. Designers and engineers must consider service design factors when creating VIP hospital orientation devices. Service design and design thinking research methods are also described. Three questions cover behavioral, psychological, and interaction safety. The problem statement was developed and validated hypotheses based on the three questions. Q1, when they go to the hospital, they will encounter many problems and generate different types of contacts; Q2, people with easy mobility will also generate contacts during hospital orientation, and VIP will have different contact problems due to visual impairment; and Q3, after ensuring behavioral safety, this study must pay attention to psychosociological aspects. Designing interaction security. This study hopes engineers and designers will understand the VIP's guide process in hospital scenarios and design auxiliary products with the VIP in mind after reading this service-based design thinking.

However, this study lacks quantitative research to support its qualitative nature and a VIP hospitalization analysis. Due to a lack of VIP research, this study used data from VIP and hospitals in Jinfeng District, Yinchuan City, Ningxia Hui Autonomous Region, China. Instead of starting with the product or technology, more scholars will research VIP needs in various application scenarios.

5. Conclusion

Disability is a social issue. This study addresses the lack of services and equipment needed for VIP solo hospital access and develops a VIP self-help medical guide service. It investigates all touch point issues during VIP solo access implementation, summarizes user needs based on VIP characteristics, makes design recommendations to designers and engineers for VIP assistive devices, and improves VIP patient experience from a human-centered service design perspective. This study uses user journey mapping and service touchpoint analysis to summarize and unify the guidance service touchpoints of visually impaired people and make auxiliary product design recommendations. These contact points were divided into eight categories: hospital environment, lift voice system, cash and self-service payment machines, medical staff and self-service order pickers, patient contact while waiting, laboratory test guidance, doctor-patient communication, and touchpoints during. These eight contact points and the issues raised in the semi-structured interviews led to four recommendations for engineers and designers to create VIP visit assistive devices. Engineers and designers should consider sensory compensation, voice settings in noisy environments, body-worn component stability, and VIP psychological safety. Semi-structured interviews, user journey maps, service blueprints, touchpoint analysis, and design considerations for engineers and designers were used to design VIP's assistive products for a guided visit service. More engineers and designers should consider users when designing products.

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