# New York University Abu Dhabi CS-UH 2012: Software Engineering

(Student Name)

Software Requirements Specification for < careConnect >

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#### 1. Introduction

# 1.1 Purpose

The purpose of this document is to present a detailed description of the healthcare system named careConnect. It will explain the purposes and features of the system, the interfaces of the system, its functionalities, several constraints under which it must operate and how the system shall react to external stimuli.

This document is intended for the supervisors, the developers and potential users of the system.

## 1.2 Scope

This software system will be a healthcare system that serves a local community. The system will be designed to make doctoring more convenient and efficient by providing real-time online consultation and appointments booking, which would otherwise have to be done in person, manually.

More specifically, the system is designed to allow clients to search for medical centers with a wide range of filters. The system will facilitate online booking through appointment scheduling, notifications to both clients and admins, and payment making.

# 1.3 Definitions, Acronyms, and Abbreviations

- GUI-Graphical User Interface
- NA-Not Applicable

# 1.4 References

See appendix.

#### 1.5 Overview

The next section, Section 2, gives a brief but comprehensive idea of the system. It is used to establish a context for the technical requirements specifications in Section 3. This section is primarily intended for users and stakeholders, thus written in an understandable way.

Section 3 describes the specific requirements related to the system in terms of implementation. This section consists of functional requirements described in sections 3.1, 3.2 and nonfunctional requirements specified within sections 3.3-3.6. This section is written primarily for the developers and describes in technical terms the details of the functionality of the system.

Section 4 specifies the system updates in terms of feedback gathering and decision making.

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# 2. The Overall Description

# **2.1 Product Perspective**

The careConnect platform is a product aimed at providing chat-based functionality for better communication and booking medical appointments. The platform was created to meet the high demand for online consultations with doctors during the pandemic, and it aims to provide a user-friendly interface for patients to find a doctor with the required specialization and book appointments online. The careConnect platform is a component of a larger system that involves different medical centers and doctors registered in the system. The platform either interacts with these external systems or has a functionality to store those data manually to display the availability of medical centers, book appointments, and facilitate payment for online consultations. The careConnect platform offers a unique chat-based functionality for booking medical appointments and facilitating online consultations. Similar platforms in the world marketplace are Zocdoc and HealthTap.

The careConnect platform stands out in the market by offering a distinct chat-based functionality for booking medical appointments and conducting online consultations. While Zocdoc and HealthTap share some similarities in their features, careConnect distinguishes itself by providing a comprehensive end-to-end service that extends beyond mere consultation. In addition to helping users choose the right prescription after consultation, the platform also tracks users' health status and maintains a record of their medical history. The ability to gather and analyze comprehensive health data is an essential aspect of constructing personalized and effective treatment plans. CareConnect's ecosystem enables users to consolidate and organize their health records, streamlining the process of gathering relevant health information for medical practitioners. By providing this all-in-one platform, careConnect offers a unique value proposition to users seeking to manage their health proactively and efficiently. careConnect will also have many features, for example, the opportunity to choose prescriptions and buy it after consultation, notification about bookings, etc.

## **2.1.1 System Interfaces**

The system has no system interfaces

#### 2.1.2 Interfaces

CareConnect will provide a web-based graphical user interface (GUI) that will allow healthcare providers to access patient data and manage their appointments. The interface will be optimized for ease of use and accessibility for users of all abilities, including compliance with the American with Disabilities Act (ADA) guidelines. The GUI will be designed with a user-centered approach and undergo user testing to ensure its effectiveness. Below are the main interface logic or optimizations that will be considered:

• The interface should support multiple languages and be culturally sensitive, especially if the software product is intended for use in a multicultural environment.

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- The interface should support different types of devices, such as desktops, laptops, tablets, and smartphones, with responsive design principles.
- The interface should have appropriate security measures, such data encryption, to protect patient privacy and comply with healthcare regulations.
- The interface should have error messages that are clear, informative, and actionable, to help users recover from errors and prevent frustration.
- The interface should have an effective search functionality that allows users to quickly find patient records, appointments, and other relevant information.
- The interface should have a customizable dashboard that allows users to view relevant information at a glance and prioritize their tasks.
- The interface should have clear and concise labeling of features and functions to reduce cognitive load on users.

#### 2.1.3 Hardware Interfaces

The system has no hardware interface requirements

#### 2.1.4 Software Interfaces

#### 2.1.4.1 Stripe API

Name: Stripe API Mnemonic: N/A

Specification number: N/A

Version number: Latest version (as of the time of development)

Source: Stripe website (https://stripe.com/docs/api)

Interface purpose: Stripe API is a payment processing software that allows businesses to accept payments online. CareConnect will use the Stripe API to process payments made through the platform for services such as appointments.

Interface definition: The Stripe API interface will use RESTful web services to communicate with CareConnect. The API will provide endpoints for creating and managing payment information, such as customers, cards, and transactions. The messages exchanged will be in JSON format and will include information such as payment amounts, payment status, and customer information. The interface will be secured using HTTPS and authentication will be provided through API keys.

#### 2.1.4.2 Google Maps

Name: Google Maps
Platform Mnemonic: GMP
Specification number: n/a

Version number: v3

Source: https://developers.google.com/maps/documentation/javascript/overview

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Interface purpose: The Google Maps Platform is used for displaying maps and location information within CareConnect's appointment booking system. This API provides a range of mapping and location-based services, including geocoding, directions, and place search, to help users find and navigate to their appointments.

Interface definition: The Google Maps Platform provides a JavaScript API that can be embedded into CareConnect's web application. The API allows developers to create and customize maps with various overlays, including markers, polygons, and polylines. The API also provides functions for geocoding addresses, calculating directions between locations, and searching for places of interest. The API sends and receives data in JSON format over HTTP requests.

#### 2.1.4.2 GoodRx API

Name: GoodRx API Mnemonic: GRX

Specification number: N/A

Version number: 1.0 Source: GoodRx

Purpose: The GoodRx API is a RESTful API that provides programmatic access to prescription drug pricing and discount information. This integration would be useful for the CareConnect platform in helping users find the most cost-effective pharmacy options for their needs.

Definition: The GoodRx API accepts HTTP GET requests with query parameters that specify the drug name, dosage, and location of the user. The API responds with pricing and discount information for the specified drug, including the name of the pharmacy and price of the product.

#### **2.1.5 Communications Interfaces**

The communications interfaces that will be used are standard web protocols such as HTTP, HTTPS, TCP/IP. Sockets will be used to provide open peer-to-peer real-time communication functionality.

#### **2.1.6 Memory Constraints**

There are no significant memory constraints for the system. Memory is required only for softwares (like Google Chrome) to open a website. No major files or data will be cached locally.

#### 2.1.7 Operations

The system must support the following authorization privileges:

• User mode: This is the default mode for regular users, where they can perform various tasks based on their roles and permissions.

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• Administrator mode: This mode provides full access to the system, allowing administrators to perform administrative tasks such as system configuration, user management, and security management.

Based on the authorization privileges, some features will be hidden. This will be discussed in Section 3 in-depth.

Regarding other special operations, like backup, this is not a priority requirement for the application as the content will be stored in the database that can be restored.

# **2.1.8 Site Adaptation Requirements**

No site adaptation requirements are needed.

#### 2.2 Product Functions

With the system, customers shall first enter their information regarding their illness, and the system shall provide suggestions regarding their symptoms. If they are eligible for online consultation, the system would match a suitable doctor for the customers. Then, customers shall have an online consultation, and have electronic medical records and prescription. They shall be able to purchase in the system directly. Moreover, the system shall provide information about health centers based on the price and location, provide the availability of doctors, and customers can make an in-person appointment. The system shall notify doctors or hospitals, and customers shall receive the confirmation. In the system, customers shall view the status and history of appointment, and history of medicine purchase.

#### 2.3 User Characteristics

- 2.3.1 The target customers should be at least 18 years old. Children and older people are not recommended to use this system.
- 2.3.2 Customers should be literate and know how to surf the Internet, so they can use this system.
- 2.3.3 The major target customers live a fast paced life, and want to use this system for quick and convenient consultation for some minor illness. The UI design shall be simple and easy to follow, and each functionality shall be clear and visible.

#### 2.4 Constraints

- 2.4.1 This system is constrained by Web Content Accessibility Guidelines and ADA (American with Disabilities Act).
- 2.4.2 This system can be used to import appointments to google calendar. Moreover, this system can open Zoom for online consultation.

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- 2.4.3 This system needs to ensure the security of the system, not hacked by outside organizations or people, and do not leak important class resources.
- 2.4.4 This system should be able to support a huge user base.
- 2.4.5 This system should have fast performance during normal hours and peak hours. It should operate in 24 hours.

# 2.5 Assumptions and Dependencies

#### 2.5.1 Assumptions

- 2.5.1.1 Users of the system will have access to a modern web browser with support for React, CSS, and JavaScript.
- 2.5.1.2 The system will be hosted on servers that meet the minimum hardware and software requirements.
- 2.5.1.3 Users of the system will have basic computer skills.
- 2.5.1.4 Users of the system may need some training for navigation.

#### 2.5.2 Dependencies

- 2.5.2.1 The web application relies on third-party APIs for geolocation. If these APIs become unavailable or are not accessible in certain regions, the functionality of the web application may be affected.
- 2.5.2.2 The web-based project management tool relies on a third-party database management system Mongodb to store project data. Any issues with this system could affect the availability and performance of the tool.

## 2.6 Apportioning of Requirements.

- 2.6.1 Minimum Viable Product
- 2.6.1.1 User authentication and registration
- 2.6.1.2 Basic search functionality for medical centers
- 2.6.1.3 Appointment making by patients
- 2.6.1.4 Slot creating by medical centers
- 2.6.1.5 E-prescription by doctors
- 2.6.1.6 Viewing appointment history and information on user profile pages
- 2.6.1.7 Design for user interface

#### 2.6.2 Additional Functionality

- 2.6.2.1 Advanced search functionality with filters (rating, price, services, distance, keywords) for medical centers
- 2.6.2.2 Integration with third-party APIs and services
- 2.6.2.3 Design for more accessible user interface

#### 2.6.3 Future Enhancements

- 2.6.3.1 Integration with a online pharmacy for medicine shopping
- 2.6.3.2 Patient feedback system for medical centers and doctors
- 2.6.3.3 Advanced user management and access control
- 2.6.3.4 Integration with popular payment gateways

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# 3. Specific Requirements

# **3.1 External Interfaces**

This system does not require an external interface.

#### 3.2 Functions

- 3.2.1 This system allows customers to register their account and log in.
- 3.2.2 Customers shall be able to filter medical centers based on various parameters (location, price, etc.)
- 3.2.3 Customers can check the availability of doctors, and make an appointment.
- 3.2.4 In their account, customers can check their future appointment, view their history of appointments.
- 3.2.5 Customer shall be able to pay for the booking fee/online consultation through a platform
- 3.2.6 Administrator shall be notified for an appointment and send the customer messages via text message/emails for confirmation.
- 3.2.7 Administrator shall be able to create an availability schedule in the system.
- 3.2.8 This system shall have a filtering mechanism that classified the cases that can have online consultation, the cases that customers need to visit a doctor in-person, and the cases that they would recommend notifying the ER.
- 3.2.9 The system shall recommend the suitable doctors based on the information provided by customers.
- 3.2.10 The system shall provide an interface that customers can consult with doctors.
- 3.2.11 Customers can view their electronic medical records for online consultations.
- 3.2.12 After the consultation or appointment, the doctor shall give a prescription, and customers shall purchase medicine in the system.

# **3.3 Performance Requirements**

- 3.3.1 Static numerical requirements:
- 3.3.1.1 The number of terminals to be supported: maximum 100,000,000 at one time
- 3.3.1.2 The number of simultaneous users to be supported: maximum 600,000 concurrent users
- 3.3.1.3 Amount and type of information to be handled: can support up to 2 TB data, including texts, images, and videos
- 3.3.2 Dynamic numerical requirements:
- 3.3.2.1 95% of activities on the system should not exceed 1 second

## 3.4 Logical Database Requirements

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#### 3.4.1 Databases

- 3.4.1.1 The system links to the local medical center database. Details regarding location, scope, specialities, doctors, availability shall be accessible and updated for the system to use.
- 3.4.1.2 The system stores client information in a list of names, password, phone numbers, basic physical conditions, medical history, and default payment method in an internal database.
- 3.4.1.3 The system stores admin information in a list of names, password, phone numbers, specialties, and hospital(s) that they belong to, in an internal database.
- 3.4.1.4 The system maintains a database for online consultation message backup in the form of message, type, sender name, receiver name, time.
- 3.4.1.5 The system maintains an appointment database in the form of appointment name, time, patient name, doctor name, descriptions.
- 3.4.1.6 The system maintains a database keeping track of payment transactions in the form of name, sender, receiver, amount, time, payment method, purpose.
- 3.4.1.7 The system maintains a database to track reviews of consultation.
- 3.4.1.8 The system maintains a database of medicines available.

#### 3.4.2 Usage

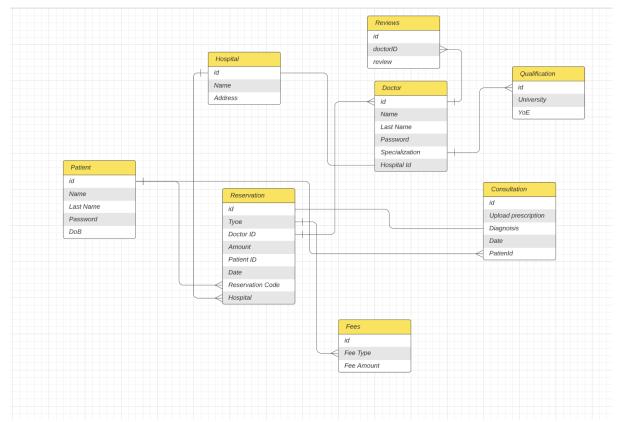
- 3.4.2.1 The system retrieves data from the local medical center database whenever there is an appointment booking request. Clients are able to filter medical centers by those attributes provided from the database.
- 3.4.2.2 The system pushes user data into the client or admin database whenever a registration is done successfully.
- 3.4.2.3 The system retrieves data from the admin database whenever there is an online consultation. Clients are able to check and choose doctors to consult through the information provided in the admin database.
- 3.4.2.4 The system visits the client and admin information database whenever there's a login request to check if the users exist and if the username matches with the password.
- 3.4.2.5 The system pushes message information to the message database whenever a message is sent out successfully.
- 3.4.2.6 The system pushes appointment information to the appointment database whenever an appointment is booked successfully.
- 3.4.2.7 The system pushes transaction information to the transaction database whenever a transaction is made successfully.
- 3.4.2.8 The system retrieves data from the message database whenever there is a request to view chat history.
- 3.4.2.9 The system retrieves data from the transaction database whenever there is a request to view transaction history.
- 3.4.2.10 The system retrieves data from the appointment database whenever there is a request from a user to create an appointment schedule.
- 3.4.2.11 The system automatically retrieves data from the appointment database based on appointment times. It sends out notifications 2 hours before the time.

## 3.4.3 Constraints

- 3.4.3.1 The system shall ensure that all the databases are kept confidential.
- 3.4.3.2 To prevent corruption, the system shall retain its data for 90 days after a designated user authorizes deletion of a record (user information, message, transaction, appointment data).

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# 3.4.4 Rough ER Diagram



# 3.5 Design Constraints

- 3.5.1.1 Sharable Content Object Reference Model
- 3.5.1.2 Aviation Industry Computer-Based Training Committee
- 3.5.1.3 Web Content Accessibility Guidelines: it makes web contents more accessible

# 3.5.1 Standards Compliance

Specify the requirements derived from existing standards or regulations. They might include:

- (1) Report format
- (2) Data naming
- (3) Accounting procedures
- (4) Audit Tracing

For example, this could specify the requirement for software to trace processing activity. Such traces are needed for some applications to meet minimum regulatory or financial standards. An audit trace requirement may, for example, state that all changes to a payroll database must be recorded in a trace file with before and after values.

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## 3.6 Software System Attributes

#### 3.6.1 Reliability

The following are the factors to establish required reliability of the software system:

- System shall store a copy of the database, to avoid any failures and data deletions
- System shall lock booking slots during payment process, or during consideration of booking, and another user will not be able to choose the same slot

# 3.6.2 Availability

- The system shall run 24/7.
- The system shall allow users to reload after failure without loss of input, except in the case of no internet connection in which the inputs cannot be saved automatically.

Our platform must be available 24/7 with the exception of scheduled maintenance periods. The CareConnect must be able to handle peak loads during registration periods, with a response time of no more than 5 seconds for each user request. We can sacrifice consistency to achieve more availability, i.e. we will use "lazy" updates during creation of the posts for example in order to reduce traffic to servers. These lazy updates can be achieved via "queue" and interval scheduling durinch which queue items will be processed.

#### **3.6.3 Security**

- User authentication: The system shall require users to authenticate themselves with a username and password before approving a booking, however it is not needed for search
- Password storage: The system shall store passwords securely using industry-standard encryption algorithms. Cryptographic hashing algorithms will be used as we prioritize safety and can tradeoff it with the slightly longer hashing process.
- Ddos-attack: The system shall limit the number of requests per unit time to avoid potential attacks to overload a server.
- User authorization: The system shall restrict access to certain areas of the program based on user roles and permissions.

## 3.6.4 Maintainability

- The system shall support version control and provide a well-documented release process to facilitate deployment of updates and bug fixes.
- The system should have unit testing for each functionality of the web-platform

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- The system shall provide a documentation for all the functionalities
- The system shall handle errors gracefully by using pop-up windows for example, showing error status codes with brief explanation

#### 3.6.5 Portability

// this section is omitted, as we are building a Web-application Also it is not very important even for the future possible mobile app before getting first users. We will follow a vertical scaling approach as much as we can by increasing power of the servers, database storage, etc.

# 4. Change Management Process

Changes and feedback shall be submitted by email. One of the team members will be responsible for checking, collecting and filtering feedback once a week. There will be a monthly meeting discussing and validating the feedback. Valid feedback will be put to implementation within the next month.

# 5. Document Approvals

The following individuals have reviewed and approved this SRS document:

Name: Xiaochen Yu Title: Developer Signature: Xiaochen Date: 5/09/2023

Name: Yuki Longyan Li

Title: Developer Signature: Yuki Date: 5/09/2023

Name: Yernar Mukayev

Title: Developer Signature: Yernar Date: 5/09/2023

Note: This document is subject to change based on future iterations and feedback from stakeholders. Any changes will require re-approval from the appropriate individuals listed above.

# 6. Appendices

#### **6.1 Interview questions**

#### For Patients:

6.1.1 How old are you, and how often do you go to hospital?

Answer1: 21, about five times a year Answer2: 21, about ten times a year

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Answer3: 21, one or two times a year

6.1.2 How far are the hospitals or medical centers you usually visit?

Answer1: 10 to 20 minutes of driving

Answer2: 15 minutes of taxi Answer3: 1 hour of driving

6.1.3 What are your reasons for visiting doctors? For a regular medical examination? Do you feel sick?

Answer1: medical examination, teeth, usually not because of sickness

Answer2: eyes, teeth(orthodontics), examination

Answer3: medical examination

6.1.4 Which departments of hospital do you usually visit? Are these necessary for an in person or zoom can also work?

Answer1: gynecology department and dentistry

Answer2: dentistry and ophthalmology department; would see a doctor in person for the first time, but prefer some consultations online

Answer3: ophthalmology, gastroenterology, dentistry; in person consultations are necessary

6.1.5 How long would it take for one visit to the doctor? Would you choose not to go to hospital because you do not have enough time due to work or study?

Answer1: 1 hour to 1 hour and a half; yes

Answer2: 2 hours; yes

Answer3: 2 hours to 5 hours; yes

6.1.6 How much would you spend on the consultation?

Answer1: insurance covered (probably 300 AED)

Answer2: Not remember

Answer3: approximately 200 RMB

6.1.7 How would you make an appointment with the doctor? By email? By phone? Do you contact the doctor directly or contact the hospital?

Answer1: hospital official websites or applications

Answer2: By phone or applications

Answer3: Through applications. I usually contact the doctor's assistant.

6.1.8 Do you have the experience of waiting for doctors for a long time in hospital?

Answer1: No, usually not

Answer2: Yes, I have waited for a long time.

Answer3: Yes

6.1.9 If you are not sure about the type of illness, what would you do? Do you search online? Ask your family or friends? Do you go to hospitals/medical centers directly and randomly choose a department?

Answer1: search online first, then ask family or friends, and then choose a department in hospitals

Answer2: I would search online, and also ask my mom (she works in the hospital), and then go to the hospital

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Answer3: I usually ask some of my relatives who work in hospitals or are doctors themselves, then go to the hospital based on their suggestions.

6.1.10 Would you visit a doctor for a prescription to purchase medicine? If you can get a prescription via online consultation, would you prefer in person or online consultation? Answer1: Yes, if this medicine needs prescription; would choose online consultation if possible

Answer2: I would if I know what kind of medicine I want to buy, and I would choose online consultation

Answer3: I would prefer online consultation under the circumstances that the doctor knows well about my medical conditions or that I know exactly what medicines I need.

6.1.11 Do you prefer purchasing medicine in person or online?

Answer1: in person, afraid of purchasing fake medicine, would prefer purchase medicine in pharmacy because it is very convenient; but purchase very simple medicine online

Answer2: depends on the type of medicine

Answer3: Online only when the platform is authorized and when I know what to buy.

6.1.12 How do you keep your medical records? Do you use printed versions? Do you often lose your medical records?

Answer1: usually not keep medical record

Answer2: I used printed medical record in my own country, but I often forget to bring my medical record when I need to visit my doctor for the second time

Answer3: Yes, I used printed versions; I don't often lose them, since I usually prepare in advance before going to a hospital. Also some medical centers create customized medical records (like dentistry) and keep my records in the medical center.

6.1.13 Nowadays online healthcare systems are becoming more and more advanced and accessible. There are many things that can be done online, like consultation, booking and payment. What do you think are functionalities that are not enabled in existing healthcare systems but are of great necessity and potential?

Answer1: It could be a system that connects consultation directly with prescription. For now, I have to take medical results with me and buy medicines in person, which is inconvenient. I would like to make online purchases.

Answer2: to measure pulse, blood pressure, vision, hearing, weight, blood test, and acupuncture. Answer3: Purchase medicines online. This system should be straightforward and convenient enough for the old to use.

Answer4 (from a doctor): Existing online healthcare systems are helpful, but they cannot enable us to measure patients' pulse and lung, and we cannot touch the patients. It's better to have sensors and softwares that have such functionalities.

#### For Hospitals/Medical Centers:

6.1.13 Do you have an appointment system? If not, do you want to have one, and what functionality do you want? If yes, what additional features do you think it is important to add? Answer1: Yes, we have an appointment system in place for our patients. The functionality we want in the system is the ability for patients to book their appointments online, view their upcoming appointments, and receive reminders about their appointments via email or text message. In addition to our current appointment system, we think it would be important to add

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features such as the ability for patients to reschedule or cancel their appointments online, as well as the option for patients to choose their preferred physician or specialist.

Answer2: Yes, we offer online appointment scheduling through our website. Our platform includes the ability for patients to select their desired provider, date, and time, as well as the option to reschedule or cancel appointments. Patients are also able to receive automated reminders and confirmations via email or text message.

6.1.14 How do you usually make appointments with patients? By emails? By phone? Answer1: We usually make appointments with patients over the phone, but we also offer the option for patients to book appointments in person at our medical center.

Answer2: We have our own apps that can be used to make an appointment, and we also accept booking appointments by phone call.

6.1.15 Do you have staff specifically for making appointments?

Answer1: Yes, we have dedicated staff members who handle appointment scheduling and management.

Answer2: Yes, we have some staff who have received professional training, and they are only responsible for making appointments.

6.1.16 What kinds of problems do you encounter with patients related to making appointments? Answer1: Some of the problems we encounter with patients related to making appointments include difficulty in scheduling appointments that fit their schedules, missed appointments, and last-minute cancellations or rescheduling requests. Patients often face communication barriers when trying to make appointments. It can be frustrating for them to reach our center through phone calls or online platforms, resulting in delays or missed opportunities for appointments. Answer2: One of the common problems patients encounter while making appointments is the urgency of their medical needs. Some patients require immediate attention, but due to the high demand for appointments, they may face delays in getting the necessary care.

#### **6.2** Analysis

As we can see from interviewees' answers, in some cases, regularly visited medical centers are not near to their home. The duration of a visit (1-5 hour) is long, in which sometimes they have to waste extra time waiting for their doctors. All interviewees admitted that they won't visit a hospital if they don't have enough time. All interviewees mentioned that they search online or ask someone who is a doctor when they are not sure about their medical conditions.

So we see a demand for authorized online consultations for patients who have medical concerns but have no time for an in person hospital visit; as well as online appointment booking so that almost every hospital visit can be efficient enough without time wasted for waiting.

When it comes to new functionalities to be added to existing systems, some of the interviewees mentioned online medicine purchase. So we decided to enable this functionality in our system as an add-on. To be specific, we also asked interview questions related to online prescription and medicine purchasing, and the interviewees showed a positive attitude towards these approaches, with specific concerns such as safety, authorization and user-friendliness (especially for old people). So these are factors to be considered in our system.

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