ISYS90078 Health, Data and Knowledge

Assignment Part 1-3

System Title: The Mobile Application of Chronic Diseases Self-Management

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PART 1: System and Functional Data Points

1. Introduction and Problems

Chronic disease is a disease with long-lasting conditions ("Chronic disease" 2018). It remains a huge burden for the healthcare industry and traditional methods of delivering healthcare are not sufficient for meeting the requirement of chronic disease treatment and management (Norris, Glasgow, Engelgau, Os'Connor, & McCulloch, 2003). Because the treatment of chronic disease needs a long duration and strict medication, it is necessary to have an effective medication plan based on the patient's clinical record. This plan can be referred to and executed by patients themselves and supervised by doctors. The strict execution of the plan will contribute to increasing the success rate of treatment.

One of the effective ways to make the plan is to devise a mobile application where the patient can achieve self-management. Apart from that, medical practitioners, GPs and specialists included, should help patients make treatment decisions and supervise their medication. Thus, this application will make patients' EHRs and paper-based records as an input. Then it will output a medication plan which can be executed by patients and supervised by their doctors.

2. System Objectives

2.1 Primary goals

This system allows patients to achieve self-management of their chronic diseases with the help and supervision of doctors.

- It allows patients to input their health records and execute a medication plan by themselves.
- It allows doctors to modify the medication plan and supervise the whole process of plan execution through this app.

2.2 Secondary goals

There are several secondary goals that the system can achieve:

- This system should store and manage data well for further analysis.
- This system should integrate with a variety of reliable knowledge bases.

- This system should be designed as an easy-to-use tool for people with medical backgrounds.

3 Functional Relationship to Other Systems

- Patient Identification System (PIS): The PIS contains patient basic and background information which will be illustrated in *Section 4.1.1* and *Section 4.1.2*. If the user wants to create an account, he can reference the PIS by using the patient ID to complete the initial setup. The user needs to type the information into the computer if some data are missing in the patient identification system.
- Electronic Medical Record (EMR) System: The EMR system contains the patient's medical record data related to the appointment, disease prescription which will be illustrated in *Section 4.1.3*. After completing the initial setup, the user can extract the necessary data from different EMR systems by directly referencing the patient's ID and add other information if some necessary data are missing. In some situations where the medical record is paper-based, the user can input the necessary data by typing them into the computer.
- Clinical Information System (CIS): The CIS contains the data associated with doctors, hospitals, and pathological labs which will be illustrated in *Section 4.1.3*. This information is referenced and included in the hospital EMR system.
- Knowledgebase System: During the stage of information processing, some knowledge associated with the disease will be needed. The detailed data needed will be illustrated in *Section 4.2.1*. These data may be extracted from different knowledge bases and can be verified and updated by doctors. Also, if some necessary information is missing, the doctor can input this by himself from his own experiences or other sources.

4 Functionality and Data Points

4.1 Function 1: account setup

When a person, both patients and doctors, is the new user for the system, the first thing he needs to do is to set up an account. In order to complete the setup process, the user needs to input the compulsory data. And the detailed data point is illustrated below:

- **Data point 1: patient information**

  Patient information is the essential information about the patient's identity. This data point can be automatically referenced from the PIS or manually typed into the computer by users if the patient is using paper-based records or some necessary data cannot be found in the identification system. The detailed data includes:

- Patient ID
- National identification number
- Name
- Date of birth
- Gender
- Medicare or insurance number
- Phone number
- Address
- Email address

- **Data point 2: doctor information**

  Doctor information is the essential information about the doctor's identity who is responsible for the patient disease. This data point can be automatically referenced from the CIS or manually typed into the computer. The detailed data includes:

- Doctor ID
- National identification number
- Name
- Patient name who you are responsible for
- Working hospital
- Working department
- Position: GP, specialist, etc.
- Working phone number
- Email address

- **Data point 3: patient background**

  The patient background is the patient's information about his life and family which is related to the disease. This data point is necessary since some information like patients'

family background is highly correlated with the occurrence of some diseases. For example, type 2 diabetes is likely to be caused by family inheritance and genetic factors ("Genetics of diabetes" 2017). All data in this data point are optional since some patients are not willing to tell others about his life and family. This data point can be automatically referenced from the PIS or EMR using patient ID, or manually typed in by users. The detailed data includes:

- Allergen: Allergen describes which substance(s) the patient is allergic to. If a patient is allergic to one substance, the medicine containing this substance cannot be prescribed.
- Habits: The habit considers some personal habits in his life which may be related to the occurrence of diseases including but not limited to:
    - Do you smoke?
    - How long have you been smoking?
    - Have you quit smoking?
    - Are you drinking alcohol?
    - How long have you been drinking alcohol?
    - Have you quitted drinking alcohol?
    - Do you have sexual behavior with others?
    - Is the other person male or female?
- Family background: The family background considers the inheritance factor of disease by asking the occurrence of disease in family members including:
    - Do you have the relative suffering from inheritance disease?
    - What disease is this relative suffering from?
    - What is the kinship with this relative?

- **Data point 4: consultation history**

  Consultation history records the patient's every consultation or appointment related to the chronic disease with doctors. The information about the patient in this data point can be automatically referenced from the EMR using patient ID, and the information about doctors and hospitals can be referenced from the CIS. Also, all data can be manually typed. This data point should include the following data:

- Consultation ID
- Consultation date

- Consultation hospital
- Consultation department
- Consultation type: standard 15 minutes, etc.
- Patient name
- Doctor name
- Symptom description
- Doctor's comment

- **Data point 5: prescription**

  This data point records all of the prescription related to the chronic disease. It can be automatically referenced from the EMR or manually typed into the computer. This data point should include:

- Prescription ID
- Prescription date
- Diagnosis of disease
- Patient name
- Doctor name
- Medicine:
    - Medicine information: name, company, type, dosage
    - Quantity
    - How many pills to be taken in a day?
- Doctor signature

- **Data point 6: pathological test**

  This data point records all of the pathological test result related to the chronic disease. It contains the result of the standard test in the pathological lab, and the result of the test which can be done by patients themselves like the blood glucose test. The patient information can be automatically referenced from the EMR, and the lab information can be referenced by the CIS. It can also be manually typed into the computer. This data point should include:

- Test ID
- Test name

- Test date
- Patient name
- Nurse name
- Lab name
- Test result
- Result description

4.2 Function 2: information verification

After the account is set up, this system will require the verification of both the patient and the doctor who is responsible for patient's disease. Only when both two verifications pass, the patient and the doctor can use the following functions. The purpose of verification is:

- To ensure that all of the information provided is authentic.
- To ensure that all of the information provided is related to the patient current disease.

4.3 Function 3: information update

The patient and the doctor can add, edit, or delete the data point. All of these processes need verification and the update log will be recorded in the system.

4.4 Function 4: preliminary plan output

After the account is set up and verified, the system can generate a preliminary treatment plan for patients and doctors by referring to one or more knowledge bases. The treatment plan includes:

- **Data point 7: preliminary plan**

  The data point is referenced from one or several knowledge bases. Although the type of a knowledge base is various, the data point should at least include:

- Plan ID
- Disease name
- Suggested appointment frequency
- Suggested appointment department
- Suggested pathological test
- Suggested test frequency

- Suggested health management guide: what should be noticed in the patient's daily life
- References

4.5 Function 5: plan finalization

After the preliminary plan is generated, the doctor should verify the data and finalize the plan with patients. The purpose of finalization is:

- To ensure that the data in *Data point 7* is authentic and effective.
- To discuss with patients to check the available time for appointments and pathological tests (generating *Data point 8*).
- To discuss with patients about how to take medicine according to the current prescription (generating *Data point 10*).

- **Data point 8: finalized plan part 1**

Part 1 is about the appointment and pathological test. It should include:

- Plan ID
- Disease name
- Appointment date and time
- Appointment hospital
- Appointment department
- Appointment doctor
- Appointment type
- Test name
- Test date and time
- Test type: Self-test or test by others
- Test lab
- Doctor signature

- **Data point 9: finalized plan part 2**

Part 2 is a health management guide in order to guide patients with what they need to do and what they should notice in their daily life like drinking a lot of hot water. It contains plan ID, a description text and the doctor's signature.

- **Data point 10: finalized plan part 3**

  Part 3 is a medication instruction which will serve as a reminder to remind patients of taking medicine at a certain time. This data point is referenced from the current prescription in *Data point 5*. If a patient does not have a current prescription, this data point will be empty until the patient gets his own prescription. The detailed data should include:

- Plan ID
- Date and time
- Medicine name
- Dosage
- Other requirements: like take with hot water
- Taken or not?

4.6 Function 6: plan update

After the plan is finalized, it will be updated during execution. All of the updates need the verification of the doctor and patient. The update includes:

- After taking the medicine, the patient can tick the box on the mobile screen to confirm that this medicine has been taken (updating "Taken or not" in *Data point 10*).
- Add, edit, or delete information in *Data point 8, 9, 10*.
- If a new consultation, prescription, or test result (from the lab and self-test) is gotten, it will add the information into *Data point 4, 5, 6* respectively.

The data mind map illustrating all of the data points is in *Appendix I*.

4.7 Functionality issues

Although this system is designed to help patient's self-management, there are some limitations that it may have:

- This system is not suitable for the patients who are not suffering from chronic diseases.
- This system cannot deal with treatments except medication like the injection, and operation, chemical and radiological treatment, etc.
- This system cannot ensure it is friendly to every user. For some elderly users who are not computer literate, the function inside the system cannot perform well for them.

PART 2: Detailed Data Definitions

5 Detailed Data Definitions

This part aims to analyze the following five data elements which are related to the system functionality:

- Allergen
- Appointment date and time
- Health management guide
- Medicine name
- Dosage

The detailed definition will be based on the healthcare criteria of AIHW METeOR, SNOMED CT (Australia version), SKMT Glossary Tool, and openEHR CKM. The reason why these two code systems are selected is that METeOR can provide a comprehensive value domain representation for the data element in this report, while openEHR mainly contains the definition needed in this report. SNOMED CT will revise the value domain and SKMT Glossary Tool will revise the definition in some data elements

Data element 1: allergen

Allergen means the substance in medicine to which the patient is allergic in *Data point 3*. Allergen is important in achieving system functionality since it can make doctors know which medicine should be avoided in the future plan. This data element combines the modified definition from openEHR and the value domain representation from METeOR. The SNOWMED CT will be used to restrict the category of the substance in order to make further analysis achievable.

Field name	Allergen
Definition	Identifier of a substance, or substance class, that is considered to put the individual at risk of an adverse reaction event (openEHR, 2018).
Reference	openEHR CKM Archetype ID: openEHR-EHR-EVALUATION.adverse_reaction_risk.v1
Value domain	The permissible value is the allergy to drug within the category of (SNOMED CT, 2018):

	Alcohol metabolism modifier, alcohol products, anti-infective agent, bile acid, drug in contact with skin, drug vehicle, enzyme inhibitor, meglitinide, nickel, radiopharmaceutical, etc.
Display representation	Display or print a text message containing standard English words.
Verification rules	- Both an individual substance and a substance class are valid entries. - A substance may be an individual substance, or a compound of simpler substances, for example a medicinal product. - The substance should be within or substance class should include the category of the value domain above from SNOMED CT. - Free text entry should only be used if there is no appropriate terminology available. - It can be empty if the patient has no allergen. (modified from openEHR, 2018)
Guide for use	This data is captured by the user's input of the text message combined by one or several English words. The valid examples are: - An individual substance like captopril - A compound of simpler substances like "Panadol" Some examples of misuse are: - Words which are too broad like "drug". - Words which are not included in the category of the value domain - Words with no reasonable meanings.

Allergen is illustrated by the definition of Substance in Adverse reaction risk (openEHR, 2018). The main issue of this reference is that the detailed value domain is not clear in openEHR. Thus, the category of drug allergy is used to clarify the value domain.

Data element 2: appointment date and time

Appointment date and time is illustrated in *Data point 8*. It is important to support functionality since it can make patients complete further appointments with the help of doctors. This data element combines the definition from openEHR and the value domain representation from METeOR.

Field name	Appointment date and time
Definition	The date/time that marks the beginning of the time for delivery of this consultation (modified from openEHR, 2018).
Reference	openEHR CKM Archetype ID: openEHR-EHR-INSTRUCTION.service_request.v1

Value domain	This data element contains two items: • Date: - Representation class: Date - Data type: Date/Time - Format: DDMMYYYY - Maximum character length: 8 • Time (24 hours): - Representation class: Time - Data type: Date/Time - Format: hhmm - Maximum character length: 4
Display representation	• Date: Display or print a combination of the day, month, and year in the Date/Time format • Time: Display or print a combination of the hour and minute in the Date/Time format
Verification rules	• Date: - DD should be between 01 and 28, 29, 30, or 31 according to the month. - MM should be between 01 and 12. - YY should be between 2018 and 2100. - Date can be empty • Time: - Time should be 24 hours - hh should be between 00 and 23 (inclusive) - mm should be between 00 and 59 (inclusive) - Time can be empty
Guide for use	This data is captured by the user's input of the date and time for the appointment. The user should select the appropriate date and time slot or make them empty if the hospital or clinic accept the immediate visit.

The appointment date and time is referenced by Service period start in Service request since it meets the requirement for the format of date and time. The issue is that the definition in Service period start is not specific to the situation of appointment. Other aspects like Service period expiry will not be used since this system does not require those functions.

Data element 3: health management guide

Health management guide is an important data element in *Data point 9*. It is an essential part to guide the patient to manage their health. This data element uses definition from openEHR and refers to the value domain representation in METeOR.

Field name	Health management guide

Definition	A suggestion, advice or proposal describing what the patient should do or notice in their daily life, which can help disease treatment and health improvement (modified from openEHR, 2018).
Reference	openEHR CKM Archetype ID: openEHR-EHR-EVALUATION.recommendation.v1
Value domain	- Representation class: Text - Data type: String - Format: X - Maximum character length: 1000
Display representation	Display or print a text message containing standard English sentences.
Verification rules	- It must conform to the standard English grammar rule. - It must be a specific guidance with no ambiguity in the meaning. - It must be clearly understood by both the doctor and the patient.
Guide for use	This data is captured by the user's input of the text message combined by several English sentences. This text message is a guide to tell the patient what they should do or notice in their daily life. Some valid examples are: - Do not eat candies. - Do jogging for 30 minutes twice a day. Some examples of misuse are: - Write redundant sentences like "Do not eat candies since the research paper says people suffering from diabetes should not intake too much sugar". - Write ambiguous sentences like "Do sports". - Write invalid sentences that are harmful to the patient's health like "Take as much Vitamin C as you can".

Although this definition is referenced by Recommendation (openEHR, 2018), the definition and verification rules are not clear. Thus, many parts are revised to conform to the situation in this system.

Data element 4: Medicine name

Medicine name is illustrated in *Data point 10*. This data element is important to instruct the patient which medicine he should take at a given time. This data element uses modified definition from openEHR and the value domain representation from METeOR. The value domain is verified from SNOMED CT.

Field name	Medicine name

Definition	The designation used as a label for this medicine.
Reference	openEHR CKM Archetype ID: openEHR-EHR-ACTION.medication.v1
Value domain	The name of medicine must include the main ingredient in the category of drug or medicament substance (SNOMED CT, 2018)
Display representation	Display or print a text containing letters or numbers
Verification rules	- It must be the full name of this medicine - It must contains the main ingredient in the value domain above. - The type of medicine is optional.
Guide for use	This data is captured by the user's input of information about the medicine. The user needs to specify the full name and it is better to add the information about the type. Some valid examples are: Atenolol 100mg One example of misuse is: • Use the abbreviation to represent the name.

This data element is referenced by Medication item in Medication management (openEHR, 2018). The original definition is suitable, although some misuse situations are not considered in it.

Data element 5: dosage

Dosage is illustrated in *Data point 10*. This data element is important to instruct the patient to take the exact amount of medicine. This data element uses the value domain representation from METeOR and openEHR for other fields' representation. However, since openEHR CKM fails to provide a precise definition, SKMT Glossary Tool will help give a precise definition for "dosage".

Field name	Dosage
Definition	Documented instruction on intended therapy for an individual person with a medical product issued by an authorized health professional ("SKMT Glossary Tool", 2018).
Reference	openEHR CKM Archetype ID: openEHR-EHR-CLUSTER.dosage.v1
Value domain	Dosage is a cluster type containing two items: • Dose amount: The value of the amount of medication administered at one time, as a real number, or range of real numbers, and associated with the dose unit. - Representation class: Total - Data type: Number - Format: N

	- Maximum character length: 4 • Dose unit: The unit which is associated with the dose amount. - Representation class: Text - Data type: String - Format: A - Maximum character length: 6
Display representation	• Dose amount: Display or print the number of Dose amount in Arabic number format • Dose unit: Display or print the string of Dose unit in the format of English words
Verification rules	• Dose amount: It must be an integer or decimal number bigger than 0. • Dose unit: It must be a valid English word related to the unit or measurements.
Guide for use	This data is captured by the user's input of both dose amount and dose unit. The user needs to specify a valid amount and a valid unit, and the system will combine them to form the dosage. • Dose amount examples: 1, 1.5, 0.125 • Dose unit examples: tablet, mg, capsule, ml Some examples of misuse are: • Input the dose amount as a range like 0.15 – 0.25 since it is not specific. • Use the abbreviation to represent the dose unit such as using "tab" to represent "tablet" except when it is accepted in the international standard such as using "mg" to represent "milligram".

Dosage of refenced by Dosage (openEHR, 2018). The issue of this reference is that the definition is not clear so it is revised by SKMT Glossary Tool. The reference also contains the time, but the time is included in Date and time in *Data point 10*. Some functions like representing the range and the abbreviation are also deleted since it is not specific to patients.

PART 3: Implementation and Development Strategy

6 Implementation Requirements and Intended Processes

6.1 Stakeholders

In order to successfully implement this application, the related stakeholder is identified as below:

- Doctor: Doctors are all of the medical practitioners including GPs and specialist who are responsible for patients. Doctors are supposed to be proficient in medical knowledge and able to give valid and constructive suggestions to patients. Also, they should be familiar with the existing healthcare coding system and ethics.
- Patient: Patients are the people who seek for the medical instruction from doctors. In order to effectively use the system, patients should provide authentic information and have basic computer literacy.
- IT specialist: IT specialists are the people who are responsible for the implementation, maintenance, and update of the system. They should be proficient in the programming language, database administration (DBA) and architecture, and front-end design.
- System analyst: System analysts are the people able to gather the requirement and user experience (UX) from users and know how to design the system. They should be able to identify and mitigate the risk inside the system, as well as capturing the requirement from doctors and patients and translate this to the language which the IT specialist can understand.
- Policy committee: A policy committee is a group of high-level managers who are responsible for developing the ICT strategic plan. They should make high-level policies for data and knowledge governance.

6.2 Implementation requirements

- All related stakeholders should be identified, and their rights and responsibilities should be fully understood. There should be an effective communication channel to enhance the understanding of requirement among different stakeholders.
- All stakeholders should be aware of the vision of this system – enhancing the management and treatment of the chronic disease patient – and the strategy they

need to achieve this vision. The implementation of the strategy and project activity should be aligned with the vision. They should also know how this system will contribute to both doctors and patients.

- All stakeholders should be aware of the role and responsibility according to different tasks. For example, IT specialists should be responsible for the maintenance and update of the system, while system analysts should be responsible for the requirement gathering and system design.
- All stakeholders should be aware of the current and potential issue and risk related to this system, including safety, privacy, and ethics. The method of mitigation and elimination of risk should be established and tested to show its effectiveness.
- All stakeholders should be aware of the potential change during the development process of the system. They should identify the benefit and risk of the change and be able to adapt to the change that will happen.
- In order to successfully use the system, all stakeholders should have relevant skills. For example, the patient should have basic computer literacy, while the doctor should have medical professionalism. The skill of doctor and IT-related employees should be recognized and qualified.
- In order to successfully use the system, some non-functional requirements such as user-friendliness and aesthetic user interface should be achieved.
- Training programs such as workshops should be used to develop and improve both the skill of doctors and IT-related employees and user experience of the patient.

6.3 Intended processes

The implementation of this system is suggested to follow the below process:

- *Step 1*: Planning

- Identify the vision and strategy of the system
- Identify all of the related stakeholder and its roles and responsibilities as well as enhancing their communication and collaboration
- Identify the current process of chronic disease management
- Identify the data point needed for the system

- Identify the current and potential issue and risk of the system, and a risk mitigation methodology should be developed.
- Implement the feasibility analysis of this system

- *Step 2*: Developing

- Develop the architecture and prototype of the system
- Develop the database which can store the related data point
- Develop the user interface of the system and interfaces to other systems
- Develop the connection between the database and the user interface
- Test the prototype and get feedbacks
- Analyze the feedback and implement further development

- *Step 3*: Training

- Develop a tutorial to teach the user how to use this system
- Create the workshop to teach IT specialists about software development and data analysis
- Create the workshop to teach doctors about medical knowledge and new findings

6.4 Change management

If a change happens which impacts the original process, some measurements should be taken in order to help users adapt to these changes:

- Enhance urgency and communication:

  Before implementing the change, all stakeholders should be aware of the urgency of this change as well as the benefit and risk of change. One of the effective ways is to build a guiding team to gather the feedback of stakeholders and help users to adapt to the change through consultation.

- Start a new trial in a small group when testing:

  The new system can be firstly implemented in a small group and the feedback will be given through that group. The goal of doing this is to get a short-term result for the system. After the system becomes mature, it will be tested within a large group of users and more feedbacks will be attained for improvement.

7 User Interface Requirements

Some requirements related to the user interface should be considered and are illustrated below:

- Some concurrency control methods such as locking should be used in the database to handle multiple accesses and updates at the same time (Bernstein, Hadzilacos, & Goodman, 1987).
- Some remedies should be fully considered when the interruption and alert happen.
- The user interface should be designed suitably for different users. For example, for patients it should be easy to read and use with a detailed explanation of the medical term, while for doctors it should contain comprehensive medical information which they need.
- The use of icons and terms should be accurate, concise, and consistent.
- The most important information should be displayed in the first order.

8 Knowledge and System Governance

The table below illustrates how each section of the governance is implemented, and all of the responsibilities and skills needed for the knowledge and system governance:

Knowledge Governance	Responsibilities	Skills
1. Quality of the knowledge • Ensure all of the input information is verified by both doctors and patients. • Ensure the input is consistent with the existing code system (AIHW, METeOR, and openEHR CKM) • Ensure the addition, edition, and deletion of data points are verified by users and the log is kept. • Ensure the selected knowledge base is authoritative, up-to-date, and accepted by the public and specialist. • Ensure the selected item in the knowledge base is related to the patient's situation. • Ensure the plan generated from the knowledge base is verified by doctors.	Doctor Patient System analyst	• Proficient in medical knowledge • Proficient in UX • Proficient in healthcare code system
2. Maintenance and update of the knowledge • Ensure the knowledge is periodically reviewed. • Ensure the knowledge is up-to-date and the date of accessing and editing is recorded. • Ensure the information can be only accessed by the relevant user according to its level of confidence.	IT specialist	• Proficient in programming languages • Proficient in information security techniques • Proficient in database architecture

• Ensure the source of information is recorded.		
3. Application of the knowledge • Ensure the output information is clear and understandable for both doctors and patients. • Ensure the medical term in this system is sufficiently explained. • Ensure the interface is friendly to both doctors and patients.	Doctor Patient IT specialist System analyst	• Proficient in requirement analysis • Proficient in UX • Proficient in medical knowledge
4. Analysis of the impact of its issues • Identify the current and potential risk of knowledge. • Identify the safety and privacy issue of knowledge. • Ensure that the feedback is collected from the user and the function is improved according to the feedback. • Ensure that the bug inside the code is repaired. • Ensure the data is backed up and well-stored.	Doctor Patient IT specialist Policy committee System analyst	• Proficient in risk management • Proficient in business and healthcare ethics • Proficient in DBA • Proficient in requirement analysis • Proficient in UX • Proficient in ICT governance • Proficient in programming languages

9 Evidence-based and Feedback

In order to achieve data and system improvement, three aspects should be considered including feasibility analysis, data quality measures, and quality review.

9.1 Feasibility analysis

- Organizational feasibility: The system should be aligned with its vision and strategy. Also, the system should have sufficient requirements in the market and an appropriate ICT infrastructure to support these requirements. The system should have qualified human resources to develop and it should comply with regulations and ethics.
- Technology feasibility: The system should have a well-established database to store the data. It can also be designed by using multiple programming languages for both the front-end design and database design. Some techniques related to security and privacy such as identity verification should be used.
- Economic feasibility: The budget for developing this system should be acceptable to all stakeholders. It should have an appropriate ROI and stable cash flow.

9.2 Data quality measures

- Completeness: The system should identify which type of data element is necessary and its completeness should be verified by both doctors and patients.
- Mutual exclusivity: The exclusivity should be maintained when accessing and editing the data.
- Accuracy: All of the data should be verified to ensure accuracy.
- Timeliness: The database should report the real-time transmission of data.
- Relevance: The design of data elements should be relevant to the patient situation.
- Accessibility: The data should be understandable for different users.
- Comparability: The system should be comparable to different types of data.
- Coherence: The system should be coherent with the vision and strategy.

9.3 Quality review

- When it occurs the missing data, the system should send a request to the user to get the complete data.
- The code system used should be periodically reviewed to ensure the appropriateness.
- The system should use up-to-date information and knowledge and it should be updated periodically.
- The level of confidence should be clarified to achieve safety and privacy.

10 Issues Identified

Combined with the functionality issue in Section 4.7, the following issue has been identified for the system:

Categories	Issues
Functionality	• This system is not suitable for patients who are not suffering from chronic diseases. • This system cannot deal with treatments except medication like the injection, and operation, chemical and radiological treatment, etc. • This system cannot ensure it is friendly to every user. For some elderly users who are not computer literate, the function inside the system cannot perform well for them. • This system is not suitable for patients who do not have a consultation with doctors currently. • This system is not suitable for patients who have a very complex condition of the disease. • This system may not be suitable for all types of the outer system like the knowledge base.
Data quality	• The code system may not be appropriate to all of the data element in this system.

	• The code system may be misused if the user does not fully understand its meaning. • When some patients use paper-based medical records, the data in the system may not be accurate. • The further analysis method of data is not indicated in this report.
Safety	• The security mechanism of the system is not adequately designed in this report. • The relevant ethics may not be sufficiently considered based on different situations. • The identity verification method to protect privacy is not indicated in this report. For example, the patient data might be accessed by his family members.

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Appendix I: The data mind map of the mobile app