



**City University of Hong Kong
Department of Computer Science**

BSCCS Final Year Project Report 2014-2015

(14CS079)

Chinese Medicine Clinic Management System

(Volume 1 of 1)

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Abstract

Healthcare services is one of the essential elements in modern society. They do not only include disease cure and body repair, but also healthy status promotion and maintenance on harmony of the systems in our bodies as well. The majority of Hongkongers may have a concept that Western Medicine relieves symptoms for short-term or providing immediate effect while Traditional Chinese Medicine (TCM) restores the harmony of different parts of our body and keep us healthy in the long run.

Use of information technology (IT) solutions would probably ease TCM practitioners' daily works as the attentions and needs of TCM are keep increasing. In Hong Kong, no matter what kinds of healthcare services, all the activities will come up with records and documentations. When the business runs for years, the management for records and documentations would become tedious and messy if they are managed manually in hardcopy. A lot of Western Medicine practitioners have adopted some commonly use solutions like The Hong Kong Medical Association's Clinic Management System 3.0. However, only about a half of TCM practitioners have incorporated IT solution in their business.

There are some major reasons behind that they do not adopt IT solutions. First, there are not enough choice of systems in the market. Second, the existing solution is not cost effective. Third, functions and business rules implemented in some existing solutions may not be useful or may even hinder their work. Fourth, some existing solutions may require a lot of Chinese character typing effort. Last but not least, there is no standard being widely used in the industry for the terminologies used at this moment and the system does not support customization.

Therefore, a system, which is trying to solve the problems above, is developed in this project. The system provides some basic functions like prescription making and patient and system administration, it also provides

some advanced functions like suspected overdose alert and drug incompatibility alert. It also supports a certain degree of customization and accept free-text input to solve the problem of no commonly adopted terminology standard. The system can also co-operates with the deliverable of AU-YEUNG Wing Shing's final year project (project code: 14CS078) to provide value-added function like drug reservation.

Other than the above features, the solution proposed by this project supports multiple clinics and possesses with health records sharing feature. The doctor can login to the system and view their patients' medical records entered to the system in other clinics by other doctors when permission is granted by patients. This allow the doctor to know the history of their patients and provide a better treatment.

Furthermore, this solution can also help forming the standard for the terminologies used in the TCM industry. All the user can contribute their customized item to the system. The set of items with higher using frequency, which set of items would probably become the standard.

Acknowledgment

First of all, I would like to thank my project supervisor, Dr. LEE Chung Sing Victor, for his guidance and support on this project. Throughout the year, he provided me with a lot of useful comments on my works and kept track on my project progress.

Next, I would like to thank Dr. YIP Yat Ping, an experienced Traditional Chinese Medicine Doctor, for providing me some professional knowledge. He has shared the methods to make prescriptions and drug classification. He also lent me reference books about drugs and predefined prescriptions. Without his help, the system prototype produced in this project would have been done based on imaginations.

I would like to thanks Mr. CHU Pak Hin and Mr. LAM Yiu Ming, Chinese Medicine student and Pharmacy in Chinese Medicine Student respectively, for their useful comments. They shared their experience on using Information Technology solution in Traditional Chinese Medicine Clinic and gave suggestions and feedbacks on the system prototype.

Last but not least, I would like to thank all the individuals who offered their sincere help on this project. Without their help, this project cannot be done smoothly.

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1. Introduction

1.1. Background Information

Healthcare services is essential in the modern society. They are not only including those treating our diseases and repairing our body, they also include those keeping our body in a healthy status and maintaining the systems in our bodies to work well. The majority of Hongkongers may have a concept that Western Medicine is for relieving symptoms while Traditional Chinese Medicine (TCM) is for restoring the harmony of different parts of our body and keeping us healthy in the long run.

Nowadays, staying healthy is one of the hot topics in the city. In addition to the aging problem in Hong Kong, more and more concerns about diseases associated with old age and weakened systems in bodies are being emphasized on. It is claimed in one of the World Health Organization's Commission on Intellectual Property Rights, Innovation and Public Health Studies that spreading TCM to all the places throughout the world is beneficial for people's health (Jia, n.d.). From this, we can see the status of TCM keep rising all over the world. Thus, the attention on TCM and the needs of TCM are growing.

1.2. Existing Problems

No matter what kinds of healthcare services, TCM or Modern Western Medicine, they are all about consultation, medication, treatments and procedures. These activities need to be recorded and keep track by documentation. As the population in Hong Kong keeps growing (Census and Statistics Department, 2014), the demand of healthcare services will greatly increases. As the amount of patient increases, the number of records produced will also increase exponentially. Unfortunately, for clinics not using information technology (IT) solution, these records are in written form, which means all these records are in hardcopies. When their businesses just start up, it might be still able to keep and manage few hundreds piles of health

records. When their clinics run for years, it may be difficult for them to find and manage thousands decks of patient profiles. It may also be a problem for storing such a huge amount of hardcopy paper records in a clinic as the size for clinics is usually small and rental fee is high.

In this situation, information technology can help. For Modern Western Medicine, there are plenty of solutions for clinical management and the majority of clinics and hospitals have adopted these solutions. For government Western Medicine clinics and hospitals, they all use the Hospital Authority (HA) in-house developed Clinical Management System (Hospital Authority, 2014). For private clinics, they adopted some popular solutions like The Hong Kong Medical Association's Clinic Management System 3.0 (Food and Health Bureau, 2014). For TCM clinics under the HA's management, most of them are using the in-house developed system, Chinese Medicine Information System (Health, Welfare and Food Bureau, & Hospital Authority, 2007; Hospital Authority, 2011). However, for private Traditional Chinese Medicine clinics, most of them have not adopted any of the solutions mentioned above. There are less than a half of practitioners in Hong Kong are using IT facilities for their work and only a half of them are satisfied with the currently adopted system (eHealth Consortium Limited, 2010).

1.3. Motivation

There are some major reasons to explain why TCM practitioners have not adopted IT solutions.

First, there may not have enough systems, which can be chosen, in the market (eHealth Consortium Limited, 2009). This may increase the difficulties to find the best solution. For example, considering a clinic which only provides consultation services. Those integrated clinical and sales systems may not fit their business. Thus, the clinic would probably refuse to adopt the solutions.

Second, the cost of many existing solutions is expensive (eHealth Consortium

Limited, 2010). Like the case mentioned above, the sales management part is not necessary for the clinic. This means that clinics are paying extra for functions which they do not need. If the cost of the system outweighs the profit or even the benefits they get, this would make the TCM practitioners hesitate to adopt those solutions.

Third, there is no standard being widely used in the TCM industry for the terminologies used at this moment (Food and Health Bureau, 2014) and practices for different doctors may vary (eHealth Consortium Limited, 2010). This would cause inconvenience to users if the system being used does not provide flexibility to do a certain degree of customization.

Fourth, as told by some existing system users, functions and business rules implemented in existing systems may not be useful or may even hinder their work. For example, if the doctor prescribes an herb with dosage larger than the suggested dosage stated in the system, the system will block the doctor from exercising their professional judgment for prescribing the recipe. This would lead to change of treatment and use a suboptimal recipe for the patient.

Fifth, some senior doctors may not be able to type Chinese characters in an acceptable speed or even cannot type Chinese. If the system requires users to type a lot for making prescription and entering history, this would discourage the doctors to use the solution.

Therefore, a system which incorporates more knowledge of the business domain and can be run under acceptable cost is needed.

1.4. Project Objectives and Scope

In Hong Kong, there are different scales of business regarding TCM clinics, from single doctor clinics for consultations only to clinics run by healthcare corporates with multiple doctors on duty at a time and dispensary with self-owned supply chain. In order to fit as much types of business as the system

can, the system only handles clinical and medication records part. For sales and dispensary part, it is handled by the deliverable of AU-YEUNG Wing Shing's final year project (Project Code: 14CS078). When combining the two systems together, they can form an integrated clinic information system. For the mapping between clinics and pharmacies, a mapping table will be maintained manually by database administrator or by another subsystem which outside the scope of AU-YEUNG's and my project.

In this project, a system that can help users with their daily jobs is developed. The system should be possess with some basic functions including patient management, medical record management and documents generation functions. In order to keep the system running at low cost, the tools chosen would be freeware. In order to solve the problem raised by no widely adopted standard for terminology used in the industry, the system should allow a certain degree of customization and accept free-text input to fit different users. Furthermore, this system would not stop the user from exercising professional decision. Once suspected decision errors and abnormal situations happens, the system will remind or warn the user instead of stops the action like the case mentioned in Section 1.3 point four. Concerning the Chinese typing ability of users, this system would minimize the chance of using word-typing input.

Nowadays, advanced booking for consultation is quite common in healthcare services. However, the system developed in this project mainly focuses on the consultation part and the related documents generation. This system only maintain a queue for waiting for consultation in each clinic. The booking and scheduling for consultation is assumed to be done by a subsystem and it will insert a record to the queue when the patient arrived.

In the development process, opinions and suggestions from potential users are received so as to optimize the system for practical use.

Concerns of Internet security will not be addressed in this project and

adoption of basic existing measure remain, i.e. anti-virus and firewall software.

2. Literature Review

In Hong Kong, information technology solutions has been used for daily operation in healthcare sector for a period of time. Just take the example of Hospital Authority, they use their in-house developed Clinical Management Systems since 1995 (Hospital Authority, 2014). It has been run for nearly 20 years. There may be some features or designs that can be learnt for this project. In the market, there are also some solutions for Traditional Chinese Medicine practitioners. However, it is not popular among the industry. From them, we can know what is unfavorable by the users. Thus, a solution that can be applied to various situations can be developed. The following are some related solutions that have been studied.

2.1. HA Clinical Management System

Hospital Authority's Clinical Management System (HA CMS) is an important system in the HA. It is used by nearly all the HA clinicians providing healthcare services (Hospital Authority, 2011). It provides a system for clinicians to access and create patient records within or outside itself (Solomon, 2008).

HA CMS in phase III development to enhance its function and features providing in the existing system in order to help the HA to provide services with high quality, less errors and high efficiency (Hospital Authority, 2011). In this sophisticated system, it provides drug allergy checking function (Hospital Authority, 2013) and this might also be useful in Chinese Medicine setting. However, some clinicians may find that the system's user interface keep changing frequently and they cannot adapt to the updated system easily. Thus, it may lead to errors due to clicking the wrong buttons.

2.2. HA Chinese Medicine Information

System

Hospital Authority's Chinese Medicine Information System (CMIS) is the information technology solution adopted by Chinese Medicine Centers for Training and Research (CMCTRs) (Hospital Authority, 2011). According to Leung et al. (2012), it is an integrated system in-house developed by HA for helping clinicians with their daily tasks and sharing data among clinics. Furthermore, it also serves for data collection for researches and studies.

CMIS has implemented functions to facilitate all aspects in the daily workflow. For instance, herb-herb interaction and dosage checking functions have been implemented in order to increase the quality and safety of services provided by reducing human errors due to carelessness. What is more, CMIS seems to be the first system developed for Hong Kong TCM industry enforcing a terminology standard. Besides, advanced functions like monitoring the suspected outbreak of infectious diseases also provided in the system which can help in administration-level staff's work. In order to keep the services quality improving, Key Performance Indicators also implemented in CMIS. As this system is centralized, it can launch policies or standards like International Classification of Diseases 11th Revision (ICD-11) which is going to be released by 2017 (World Health Organization, 2014) with ease. It may be the most comprehensive and useful system that suits corporate level healthcare services providers.

However, there is quite a few number of clinics are in such a large scale. Most of TCM clinics are small to medium enterprise level. Those surveillance and performance monitoring function may not be useful to those common clinics and these functions may require a large amount of resources, thus increase the cost. From a LegCo document, over five million of Hong Kong dollars were used for the implementation of CMIS in five CMCTRs (Health, Welfare and Food Bureau, & Hospital Authority, 2007), i.e. over one million per clinic. This huge amount of budget seems not affordable by those common clinics.

2.3. KT Chinese Medical Integration System

KT Chinese Medical Integration System (in Chinese: 國泰中醫整合系統) is a system developed in Taiwan. This system is being used by some clinics in Hong Kong. According to the website (國泰電腦有限公司, & 國圓科技股份有限公司, n.d.), it is an all-in-one system which can support a whole workflow in clinics, including consultation, drug dispense, point-of-sales and clinicians roster scheduling. It supports various well-known database systems with different performance, from MySQL to Oracle and Informix. This system can also connect with peripheral systems like queue number calling system which can make the clinic look modern and give their client more confidence on their services.

This system may be suitable to some large clinics in Hong Kong as it possesses a queuing system and also have the ability to cooperate with other peripheral systems. However, as this system is developed based on Taiwan's TCM industry, some of the functions implemented in the system may not be useful in Hong Kong or even tailor-made for Taiwanese.

2.4. Clinic Management System by ONE-POS

The TCM clinic management system developed by ONE-POS is called 中醫診所管理系統. It is a Hong Kong local developed system. It provides users with patient management, health record management and point-of-sales functions (IT Force (Hong Kong) Limited, 2014). Based on the functions provided, the system might fit a lot of clinics in Hong Kong. However, from the screen capture provided in the website (IT Force (Hong Kong) Ltd., 2014), it seems they mixed the domain of sales and TCM clinics. The functions buttons of the

two domains mixed in one panel and this would make the user confused. From the user interface captured, it can be seen that this system requires a lot of word typing for entering the diagnosis and health records. Since doctors, especially those experienced, may not familiar with word typing and thus cannot use the system.

2.5. Summary

In the systems developed by Hospital Authority, both of them possess with a common feature, which is drug checking. This drug checking function include the checking of drug compatibility and patient allergy history. The HA implement this kind of function in both systems, which may indicate that the function could probably reduce prescription faults due to carelessness. Therefore, this function is considered to be implemented in this project.

Consider the business domain mixing problems, this would be solve by separating the domains by two systems, like the system to be develop in this project only focus on clinical part and the one to be develop by AU-YEUNG's will be focusing on pharmacy and sale part.

3. Technology and Tools Reviews

3.1. Application Type

In business setting, most commonly used devices should be personal computers. More than a half of these computers are using Windows as their operating systems (Net Application.com, 2014). Thus, applications used on these computers are mainly three types, Windows applications, Java applications and web applications. However, Java applications run on Java Virtual Machine which requires more resources and may not be able to run on slow or old computers. Therefore, in this project, only Windows application or web application will be considered as the type of the application.

3.1.1. Windows Application

Windows application for this system will mainly consist of two parts, client application and server. The server is the connected database. For Windows application, developers can use .NET framework for the development. With the frameworks, useful libraries provided allow programmers to develop the system with nice graphical user interface easily. However, Windows applications can only be run on Windows, thus limits the user scope on Windows users.

3.1.2. Web Application

Web application for this system will mainly make up of three parts, web browser, web server and database. This type of application can provide a cross platform feature. However, the user interface is rendered by the web browser and different browser or even different version of browser may have different behavior on the same coding. This may trigger some abnormal behavior of objects on the user interface and increase the degree of difficulty on development.

3.1.3. Conclusion

Windows application is chosen for this system. The system should be stable enough for users to use. It should not depends on third-party software too much as defects in those software will let the errors propagates to the system developed based on them, thus decrease the confidence of using the system. Web application depends on web browser while Windows application does not. Furthermore, Web application relies on two remote components, web server and database while Windows application relies on one only, which is database. The system to be developed is targeting small to middle size clinics and they usually do not have much budget to have back-up or stand-by server for them. Thus, one of this component fails will lead to the system collapse. Also, the network condition may affect the performance in data transfer. More remote components, higher the chance of data transfer. Relying on more remote component may decrease the reliability of the system. Therefore, Windows application in client server model may be more suitable for this project.

3.2. Reporting tools

In the system going to be developed, it possesses with document generation and reporting functions. A reporting tool can help doing these job well with ease. In this project, JasperReports and Crystal Reports will be considered as the writer is more familiar with.

3.2.1. JasperReports

According to Jaspersoft Community (TIBCO Software, Inc., 2014), JasperReport is one of the popular open source reporting engines. It is written in Java and able to use different kinds of data source. The generated documents can be print or exported to different format including PDF.

3.2.2. Crystal Reports for Visual Studio

Crystal Report is a well-known commercial tool for reporting. According to its

official webpage (SAP, n.d.), it provides a developer version for Visual Studio development environment for free with some restriction on profit making. Developers can design the report layout under the Visual Studio environment and deploy and sell the product without putting extra charges on the client. However, the reports or documents generated requires a freeware, Crystal Reports Viewer, to view and print the reports.

3.2.3. Conclusion

Crystal Reports for Visual Studio is chosen as the client application will be a Windows application and will use Visual Studio as the integrated development environment. Also, the application will not use Java as the programming language, if JasperReports is chosen, extra container or server will be needed and which the setup is tedious. Therefore, Crystal Reports for Visual Studio would be better for this project.

4. Solution, System and Design

4.1. Solution and System Overview

This solution is aimed at supporting clinical operation for all scales of TCM clinic business in Hong Kong, ranging from single-staff clinics to chain store clinics. Different from many existing solutions, which only simply support single user or multiple users at a single clinic, it supports multiple users and multiple clinics.

This system provides health records sharing feature. Nowadays, doctors may work for multiple clinics and their patient may consult them at different clinics. If those clinics keep hardcopy health records or adopted a single clinic system, the health records may not be able to transfer from clinic to clinic and hence doctor may not obtain instantaneous reference to them. Once the clinics join to use this system, health records kept at one clinic can be viewed by doctors in the same clinic or by the doctor in-charge across different clinics. This can let the practitioners know the patient history more and provide better treatments.

Considering the diversity of Chinese typing ability of TCM practitioners in Hong Kong, this system provides some commonly used drug names and terms for users to choose in a systematic way which is different from a lot of solutions in the market, require a lot of text typing effort or choosing items from a messy table. In this system, user can easily locate and choose the term they want by some screen criteria. If the term does not exist in the database, they can still enter it by free-text. Furthermore, the preset terms relating to cases differentiation, symptoms and diagnosis are based on the World Health Organization (WHO)'s WHO International Standard Terminologies on Traditional Medicine in the Western Pacific Region (WHO Regional Office for the Western Pacific, 2007).

Nowadays, TCM not only use drugs for treatment in Hong Kong. Acupuncture

as a curing procedure is becoming more and more popular. Therefore, this system can also record the acupuncture points that used for acupuncture in text form. Similarly, the names of acupuncture points are provided for doctors to choose from as mentioned above. The list of points provided is based on the WHO Standard Acupuncture Point Locations in the Western Pacific Region (WHO Regional Office for the Western Pacific, 2009).

Once the electronic health record sharing system developed by the government is ready for the TCM sector and they adopt the same code set or International Classification of Diseases 11th Revision (ICD-11) which is due by 2017 (World Health Organization, 2014), this system can adapt and communicate with it for sharing the health record with less effort or modification as both systems are using some WHO terminologies standards.

4.2. System Functions Overview

Users are identified with four different roles in this system and can access various features and functions according to their classification. The four user roles are System Administrator, Clinic Administrator, Doctor and Staff respectively. In addition, there is a special role which prevent the user for using the system in that associated clinic, namely “No Access”. Each user can possess more than one role under a clinic and across the system. Further discussion see Section 5.2.

The main functions of the system are as follows.

- Main System Login / Start Patient Sub-system
- Patient Management
 - Create new patient records
 - Enquire / Edit patient records
- Drug Management
 - Add drug / sub-drug items
 - Enquire / Edit drug information
 - Edit incompatible drug information

- Formula Management
 - Create new predefined formula
 - Enquire / Edit predefined formula
- Clinic Management
 - Create new clinic records
 - Enquire / Edit clinics information
- User Management
 - Create user accounts
 - Enquire / Edit user account(s) information
 - Assign / Revoke clinic and role to users
- Patient Queue Management
 - Put patient into the queue
 - Remove patient from the queue
 - Assign doctor-in-charge (for staff and clinic administrator only)
- Consultation
 - Enter medical record
 - Make prescriptions
 - Issue certificates and official records
 - Drug stock checking and reservation (co-operate with AU-YEUNG's final year project system prototype)
- Add / Delete stock phrases for doctor's remark and instructions for drug usage
- Reporting
- Document Reprint

The functional details of some functions are different for different user role.

This is going to be discussed in the Section 5.2.

For System Administrator, he/she can perform patient management, drug management, formula management, clinic management, user management and reporting. As system administrator is a special role who only takes care of system-wide information, therefore, he/she cannot view reports for a specific clinic or perform patient queue management.

For Clinic Administrator, he/she can perform patient management, drug management, formula management, enquire / edit home clinic information, user management, patient queue management, reporting and document reprint.

For Doctor, he/she can perform patient management, formula management, enquire / edit his/her account's information, reporting, document reprint, patient queue management, consultation and add / delete stock phrases for doctor's remark and instructions for drug usage. For this type of users, they cannot perform drug management as it can make changes to the parameters for prescription safety checking. In order to prevent doctors from changing the parameters like upper dosage limit to interfere the checking, this function is not provided for doctors only with this role.

For Staff, he/she can perform patient management, patient queue management, enquire / edit his/her account's information, reporting and document reprint.

This system also provides a patient sub-system, which allow patients to create, enquire and edit their own patient record and enter/leave the patient queue. However, it is not the main focus of this project. It is made in case manpower is not enough in a clinic, so that patient can do these simple tasks on their own.

The following is the use case diagram for this system which can provide a better understanding and overview of functions that the main system intends to provide.

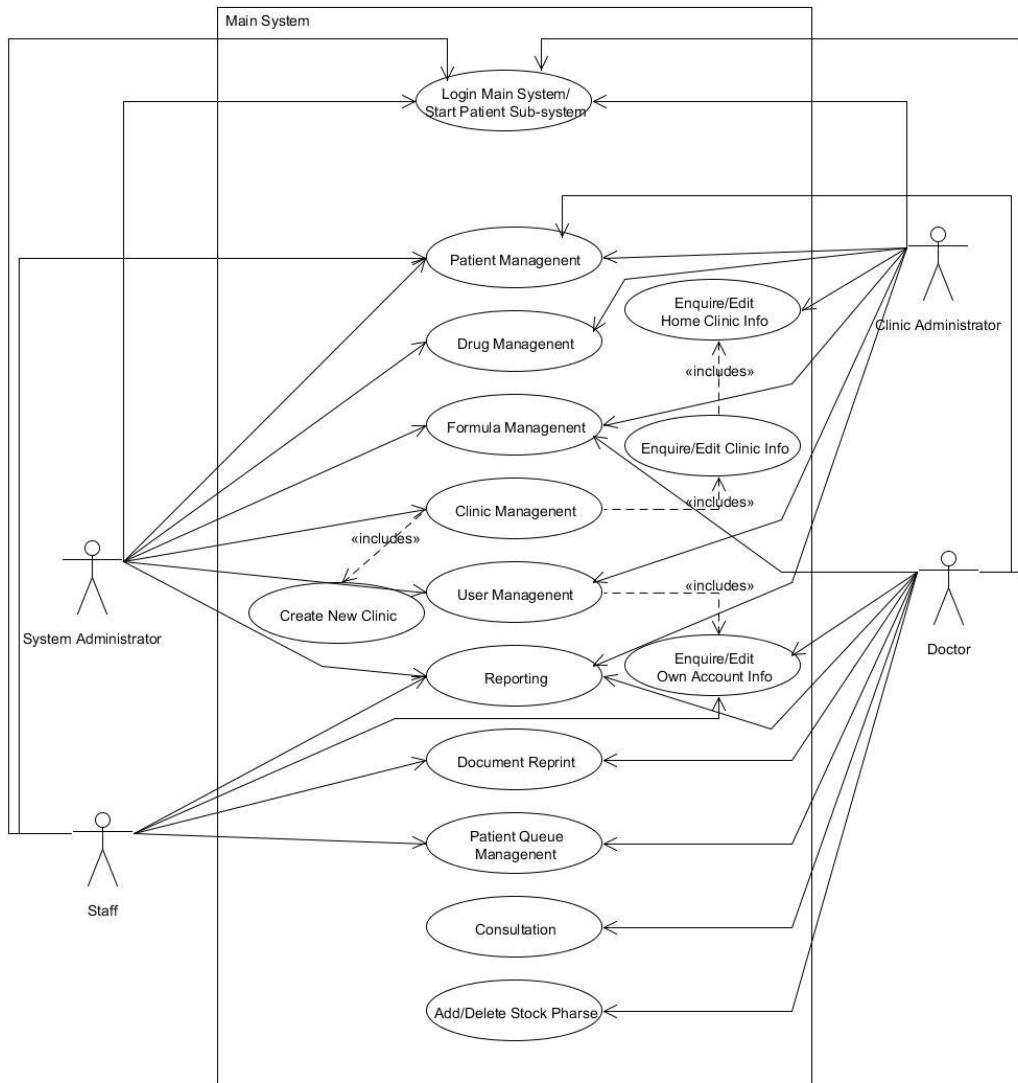


Fig 4.1 Use Case Diagram for the Main System (Human Actors)

4.3. Functional Requirement

4.3.1. Main System Login / Start Patient Sub-system

Staff, Doctor, Clinic Administrator and System Administrator can login or start the patient sub-system by entering their user name and password. As the system can support multi-clinics and multi-role for each user, they also need to provide the clinic and role information before they can login or start the patient sub-system.

4.3.2. Patient Management

4.3.2.1. Create New Patient Records

All users including those who are using patient sub-system can create new patient records when the patients are not yet registered in the system. They can enter patient's personal particulars, drug allergy history and the preference for sharing medical history across the system. The data will be stored in the database for further reference. No repeated registration for the same personal identification document (i.e. Hong Kong Identity Card or Passport) is allowed.

4.3.2.2. Enquire / Edit Patient Records

All users including those who are using patient sub-system can view and edit the patient records stored in the system. They can search the patient record by using patient's Patient ID, personal identification document number and/or phone number. For user using patient sub-system, password is required before they can view the personal particulars and apply changes in order to prevent unauthorized retrieval and alteration on patient records.

4.3.3. Drug Management

4.3.3.1. Add Drug / Sub-drug Items

System Administrator and Clinic Administrator can add new drug items to the system for making prescription and defining formula. They can enter the drug name, dosage limits, drug category, properties and contraindication for pregnant and Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency patients. If the drug has sub-drug items like processed drug, user can enter those name to the system under the main drug item. No repeated drug names are allowed for registration.

4.3.3.2. Enquire / Edit Drug Information

System Administrator and Clinic Administrator can enquire and edit drugs information stored in the system. They can select the drug item and change the information. They also can mark the drug as deleted to hide the drug item from being used for prescription and formula. For sub-drug items, only the name can be changed.

4.3.3.3. Edit Incompatible Drug Information

System Administrator and Clinic Administrator can specify the incompatibility of drugs in the system. This information is stored in the system for the safety checking for prescriptions.

4.3.4. Formula Management

4.3.4.1. Create New Predefined Formula

Doctor, Clinic Administrator and System administrator can store some frequently used or useful formula in the system for making prescription with ease. They can give a name for each formula. Each formula consists of drugs with their corresponding dosage and preparation/decoction method. Each formula should have a unique name for identification, therefore no repeated use of formula name is allowed.

4.3.4.2. Enquire / Edit Predefined Formula

Doctor, Clinic Administrator and System Administrator can enquire or edit formula stored in the system. They can change the name and ingredients of the formula. More than that, they can also mark formulas as deleted and make the formula not available for use in prescriptions.

4.3.5. Clinic Management

4.3.5.1. Create New Clinic Records

System Administrator can create new clinic records. They need to assign a unique ID for the clinic. They also need to enter the clinic name, address and phone number(s) of the clinic as these information will be shown in the documents produced by the system in the clinics. They also can mark the clinic as suspended which means the clinic account is not activated yet.

4.3.5.2. Enquire / Edit Clinics Information

System Administrator can enquire and edit all the clinics information stored in the system while Clinic Administration only can enquire and edit the information of the currently login clinic. As the Clinic ID is a unique identifier for the clinic, it cannot be changed with this system, while other information can be changed.

4.3.6. User Management

4.3.6.1. Create User Accounts

Clinic Administrator and System Administrator can create new accounts. They need to assign a unique user ID for each user. They also need to enter their name and password and assign a role and clinic for the account. If the account is granted with Doctor Role, the Chinese Medicine Practitioner registration number is also required. They can also set the account to “suspended” when creating the account. For Clinic Administrator, they can only grant user role permission for their own clinic while for System Administrator can grant all roles with all clinics to a user.

4.3.6.2. Enquire / Edit User Account(s) Information

Staff, Doctor, Clinic Administrator and System Administrator can enquire and edit their own account information like name and passwords but not user ID. Clinic Administrator can enquire and change the account information of users which have right to access the system with their clinics. System Administrator can enquire and change account information of all the users. Both administrators can suspend user accounts under their management but not the same account they login with.

4.3.6.3. Assign / Revoke Clinic and Role to Users

System Administrator can assign and revoke roles and clinics to all users but cannot revoke administrator roles of themselves. Clinic Administrator can assign roles of their clinic to all users and revoke assigned roles of their own clinics but not the administrator role of themselves. For adding Doctor Role, the user should have Chinese Medicine Practitioner registration number stored in their user account record.

4.3.7. Patient Queue Management

Each clinic maintains their own patient queue for waiting for consultation. Staff, Doctor and Clinic Administrator can add and remove patient in the queue. When calling patient, Staff and Clinic Administrator can assign doctor in-charge to the patient while doctors will assign themselves as the doctor in-charge automatically.

4.3.8. Consultation

4.3.8.1. Enter Medical Record

Doctor can enter medical record when meeting with patients. They can enter the symptoms, differentiation and diagnosis for the consultation. Also, they can record the acupuncture points that the patient received treatment. They can enter some remarks for the patient as a reminder. They can also give prescription(s) for the patients.

4.3.8.2. Make Prescriptions

Doctor can make prescriptions for patients during consultation. They can use formula as template for making prescription. They also can make up a prescription by their own using drugs stored in the system. Prescription safety check will be done at the end of the process. User will be notified for any violation of rules. User can choose to make changes to the prescription or not.

4.3.8.3. Issue Certificates and Official Records

Before the end of the consultation, the doctor can issue prescriptions, sick leave certificate, consultation certificate, pregnancy certificate and medical records when necessary. The information on the documents follows the common practices or standards of the industry.

4.3.8.4. Drug Stock Checking and Reservation (Co-operate with AU-YEUNG's System)

When the Chinese Medicine Pharmacy Management System (CMPMS, AU-YEUNG's final year project system prototype) works together, this system can query the stock by calling CMPMS's function. If the stock availability is low or zero, a reminder will be shown to the doctor. If all the prescription(s) do not contain drug which is out of stock, the system can make a function call to CMPMS for drug reservation.

4.3.9. Reporting

Different users can view different reports. It including listing report and statistical report. The rights for viewing the reports are as follows:

Reports/Role	System Admin.	Clinic Admin.	Doctor	Staff
User Listing	✓	✓		
Clinic Listing	✓	✓		
Drug Listing	✓	✓	✓	

Patient Listing	✓	✓		✓
Suspicious Prescription Listing		✓		
Statistic Report of Daily Consultation in the Past 30 Days		✓		✓
Diagnosis Statistic in the Past 30 Days		✓		

Fig 4.2 User Rights for Viewing Different Report

4.3.10. Document Reprint

Staff, Doctor and Clinic Administrator can (re-)issue documents. These include Complete Medical Records, Single Consultation Medical Records, Prescriptions, Consultation Certificate and Sick Leave Certificate. For Sick Leave Certificate, the issue time should be within 24 hours after consultation ends.

4.3.11. Functional Requirements Related to Co-operation between CMCMS and CMPMS

Account in this system (CMCMS) can be used in CMPMS without another registration and vice versa. Only granting right is required. CMCMS can query CMPMS on drug availability or do drug reservation in the associated pharmacy of the clinic for prescriptions. CMPMS can query on drug items which exist in CMCMS. CMPMS can get prescription details from CMCMS by prescription IDs or other unique data combination. CMPMS can also query on procedures/treatments done in a consultation.

4.4. Design

This system is in server client model. All the windows can instantiate corresponding data manager to get the required entities or prepare data for entering the database. The data manager classes can instantiate a database manager which is responsible for communication between the windows application and the database. The data manager objects can create entities

objects by data retrieved by database manager and pass to the calling windows form GUI. The following simplified analysis stereotype diagram illustrates the concepts.

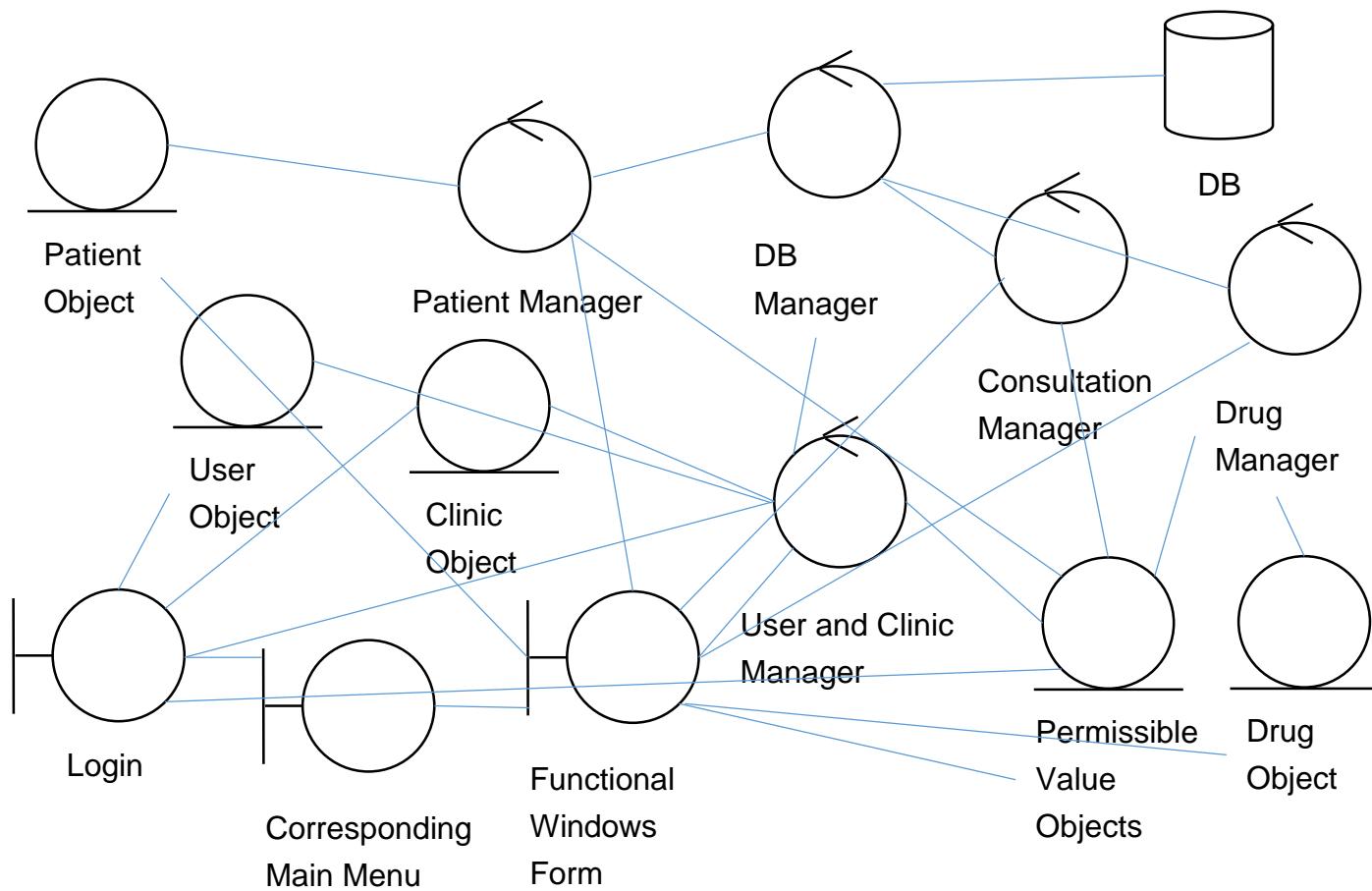


Fig 4.3 Simplified Stereotype Class Diagram for the Application

For database design, it consists of 3 schemas, namely cmcms, cmcis and cmpms. Cmcms is the main database schema for this system. Cmcis is the schema for sharing data between this system and CMPMS. Cmpms is the schema belongs to CMPMS, which is designed and implemented by AU-YEUNG Wing Shing. CMCMS can use the schemas cmcms directly for retrieving data. It also can retrieve data from schema cmpms through calling stored procedures in cmcis which are written by AU-YEUNG.

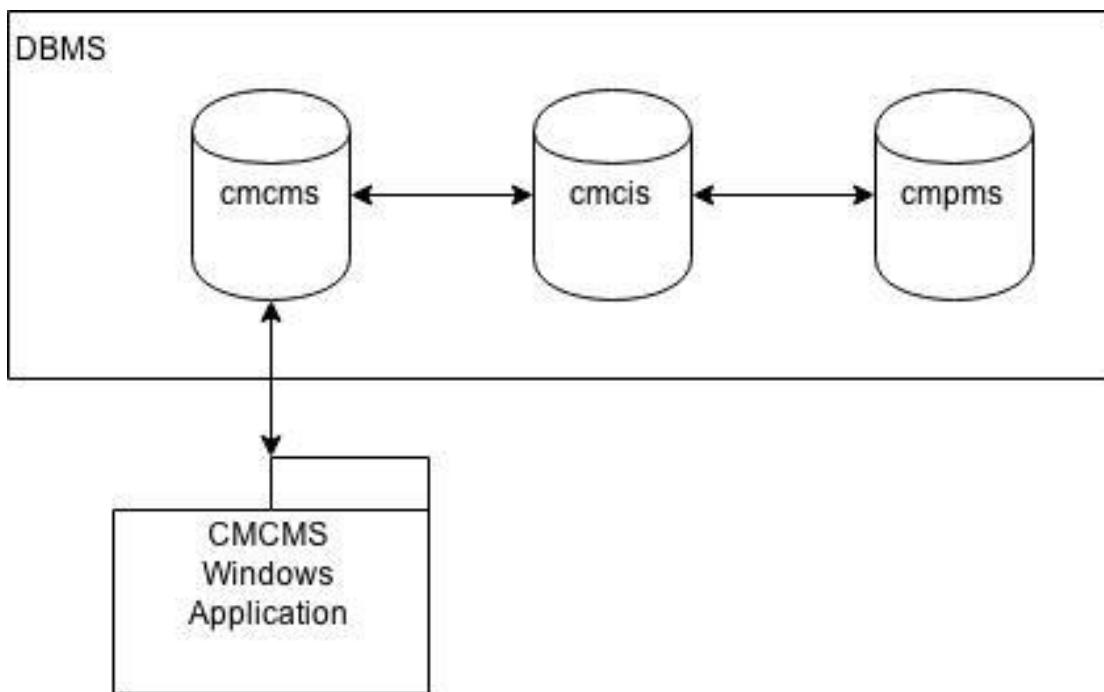


Fig 4.4 High-level design of the database

5. Detailed Methodology and Implementation

5.1. Methodology

5.1.1. Drug Name

Drug names are not strictly standardized in the TCM industry in Hong Kong. In this system, a drug list is provided for users to select from for entering drug related information like prescriptions. In order to provide drug names which can be recognized by most of the users in Hong Kong, the drug items information incorporated to the system is based on a reference book, 常用中藥學 (成都中醫學院, 1964), which is applicable for the professional examination.

5.1.2. WHO Terminologies and Standards

In this system, terminologies for diagnosis, symptoms, acupuncture points, treatment methods and case differentiation is provided for user to select in order to reduce the word typing effort when using the system. However, there are no agreed standard being used in the TCM industry in Hong Kong.

For the current systems in the HA, the terminologies for diseases and procedures are following some International standards. For Modern Medicine, International Classification of Diseases (ICD) 9th Revision (ICD-9), ICD-10, ICD-9-Clinical Modification are used. However, traditional medicine is not yet covered by the currently published version, i.e. ICD-10, and it will be covered in the new version of ICD, ICD-11 which is due by 2017 (World Health Organization, 2014). At the moment, one of the standard using by the HA for TCM terminologies is another standard published by WHO, WHO International Standard Terminologies on Traditional Medicine in the Western Pacific Region (ZIEA, 2012).

In this system, acupuncture points also be recorded if the patient has received

acupuncture as treatment. Therefore, this system provided a list of acupuncture points for doctors to choose from. World Health Organization has published a standard for acupuncture named WHO Standard Acupuncture Point Locations in the Western Pacific Region (WHO Regional Office for the Western Pacific, 2009). This standard listed out 361 acupuncture points that used for education, research, medication and knowledge exchange. This standard should be suitable for Hong Kong's Practitioner.

In the foreseeable future, the electronic health record (eHR) sharing system developed by the Hospital Authority (HA) for the Hong Kong Government will ready for the TCM industry. In order to enable data sharing from the system to the eHR system which ease, WHO standards should be used. At the development time of the system prototype, ICD-11 beta is available. However, the data is keep changing and it is not yet used by the HA. As both standards are developed by WHO, they should not be contradicting to each other and could be easily convert from one to another. Therefore, WHO International Standard Terminologies on Traditional Medicine in the Western Pacific Region (WHO Regional Office for the Western Pacific, 2007) and WHO Standard Acupuncture Point Locations in the Western Pacific Region (WHO Regional Office for the Western Pacific, 2009) would be used as the reference for the terminologies and acupuncture points stored in the system in advanced respectively.

5.2. Implementation

5.2.1. Login Form

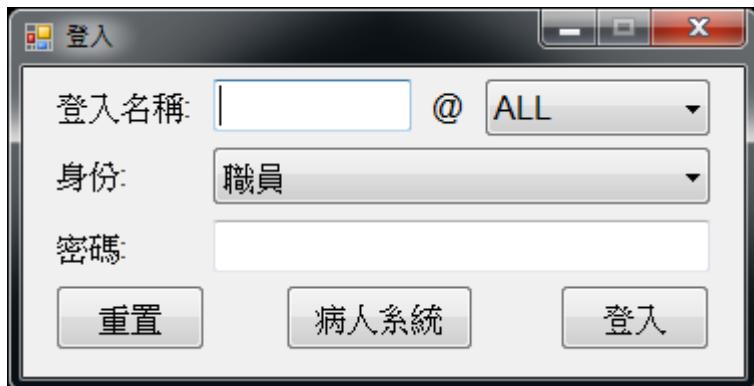


Fig 5.1 Screenshot of the Login Form

User can do the following by using this form:

- Login to the system
- Start patient sub-system

5.2.1.1. Login to the System

System Administrator, Clinic Administrator, Doctor and Staff can enter their user name and password and choose the login clinic and user role to login the system. The reason why users are required to choose the login clinic and user role to login is due to the same user can work in multiple clinics with multiple roles. This will be further discussed in Section 5.2.8.1. When the combination of the four items is incorrect, an error message will be shown. At the first time of using this system, only the system administrator account (user name: SYSADM) with access clinic ID “ALL” is exist in the system. When successfully login, the client application will store the user and clinic information as data for other windows forms until logout.

5.2.1.2. Start Patient Sub-system

Clinic Administrator, Doctor and Staff can Start Patient Sub-system and show the Patient's Menu to patients for self-access to register, edit personal particulars and queue up. This action also require user to enter the user

name, clinic ID, user role and password in order to ensure the application is launched with the correct clinic with an authorized person.

5.2.2. Drug Selection Panel

請從左至右選取藥物篩選條件

藥類	子藥類	筆劃數	字數	性味	藥項	子藥項
全部	全部	全部	全部	<input type="checkbox"/> 寒	麻黃	- 淨麻黃
解表		2	2	<input type="checkbox"/> 热	桂枝	麻黃紉
湧吐		3	3	<input type="checkbox"/> 溫	紫蘇	密灸麻黃
瀉下		4	4	<input type="checkbox"/> 凉	荊芥	
清熱		5		<input type="checkbox"/> 辛	羌活	
芳香化濕		6		<input type="checkbox"/> 甘	防風	
利水滲濕		7		<input type="checkbox"/> 酸	白芷	
祛風濕		8		<input type="checkbox"/> 苦	藁本	
溫裡		9		<input type="checkbox"/> 鹹	細辛	
芳香開竅		10		<input type="checkbox"/> 淡	辛夷	
安神		11			生薑	
平肝息風		12			蔥白	
理氣		13			胡荽	
理血		14			檸柳	
補益		15			香薷	

Fig 5.2 Screenshot of Drug Selection Panel

This panel is used for user to select drug and/or sub-drug without typing any words. The checkbox for showing deleted drug and the list box for sub-drug items is hided from user if it is not applicable to the function. Change of the value selected for each criteria list box will lead to update of permissible values on its right. Each list box associated with a stored procedure for retrieving the permissible values.

5.2.3. Patient Management

5.2.3.1. Patient Search Panel

The screenshot shows a search panel with the following fields and controls:

- A header message: 請輸入以下最少一項資料以供檢索
- Input field: 病人編號: (Patient ID)
- Input field: 身份證/護照號碼: (Identification Document Number)
- Input field: 電話號碼: (Phone Number)
- Check box: 包括已故病人 (Include deceased patients)
- Buttons: 搜尋 (Search) and 重置 (Reset)
- Output area: 病人姓名: (Patient Name) followed by a large empty rectangular box.

Fig 5.3 Screenshot of Patient Search Panel

All the functions that related to patient search are using the above panel. It allows user to search patient with the patient's patient ID, personal identification document number and phone number. Any patient records match all the criteria entered will be shown in the list box at the bottom for user to select. By default, the result will include any patient who are marked as deceased. A checkbox is provided for include those result.

Whole list of patient will not be provided for searching and selection purpose. As the patient records stored in the system may not contain only the patients of a particular clinics, due to privacy issue, the system cannot disclose all patients' information without search key provided.

5.2.3.2. New Patient Registration

The screenshot shows a Windows application window titled "新登記病人". The main area is labeled "新登記" and contains sections for "個人資料" (Personal Information) and "藥物敏感史" (Drug Allergy History). In the "個人資料" section, there are fields for "中文姓名" (Chinese Name), "英文姓名" (English Name), "聯絡電話" (Phone Number), "出生日期 (日/月/年)" (Date of Birth), "性別" (Gender), and checkboxes for "G6PD/蠶豆症/葡萄糖-6-磷酸脫氫酶缺乏症患者" (G6PD/ favism/ glucose-6-phosphate dehydrogenase deficiency patient) and "懷孕" (Pregnant). Below these are fields for "地址" (Address), "密碼" (Password), and "確認密碼" (Confirm Password). The "藥物敏感史" section contains a note "請從左至右選取藥物篩選條件" (Please select drug screening conditions from left to right) and a grid for filtering drugs by category (藥類), radical (子藥類), stroke count (筆劃數), and nature/taste (性味). A list of herbs (藥項) is shown on the right, with buttons to move selected items between the "已選藥項" (Selected Drugs) and "藥項" lists.

Fig 5.4 Screenshot of New Patient Registration Windows Form

This form can be used by all users including those using Patient Sub-system. Users can use it to create new user records. They can enter patient's particulars including Chinese name (optional), English name, personal identification document number (Hong Kong ID Card or passport number), phone number, date of birth, gender, address and password. Two checkboxes will be provided for user to check if the patient has Glucose-6-Phorsphate Dehydrogenase Deficiency (G6PD) or pregnant. These two pieces of information are used for prescription safety checking. The pregnant checkbox will be enabled when the gender chosen is female as it is extremely rare for male to become pregnant. This status can be changed by doctor during consultation no matter the patient is male or female. If the patient has known drug allergy history, the drug names can be entered to the system by choosing them from the drug selection panel. Before passing the data to the database, the password will be hashed with SHA-256. Once the register button is pressed, if the personal identification document selected is HKID, the system will check whether the HKID number is valid. If it is invalid, the

registration will be rejected. Then the system will check whether the identification document number exist in the system. If it exists, the registration will be rejected. If the patient is successfully registered, the record will be inserted to the patient record table in the database and the patient ID will be shown on the screen. All the checking is done in a stored procedure before inserting the record to the table.

5.2.3.3. Enquire / Edit Patient Information

Fig 5.5 Screenshot for Enquire / Edit Patients' Personal Particulars

This form can be used by all users including those using Patient Sub-system. Users can use it for enquiring or editing patient records. First, users can search the patient using the patient search panel. A checkbox will be provided for searching patients who are marked as deceased and the checkbox is hidden when using Patient Sub-system. The search result will be shown in a list box. User can select the record that is needed. Then, the patient information will be shown in a similar panel as the one in patient registration, the only different is a deceased checkbox is available for staff to mark the patient as deceased and that checkbox is hidden when using Patient Sub-system. Before passing the data to the database, the password will be hashed with SHA-256. When confirm button is clicked, the database record will be updated. For using Patient Sub-system, user will be requested to enter the

patient's password before viewing the information and confirming the change in order to prevent unauthorized access and alteration on patients' personally identifiable information (PII).

5.2.3.4. Database

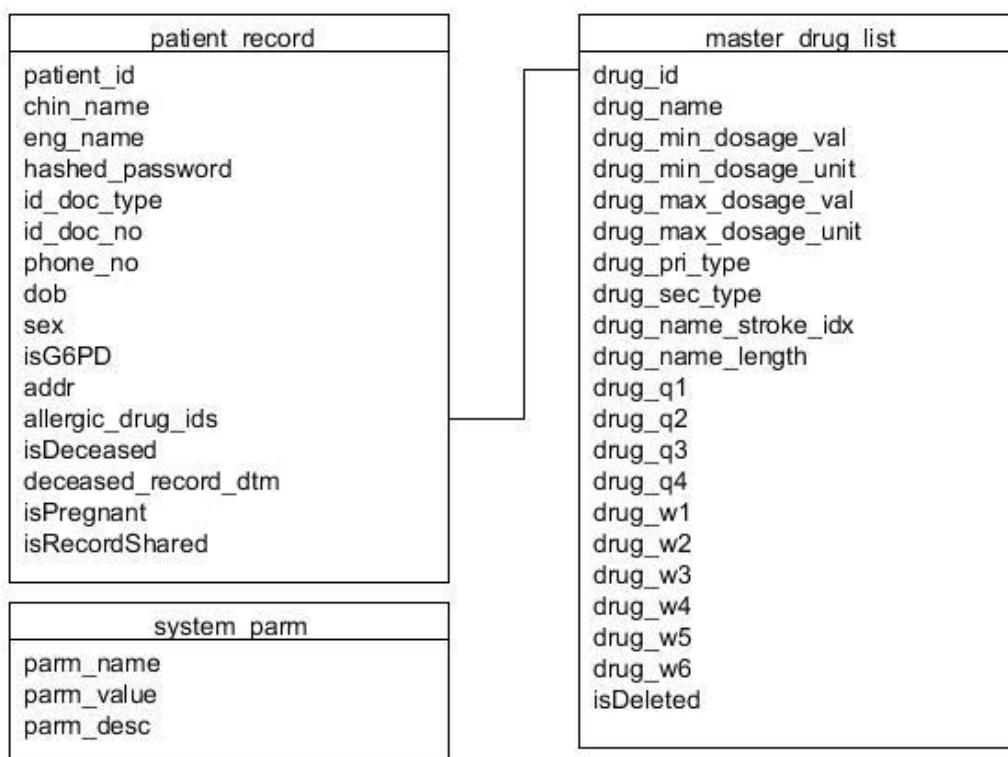


Fig 5.6 Database Table of Patient Record

Patient records are stored in the patient record table (`patient_record`). The data includes patient ID (`patient_id`), Chinese name (`chin_name`), English name (`eng_name`), hashed password (`hashed_password`), personal identification document type (`id_doc_type`), personal identification document number (`id_doc_no`), phone number (`phone_no`), date of birth (`dob`), gender (`sex`), flag for G6PD deficiency (`isG6PD`), address (`addr`), drug allergy history (`allergic_drug_ids`), flag for deceased patient (`isDeceased`), date time of deceased record (`deceased_record_dtm`), pregnant flag (`isPregnant`) and flag for sharing medical records (`isRecordShared`). The patient ID is generated by a function based on the value of an entry in the system parameter table (`system_parm`). The entry is used for holding the largest / latest patient ID,

and which has parameter name (parm_name) as “pat_id_cnt”. After each generation of patient ID, the parameter value (parm_value) will be updated to the one just generated. This generation method can make the generation of patient ID more flexible, not restricting it only be integer serial number. It can be changed to other generation method easily.

For drug allergy history, it is stored in VARCHAR format. It is formed by concatenating all the allergic drug IDs (see Section 5.2.4.4) with “||” as delimiter. For this table, read is more than write. Creating an extra table would causing extra join operation, which may increase the seek time. Thus, keeping it together with the patient record in this format may be a better choice for a better performance.

5.2.4. Drug Management

5.2.4.1. Add Drugs

The screenshot shows a Windows application window titled "藥物管理". The top menu bar has tabs: "新增藥物", "查詢 / 修改藥物資料", and "配伍禁忌". The main area is titled "加入子藥項" (Add Sub-drug Item). On the left, there are input fields for "藥名" (Drug Name), "劑量下限" (Dosage Lower Limit), "劑量上限" (Dosage Upper Limit), "藥類" (Category), "子藥類" (Sub-category), "性味" (Properties), and "禁忌" (Contraindication). Below these are dropdown menus for "孕婦" (Pregnant women) and "G6PD" (G6PD). At the bottom are "加入項目" (Add Item) and "取消" (Cancel) buttons. The right side features a large grid table with columns: 藥類 (Drug Category), 子藥類 (Sub-category), 劑劃數 (Frequency), 字數 (Character), 性味 (Properties), 藥項 (Drug Item), and 子藥項 (Sub-drug Item). The grid lists various traditional Chinese medicine terms like 麻黃, 桂枝, 紫蘇, etc. A search bar at the bottom left says "藥項名稱" (Drug Item Name) and "子藥項名稱" (Sub-drug Item Name).

Fig 5.7 Screenshot of Drug Management Form with Add Drug Tab Page Selected

System Administrator and Clinic Administrator can enter drug entry to the system by this tab page. They can enter the name, dosage limits, category, properties and contraindication of the drug. After clicking the added button, a

stored procedure in the database will be called and checking will be done before inserting the record into the database. They stored procedure will check whether the drug name is exists in the database and the dosage limits are valid. If the name exists or invalid dosage limits are entered, the entry will be rejected. If not, the entry will be added to the database and the corresponding drug name will be shown in the drug selection panel on the right. If the drug item possesses with sub-drug, for example prepared drug, users can select the drug item by the drug selection panel and enter the sub-drug name into the textbox provided. Those sub-drug name cannot be repeated.

5.2.4.2. Enquire / Edit Drug Information

Fig 5.8 Screenshot of Drug Management Form with Enquire/Edit Drug Information Tab Page Selected

System Administrator and Clinic Administrator can view or edit drug or sub-drug information with the above tab page. For amending drug items, all the information except sub-drug name can be changed. After clicking the amend button, a stored procedure in the database will be called. Checking on dosage limits will be done. If the data are valid, the record will be updated. For sub-drug items, only the sub-drug name can be changed. Both drug and sub-drug

items can be marked as deleted to make them not available for using in formula and prescription. If the formula contain the deleted drug(s), the formula will be marked as system suspended and cannot be used in prescription until all the drugs in the formula are not marked as deleted.

5.2.4.3. Drug Incompatibility

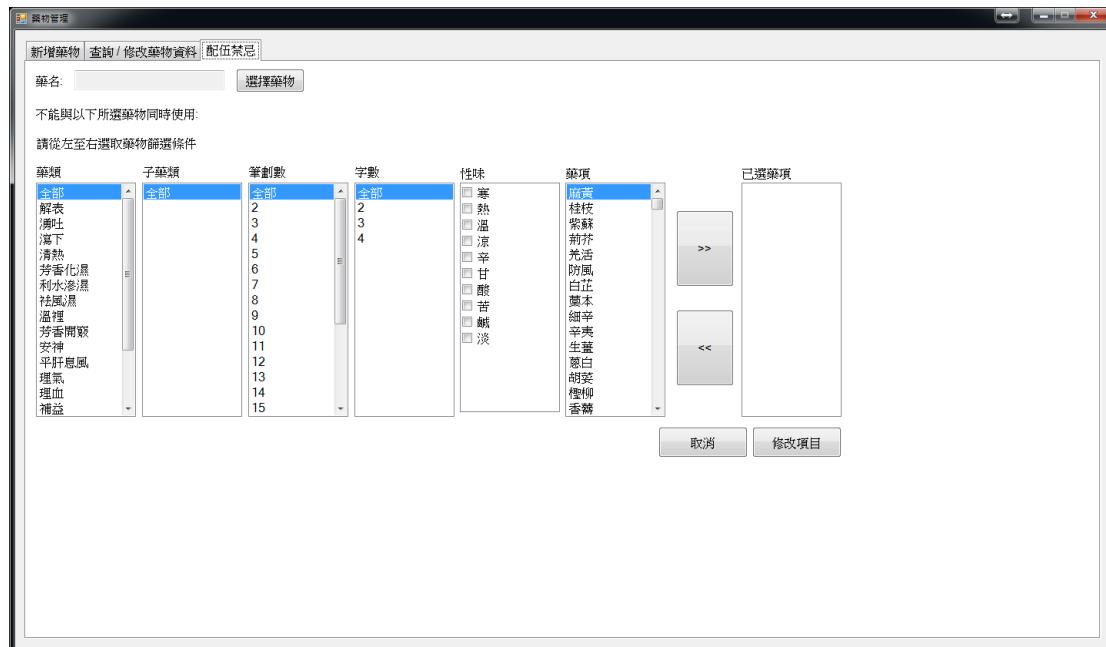


Fig 5.9 Screenshot of Drug Management Form with Drug Incompatibility Tab Page Selected

System Administrator and Clinic Administrator can specify the drug-drug interaction contraindication in this tab page. When clicking the select drug button, a drug selection panel will be shown for users to select drug. Then, they can select drug(s) that are not compatible with the selected one in the panel above. Drug cannot be selected more than once and the drug cannot be incompatible with itself. When amend button is clicked, the incompatible record will be added / removed in the both drug records.

5.2.4.4. Database

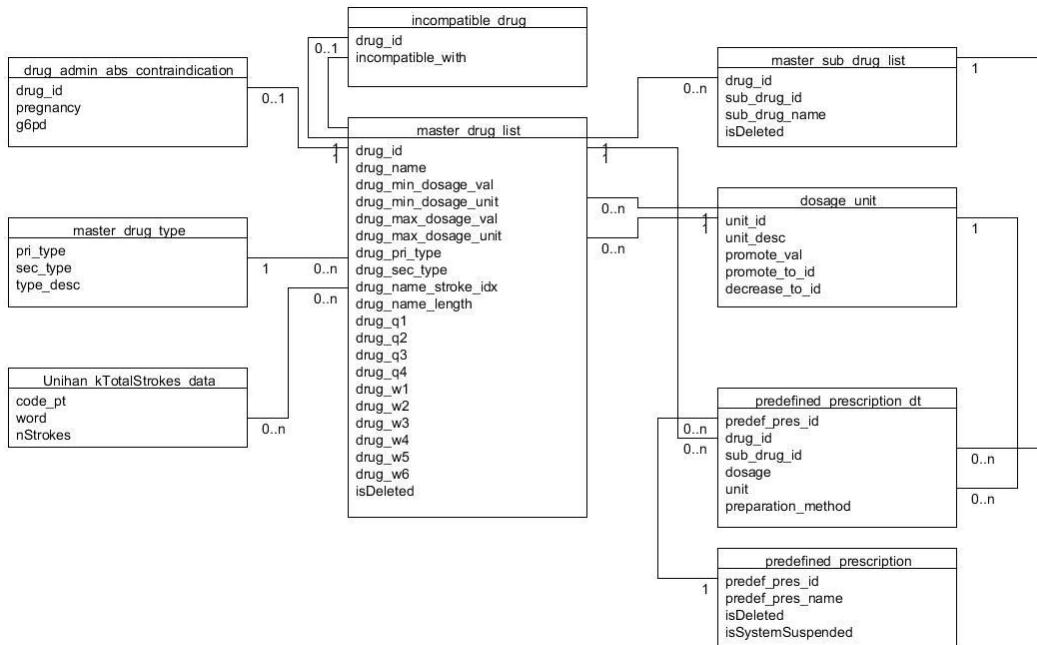


Fig 5.10 Database Tables Related to Drug Management

Drug data will be stored mainly in the database with two tables. One is called master drug list (master_drug_list) and another one is called master sub-drug list (master_sub_drug_list). When the drug is prepared with different method or with different origin, its name and usage may have different and it can be classified as sub-drug. The sub-drug name (sub_drug_name) and sub-drug ID (sub_drug_id) of that item will be stored in the master sub-drug list with its original drug ID (drug_id). And its original drug information, including its properties and suggested dosage range, will be stored in the master drug list. For stroke number of the first character of the name, it will be based on the data provided by Unicode, Unihan_DictionaryLikeData.txt in Unihan.zip (Unicode, Inc., 2014), and they are stored in the table Unihan_kTotalStrokes_data. For primary drug type (drug_pri_type) and secondary drug type (drug_sec_type), they are based on data in master_drug_type where sec_type is equals to 0 and not equal 0 respectively. For unit of the dosage limits (drug_min_dosage_unit and drug_max_dosage_unit), they are the unit_id stored in the table dosage_unit where dosage_unit stored the unit name (unit_desc), ID (unit_id) and unit

conversion related data. The unit conversion related data is based on the information stated in the Schedule 1 of Weight and Measures Ordinance (1997).

If the drug should be avoided or must not be used for G6PD or pregnant patient, a record will be added to the absolute contraindication table (drug_admin_abs_contraindication) with the drug ID and the level of contraindication (pregnancy and g6pd).

For drug incompatibility data (incompatible_drug), the drug ID is based on the drug ID stored in master drug list. The incompatible_with field is a VARCHAR data make up by concatenating those incompatible drugs' ID with “||” as delimiter. When the stored procedure responsible for update this table added a rule “Drug A is incompatible with Drug B”, the reverse combination “Drug B is incompatible with Drug A” will also be added to the table. And it will do the similar action for removal of the incompatibility rules. The data are stored in the above format can allow the matching of drug item IDs using and string functions like regular expression and replace instead of complex manipulation or complicated SQL statements.

If the isDeleted field of drug or sub-drug changed to “1”, i.e. marked as deleted, the related formula (entries in predefined_prescription) will be marked as system suspended (isSystemSuspended change to “1”), and vice versa. Further discussion on formula will be in Section 5.2.6.3.

5.2.5. Prescription Panel

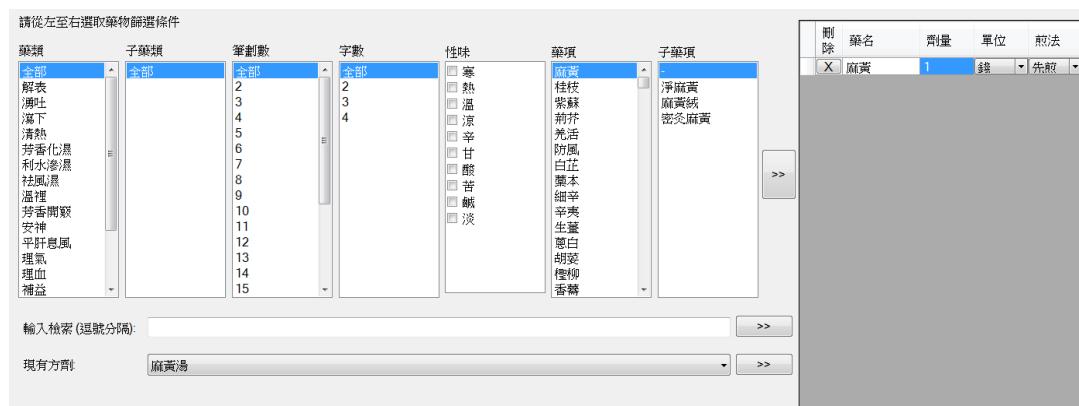


Fig 5.11 Screenshot of Prescription Panel

The panel provides three ways for user to select drug(s) for making a prescription or formula. The three ways are select drug using drug selection panel, text-based search and use existing formula. When the drugs are selected, the item will be shown on the data grid view and user can enter or alter the dosage, unit and decoction/preparation method like decoct first and decoct later for each drug item.

5.2.6. Predefined Formula (Formula)

5.2.6.1. Add Formula

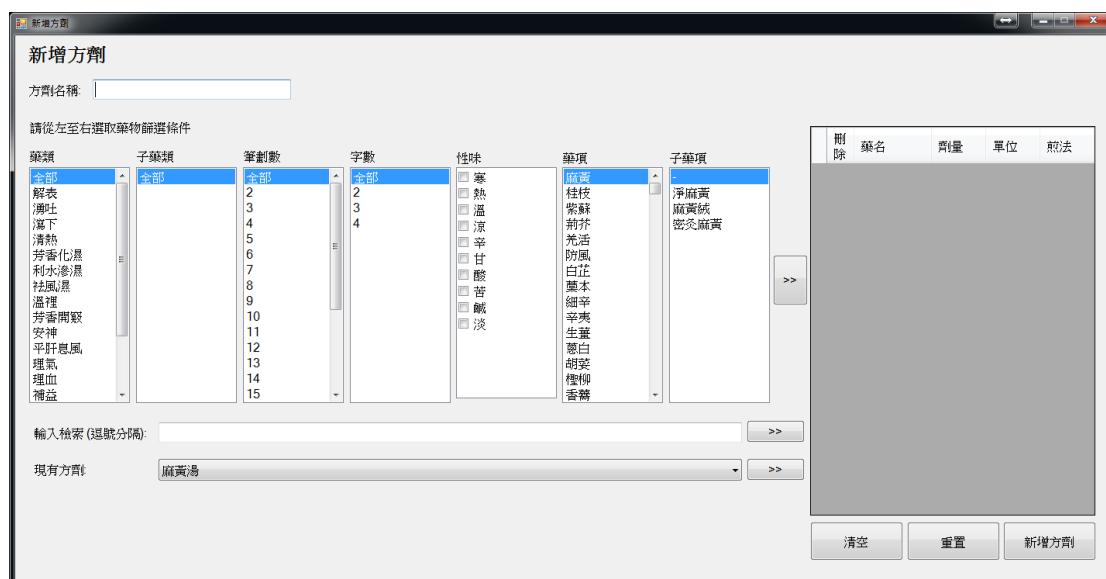


Fig 5.12 Screenshot of Add Formula Form

System Administrator, Clinic Administrator and Doctor can use the form above to create new formula. This form consists of a textbox and a prescription panel for users to input data. The textbox at the top is for users to enter the formula name and the prescription panel is for user to enter the formula. When “add formula” button is clicked, the system will check whether the formula name exists in the system. If it exists, the action will be rejected. If not, then record will be inserted to the database. When adding a formula, the system will not check any rules regarding drug safety in order to allow users to enter some uncommon or folk formula.

5.2.6.2. Enquire / Edit Formula

The screenshot shows a Windows application window titled "查詢 / 更改方劑" (Query / Change Formula). At the top left is a dropdown menu for "方名稱" containing the text "麻黃湯". To its right are checkboxes for "包括已刪除方劑" (Include deleted formulas), "更改名稱" (Change name) with a field containing "麻黃湯", and "刪除" (Delete). Below these are two dropdown menus: "請從左至右選取藥物篩選條件" (Please select filter conditions from left to right) and "現有方劑" (Existing formulas) which also contains "麻黃湯".

The main area contains several tables:

- 藥類 (Drug Categories):** A grid with columns: 全部 (All), 子藥類 (Sub-drug category), 筆劃數 (Stroke count), and 字數 (Character count).
- 性味 (Properties):** A grid with columns: 塞 (Constricting), 热 (Hot), 溫 (Warm), 涼 (Cool), 辛 (Pungent), 酸 (Acidic), 苦 (Bitter), 鹹 (Salty), and 淡 (Mild).
- 藥項 (Drug Items):** A grid with columns: 藥名 (Drug name), 離量 (Dosage), 單位 (Unit), and 煎法 (Decoction method).
- 子藥項 (Sub-drug items):** A grid showing specific drug items like 麻黃, 桂枝, 紫蘇, 茄子, 洋活, 防風, 白芷, 薤本, 細辛, 辛夷, 生薑, 蔥白, 胡荽, 檸檬, 香薷, 淨麻黃, 薤實, 密灸麻黃, etc.

At the bottom are three buttons: "清空" (Clear), "重置" (Reset), and "更改方劑" (Change formula).

Fig 5.13 Screenshot of Edit Formula Form

System Administrator, Clinic Administrator and Doctor can use the above form to view or edit formula. A dropdown list will be provided for users to select the existing formula. Then, they can change the formula name, by checking the checkbox change name. They also can alter drug items, dosage and decoction method or to mark the formula as deleted. When update button is clicked, the system will do the similar checking as new formula and update the database records.

5.2.6.3. Database

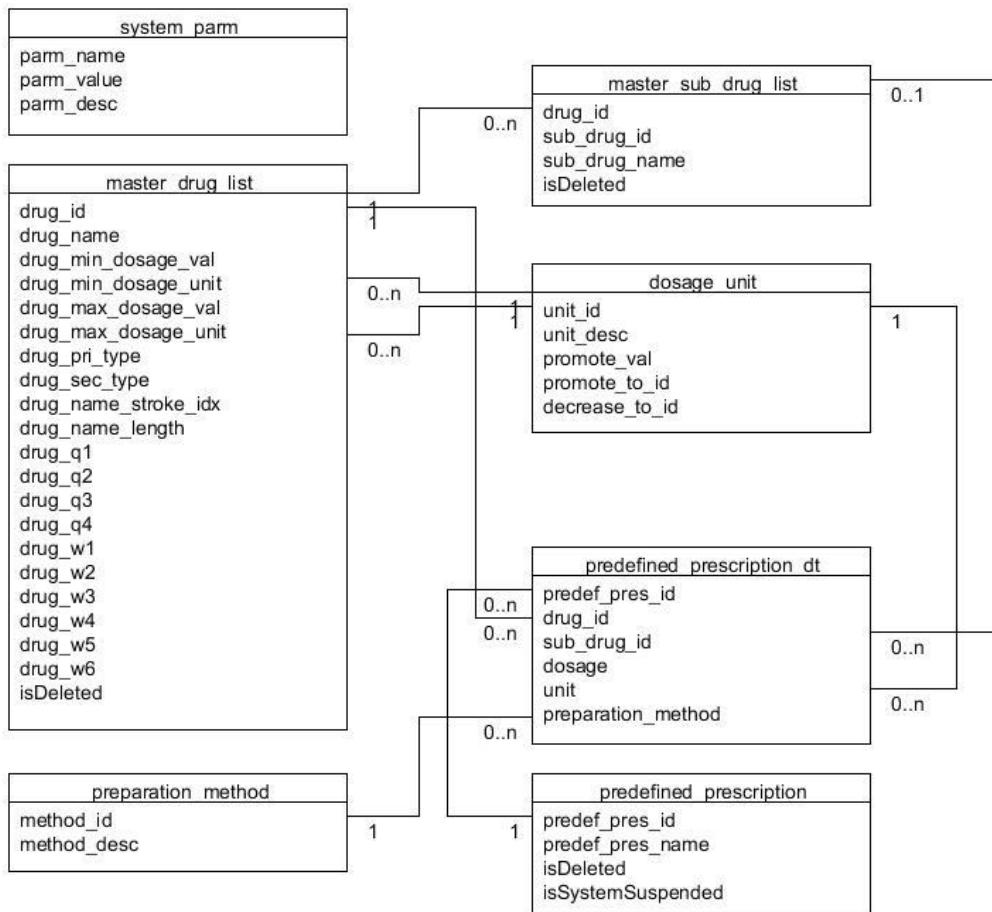


Fig 5.14 Database Tables Related to Formula

The database stores the formula data mainly with two tables, namely formula table (`predefined_prescription`) and formula detail table (`predefined_prescription_dt`).

The formula table stores the formula ID (`predef_pres_id`), formula name (`predef_pres_name`), delete flag (`isDeleted`) and system suspend flag (`isSystemSuspended`).

The formula ID generation is similar to that of patient ID mentioned in Section 5.2.3.4. The entry in system parameter table used for the ID generation is “`predef_prescription_cnt`”.

Formula detail table stores the formula details, includes the formula ID, drug ID (drug_id), sub-drug ID (sub_drug_id), dosage value (dosage), dosage unit ID (unit) and preparation method ID (preparation_method). The drug ID and sub-drug ID are based on data in the master drug list and master sub-drug list (see Section 5.2.4.4.). For sub-drug ID equals to 0, it stands for the item is a drug while for sub-drug ID is a non-zero integer means the item is a sub-drug. For dosage unit ID, it is based on the data stored in the table dosage_unit. For decoction method ID (preparation_method), it is based on the data stored in the decoction method table (preparation_method).

5.2.7. Clinic Management

5.2.7.1. New Clinic

The screenshot shows a Windows application window titled "新增診所" (Add Clinic). The window has a standard title bar with minimize, maximize, and close buttons. The main area is a dialog box with a light gray background. At the top left, it says "新增診所". Below that is a section labeled "診所基本資料" (Clinic Basic Information). This section contains several input fields: "診所代號" (Clinic ID) with a text input field, "診所中文名稱" (Chinese Clinic Name) with a text input field, "診所英文名稱" (English Clinic Name) with a text input field, "地址" (Address) with a text input field, and "電話(最多3組, 逗號分隔)" (Phone (Up to 3 groups, separated by commas)) with a text input field. There is also a checkbox labeled "停用" (Suspended). At the bottom left is a "重置" (Reset) button, and at the bottom right is a "確定" (Confirm) button.

Fig 5.15 Screenshot of New Clinic Form

System Administrator can use the form above to add new clinic entry to the system. It allows users to enter clinic ID, names, address and phone number(s) for the new clinic. A checkbox is also provided for users to select whether the clinic is suspended or in use. When confirm button is clicked, the system will check whether the clinic ID is exists. If it exists, the action will be rejected. Clinic ID is a key field for the clinic table and also for user to have an easier reference to the clinic as clinic names can be repeatedly used. For example, a Doctor, say Dr CHAN Siu Ming, have 2 clinics. Both of them are

called Dr. CHAN Siu Ming TCM Clinic. Then, user may have difficulties to distinguish two different clinics. At this moment, Clinic ID can help. The one in place A can have the Clinic ID as CSM1 and the other one in place B can have the Clinic ID CSM2. So that, user and the system can distinguish between the two clinics without referring to the details of the clinic record.

5.2.7.2. Enquire / Edit Clinic Information

查詢 / 更改診所資料

診所代號: CSM

診所基本資料

診所代號: CSM 診所中文名稱: 陳小明中醫診所

診所英文名稱: CHAN SIU MING TCM CLINIC

地址: 香港中環高士威道3號環宇大廈1003室

電話(最多3組, 逗號分隔): 21010101

停用

Fig 5.16 Screenshot of Enquire / Edit Clinic Information Form

System Administrator can use the form above to view or edit clinics' information and Clinic Administrator can use it to edit the current login clinic's information. This form is similar to the one used for creating new clinic. A dropdown list is provided for users to select the clinic ID. The system allows users to change all the items entered when creating the clinic entry except clinic ID. When confirm button is clicked, the system will update the entry in the database.

5.2.7.3. Database

clinic
clinic_id
clinic_chin_name
clinic_eng_name
clinic_addr
clinic_phone_no
isSuspended
last_update_dtm

Fig 5.17 Database Table Clinic

Database stores all the clinics data in the clinic table (clinic). The data are clinic ID (clinic_id), Chinese name (clinic_chin_name), English name (clinic_eng_name), address (clinic_addr), phone number(s) (clinic_phone_no), suspended flag (isSuspended) and the last update date/time (last_update_dtm).

5.2.8. User Management

5.2.8.1. Relationship between User, Clinic and Role

This system supports multi-clinics and multi-users. Each user can work in one or more clinics. Each user can possess with more than one role under the same clinic and different role(s) in different clinics. Therefore, their role would associate with the corresponding clinic to specify which role is belongs to which clinic.

In this system, basically provides 4 roles, namely System Administrator, Clinic Administrator, Doctor and Staff. This account provides a special role for restricting the account owner from login the system with the associated clinics even if he/she has other role(s) in that clinic, and it is named “No Access”. The use for this role is to suspend the access of the user from a certain clinic for some reasons. For examples, the staff has do something wrong and the clinic administrator would like to suspend the staff’s work to have further

investigation or the user taking a long holiday and the administrator wants to suspend the account for security reason. Then, the administrator can apply the “No Access” Role to the staff account during the period of suspension instead of revoke all the roles granted to the staff, in order to prevent any access to the system using the account.

Regarding the clinic-role combination, the special clinic for System Administrator with ID “ALL” can only combine with the System Administrator even not the “No Access” Role and other clinics can associate with all the other roles.

5.2.8.2. New User Account



Fig 5.18 Screenshot of User Management with New User Tab page Selected

System Administrator and Clinic Administrator can use the tab page above to create new user accounts. The system requires users to assign a unique user name for each user account. It also requires users to enter the Chinese and English name, password for the new account owner and assign a role and clinic for him/her. For System Administrator, they can assign any clinic for the user. For Clinic Administrator, they can only assign the current login clinic for the user. If the account owner is a registered Chinese Medicine Practitioner, usually assigned with Doctor Role, the registration number must be entered.

Otherwise, the creation of account will be rejected by the system when adding Doctor Role. A checkbox is provided for user to indicate the account is in use or not. Before passing the data to the database, the password will be hashed with SHA-256. When confirm button is clicked, the system will check whether the user ID and registration number is exists. If it exists, the action will be rejected. If not, the record will be inserted to the database.

5.2.8.3. Enquire / Edit User Information

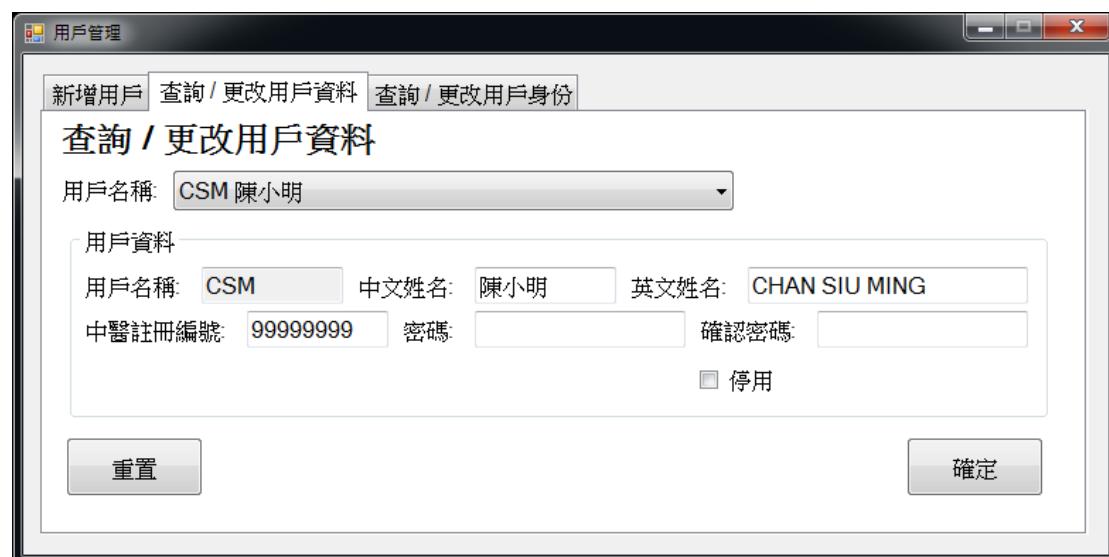


Fig 5.19 Screenshot of User Management with Enquire / Edit User Information Tab page Selected (For System Administrator and Clinic Administrator)



Fig 5.20 Screenshot of Enquire / Edit User Information Form (For Doctor and Staff)

System Administrator and Clinic Administrator can use the tab page shown in Fig 5.19 to view and edit user accounts information including themselves.

Doctor and Staff can use the form shown in Fig 5.20 to view and edit their account information. The main body for the two user interface are similar, they both allow user to view the user ID and view and edit the Chinese and English name, Chinese Medicine Practitioner registration number and password.

For the one used by System Administrator and Clinic Administrator, a dropdown list will be provided for them to choose which account to be viewed or edited. Only the account under his/her management will be shown and can be selected from the list. For System Administrator, all the accounts including those created in CMPMS, are under their management. For Clinic Administrator, only the accounts with roles associated with their clinic are under their management.

Users can change all the information for the selected account except user ID. He/she cannot suspend his/her own account. Before passing the data to the database, the password will be hashed with SHA-256. When confirm button is clicked, the system will check whether the Chinese Medicine Practitioner registration number is used by other account if it is not blank. If it is used by other account, the update will be rejected, else the record will be updated.

5.2.8.4. Enquire/Amend User Role

The screenshot shows a Windows application window titled "用戶管理". At the top, there are three tabs: "新增用戶" (Add User), "查詢 / 更改用戶資料" (Query / Change User Data), and "查詢 / 更改用戶身份" (Query / Change User Identity). The third tab is currently selected. The main area contains the following fields:

- "用戶名稱:" dropdown menu showing "CSM 陳小明".
- "用戶名稱:" text input field showing "CSM".
- "診所/身份:" dropdown menu showing "CITYC/醫生", "CITYC/診所管理員", "CSM/職員", "CSM/醫生", and "CSM/診所管理員".
- "移除" (Remove) button next to the dropdown menu.
- "診所代號:" dropdown menu showing "ABC".
- "身份:" dropdown menu showing "不能存取" (Cannot be stored).
- "增加" (Add) button next to the dropdown menu.
- "重置" (Reset) button at the bottom right.

Fig 5.21 Screenshot of User Management with Enquire / Amend User Role Tab page Selected

System Administrator and Clinic Administrator can use the above tab page to manage user roles. A dropdown list will be provided for users to choose which account to be viewed or amended. All the accounts in the system, including those created in CMPMS, will be shown and can be selected from the list. The authority of the user role granted to the account should not higher than the user's current login role, i.e. System Administrator can grant all the roles and Clinic Administrator can grant all the roles except System Administrator Role. The clinic associated to the role should under his/her management.

5.2.8.5. Database

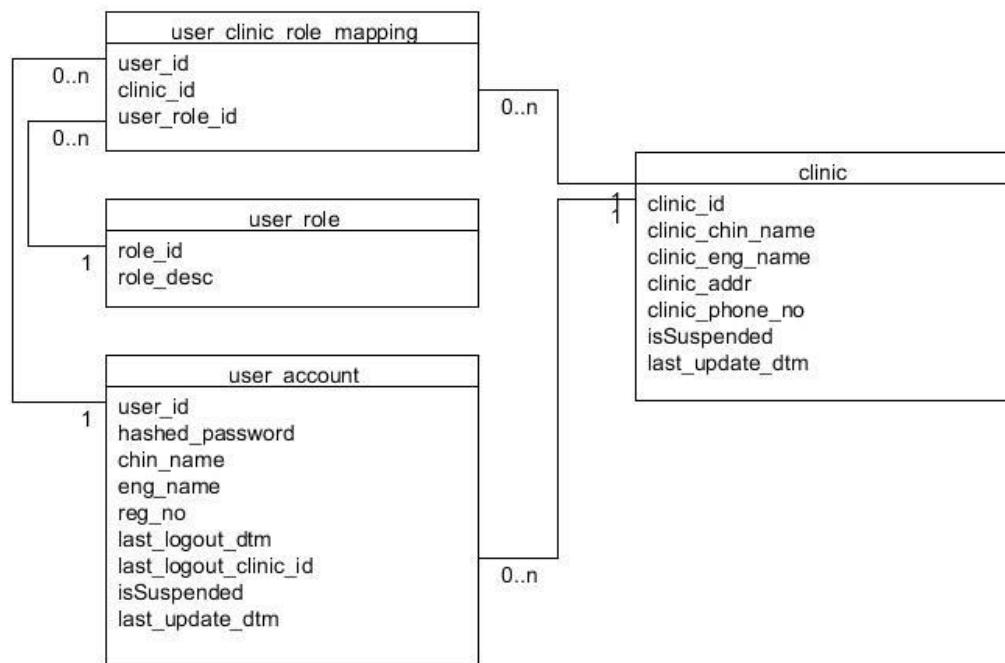


Fig 5.22 Database Tables Related to User Management

There are four tables related to the user and role management. They are user account table (user_account), clinic table (clinic), user role table (user_role) and user-clinic-role mapping table (user_clinic_role_mapping).

Clinic information is stored in the clinic table.

User role table is a constant table and maintained by the system developer and database administrator. It stores the role ID (role_id) and role description

(role_desc). As patient do not need to login the system by their own patient account, the system only have the role representation for clinic staff users, it means only the roles for clinic staff are stored in the user role table. The content in descending order of role authority are as follows:

Role ID	Description
40	System Administrator
30	Clinic Administrator
20	Doctor
10	Staff
0	No Access

Fig 5.23 User role table content

Role 0 is a special role. When it is applied to the account, the account cannot login to the system with the corresponding clinic even if he/she has some high authority role(s) in that clinic. The use for this role is to suspend the access of the user from a certain clinic for some reasons. For details, see Section 5.2.8.1.

Account information entered is stored in the user account table. The last logout Clinic ID (last_logout_clinic_id) and last logout date time (last_logout_dtm) field will be updated when the user logout. The last logout Clinic ID is based on the data stored in clinic table.

User-clinic-role mapping table is a table storing the information about which clinic and role that the user possesses with. It has three fields, user ID (user_id), clinic ID (clinic_id) and role ID (user_role_id), which are based on the information stored in user account table, clinic table and user role table respectively. This table is used, instead of storing the clinic and role item with the user account entry, is because each user can work in different clinics with different and multiple roles. For example, Doctor A has his own clinic and he is the clinic administrator, he will have Role 20 and 30 for Doctor A's clinic. Besides, he also can work in his friend's clinic, say Clinic B, as a doctor. Then,

he also will have the Role 20 for Clinic B. This can reduce the redundancy of data stored.

5.2.9. Patient Queue

This system maintains a patient queue for each clinic and each queue is independent from each other. The patient queue shown to users are based on the login clinic. Patient can enter or leave the queue by using the Patient Sub-system or in the help of any clinic staff using the main system. The followings are the screenshots of user interface related to patient queue.

挂号

請輸入以下最少一項資料以供檢索

病人編號:

身份證/護照號碼:

電話號碼:

搜尋

病人姓名:

挂号 / 查詢輪候 取消掛號

Fig 5.24 Screenshot of Registration Form for Patient Queue in Patient Sub-system

挂号
請輸入以下最少一項資料以供檢索
病人編號: _____
身份證/護照號碼: _____
電話號碼: _____

叫名
醫生: CSM 陳小明
按「下一位」以根據登記順序叫名
或
輸入病人編號作優先診治
_____ 下一位

輪候名單
更新日期/時間: 06/04/2015 19:25:45 [更新]

#	病人編號	中文姓名	英文姓名	性別	出生日期	輪候時間	狀況	醫生
1	1	上官思賢	SHEU...	M	09/01/1...	06/04/...	進入診症	陳小...
2	3	關希欣	MAGG...	F	11/01/1...	06/04/...	輪候中	
3	4	胡芯藍	WU S...	F	14/01/1...	06/04/...	輪候中	
4	5	李廣仙	LEE K...	M	05/02/1...	06/04/...	輪候中	

Fig 5.25 Screenshot of Patient Queue Management Form for Clinic Administrator and Staff

挂号
請輸入以下最少一項資料以供檢索
病人編號: _____
身份證/護照號碼: _____
電話號碼: _____

叫名
已叫名 / 診症中 病人
據登記順序叫名
輸入病人編號作診治
病人編號: _____

輪候名單
更新日期/時間: 06/04/2015 19:27:38 [更新]

#	病人編號	中文姓名	英文姓名	性別	出生日期	輪候時間	狀況	醫生
1	1	上官思賢	SHEU...	M	09/01/1...	06/04/...	進入診症	陳小...
2	3	關希欣	MAGG...	F	11/01/1...	06/04/...	輪候中	
3	4	胡芯藍	WU S...	F	14/01/1...	06/04/...	輪候中	
4	5	李廣仙	LEE K...	M	05/02/1...	06/04/...	輪候中	

Fig 5.26 Screenshot of Patient Queue Management Form for Doctor

Each patient is assigned with a status to indicate which stage of the workflow he/she is in. The statuses include “Waiting”, “Calling”, “Entering Consultation”, “In Consultation” and “Consult Later”. Patient’s status in this system can only be changed as the following figure. Please see Appendix B for the enlarged version.

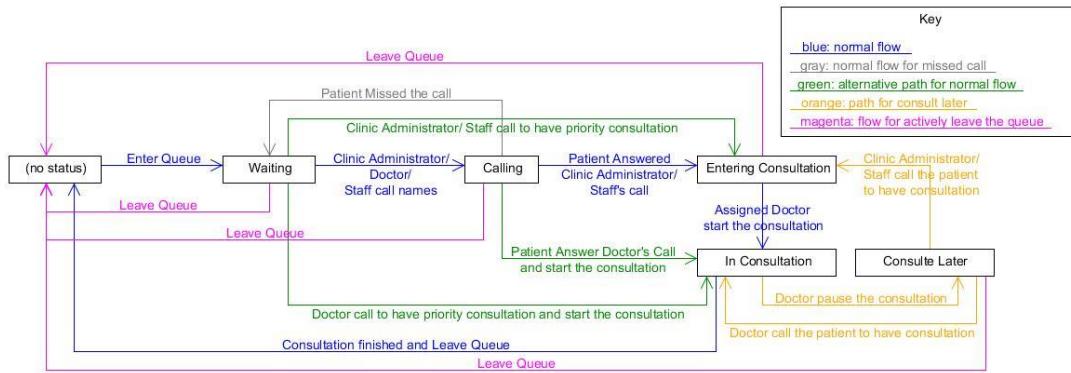


Fig 5.27 Patient Status Flow Diagram

When a patient enters the queue, he/she will be assigned the status “Waiting”. Then, when any clinic staff calls his/her names for consultation, the status will be changed to “Calling”. If he/she missed the call, the status will change back to “Waiting”, else the status will proceed to “Entering Consultation”. Then the assigned doctor starts the consultation, and the status changes to “In Consultation”. If the calling procedure is done by Doctor, the status will change to “In Consultation” directly instead of passing through “Entering Consultation”. If the patient is given a priority consultation, the flow will skip over the “Calling” status. When the consultation finished, the patient will leave the queue. If the consultation needs to be paused due to some reason, say taking an X-ray examination in a Laboratory, the patient status will be changed to “Consult Later” and the consultation can be restarted by any staff in the clinic. At any status except “In Consultation”, patient can leave the queue actively.

From the screenshots in Fig 5.25 and Fig 5.26, patient queue management functions are available for all doctor and non-doctor staff roles. The system allows doctor and non-doctor staff to do the patient queue management because the system need to fit for different practices. For clinics with only the doctor and no other staff, then the doctor should do the registration and calling and they should be able to do so without login with another roles. For some larger clinics, staff will help managing the queuing patients and calling the names. Then, the doctor has no need to do the management but only get

the called patient.

5.2.9.1. Enter / Leave Waiting Queue and Position Enquiry

The three user interfaces shown in Fig 5.24, Fig 5.25 and Fig 5.26 possess with a patient search panel and 2 buttons namely “Register/Check Position” and “Unregister”. Users can use the form provided to add patient to or remove patient from the patient queue and check the patient’s position in the queue. User can search and select patient with the patient search panel. When patient is selected and register/check position button is clicked, the patient will be put into the waiting queue of the currently login clinic and the position will be shown. The patient cannot double register to the same queue, i.e. in the same clinic. When the patient is selected and unregister button is clicked, the patient will be removed from the queue if he/she exists in the queue. Message will be shown to notify the user no matter the action is successful or not. Both actions will trigger the update of the waiting list shown on the right of the windows form (Fig 5.25 and Fig 5.26) if the action is done with the user interface for Clinic Administrator, Staff and Doctor.

5.2.9.2. Calling Name and Change Doctor-in-charge

When the patients are going to be seen by the doctor, their name will be called.

For Clinic Administrator and Staff, they have a dropdown list to choose which doctor is going to see the next patient in their user interface. Only the doctors who have the Doctor Role in that clinic will be shown in the list.

For all the clinic staff, they can click the next patient button to start the calling procedures. A mechanism in the system will control only one staff logged in with that clinic can execute this procedure at the same time. When the button is clicked, a dialog box will be shown to ask whether the first patient in the queue is in the clinic and the patient’s status is changed to “Calling”. Then the

user can call the patient's name. User can click "Yes" for the patient answering his/her call, "No" for not here or no response from patient and "Cancel" to stop the calling procedure. If "Yes" is selected, the patient status will be updated. For Doctor's call, the status will change to "In Consultation". For others, the status will change to "Entering Consultation". If "No" is selected in the dialog box, the second patient's information will be shown and so on until all patient have been called and the procedure will stop or one of the patient answered the call and clicked "Yes". When the procedure stop, the missed call counter of all the patient have called with response "No" will be increased by one and patients' status will turn back to "Waiting". And the counter is for further development to implement some penalty mechanisms for those having too many miss calls.

A textbox is provided in the middle of the forms for all the staff to enter the patient ID which exists in the queue and with status "Waiting" to have a priority consultation or continue an unfinished consultation for patient with status "Consult Later". All the patient with status "Consult Later" can only use this function to have consultation as the system cannot determine when is ready for the patient to continue the consultation.

When the patient status is "Entering Consultation", he/she has been assigned with a doctor in-charge. For the assigned Doctor, he/she can click "Called Patient/In Consultation Patient" button to start the consultation. At each time, at most one called / in consultation patient for one doctor exists in the queue. After any start consultation action has been done successfully, a consultation form will be shown for the doctor to do the consultation.

Any calling action with doctor has assigned with patient in status of "Entering Consultation" and "In Consultation" will be rejected.

In case of Clinic Administrator or Staff select the wrong doctor, there is a change doctor in-charge function for them to do the correction. However, this change can only be done when the doctor is not assigned to any patient with

“Entering Consultation” or “In Consultation” status. For those changes that cannot be done, the status will remain unchanged and wait for the doctor assigned to have consultation with them or use the change doctor in-charge function when the correct doctor has finish the current consultation.

In case of accidentally close of the program by doctor, the called patient button will serve to retrieve the patient who is “In Consultation” and in-charge by that doctor and get back the consultation form just closed.

Once the consultation is done, the patient will be removed from the queue.

5.2.9.3. Database

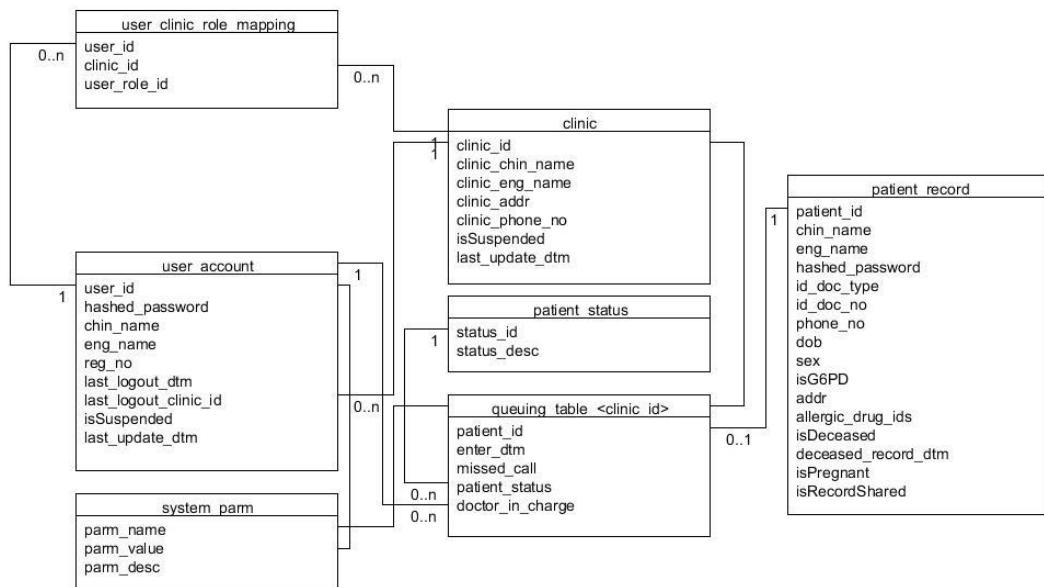


Fig 5.28 Database Tables Related to Patient Queue

Each clinic would have its own queuing table and flag for calling process. The name of queuing tables are queuing_table_<clinic_id> and the lock will be an entry in the system parameter table (system_parm) with parameter name (parm_name) queuing_table_<clinic_id>_LOCK for controlling the concurrent calling name activities. The clinic ID are based on the entries in clinic table. If the clinic ID is CSM, the queuing table name and the parameter name are queuing_table_CSM and queuing_table_CSM_lock respectively. The

parameter value (parm_value) would either be the user ID who are using the queuing table or null for no one is using it. When first access to the queuing table or the table is not exist in the database, the stored procedure accessing the table will create it and add the corresponding entry to the system parameter table using dynamic SQL, i.e. SQL statement prepared at execution time. In the queuing table, it records the patient ID (patient_id), entering date time (enter_dtm), patient's status (patient_status), assigned doctor (doctor_in_charge) and number of missed call (missed_call). Patient ID is based on the entries in patient record table (patient_record), which holds all the patient records in the system.

Patient status table (patient_status) holds all the permissible statuses for patients in the queue. The contents are the five status mentioned in Fig 5.27. Patient status in queuing table is the ID referring to patient status table. Doctor in-charge field is the user ID in user account table which assigned to the patient and having the Doctor role (Role 20) with corresponding clinic in user-clinic-role mapping table.

Number of missed call field in queuing table is for future development to implement penalty mechanism.

Before any calling name actions start, the stored procedure will first try to check the system parameter for the clinic queuing table. If the parameter value is the user ID of the actor, then the calling name action can proceed. If the value is null, then the stored procedure will acquire the lock by change the value null to the actor's user ID. If the value is other user ID, a message will be shown to the actor to notify him/her another colleague is calling name. After one calling name flow, i.e. one of the patients answered the call or all the patients missed the call, the lock will be released by setting to value null.

The reason why this concurrent access control is handled programmatically instead of by the database's default mechanism only is because the calling name activities is done by multiple times of stored procedure call. The

connection will be killed after each call in order to release unnecessary resources for other jobs while waiting for user's response. Also, adding patient to or removing patient from the queue is allowed for other users during the calling name process. Thus, the concurrent access control cannot only be done by the default database mechanism as it is not done by single connection and in one call.

5.2.10. Consultation

The screenshot shows a Windows application window titled "病歷". The left side has a "病人資料" panel with fields for Patient ID (5), Name (李廣仙 / LEE KWONG SIN), Gender (M), and Pregnancy status (懷孕). Below that is a "藥物敏感" section. The right side features a "病歷" table with columns for #, Date/Time, Diagnosis, Symptoms, Differentiation, Prescription Summary, and Acupuncture Points. A "使用已選紀錄作藍本" button is at the bottom of this table. To the right of the table are buttons for "檢視詳細紀錄", "病假" (leave application), "停產證明" (maternity certificate), "痊愈證明" (recovery certificate), "到診紀錄證明書" (attendance record certificate), and "是次醫療紀錄" (current medical record). At the bottom are buttons for "暫存" (temp save), "稍後再診" (reschedule later), "確定並列印處方" (confirm and print prescription), and "完成診症" (complete consultation).

Fig 5.29 Screenshot of Consultation Form

In consultation form, doctor can view patient's personal particulars, drug allergy history and medical records. He/she can enter information for the current consultation, including symptoms, differentiation, diagnosis, prescription, remarks and acupuncture points. He/she can also issue documents like sick leave certificate, pregnancy certificate and consultation certificate. He/she can also change the pregnancy flag of the patient in this form. If the patient is not a new patient, his/her past consultation record in this clinic or entered by this doctor will be listed out in descending order of consultation date time. If the patient has chosen to share medical records, the records in other clinics entered by other doctors to the system will also be shown. The doctor can choose one of the record as the template for the

current consultation record. The old record will be copied to the database as the current consultation. The old record will not be affected. After the consultation, user should click the finish button in order to remove the patient from the waiting queue. If the patient is required to leave temporarily for some reasons, say to take an X-Ray examination, the doctor can click consult later and go on with another patient first. The status of the patient will change to “Consult Later”. When the form is closed with the close button at the top right corner, the information in the form will be saved to the database and the patient status will change to “Consult Later” if it is not confirmed yet. If the information is confirmed, the patient status will remain unchanged.

After confirming and printing prescription(s), the documents generation functions on the right of the user interface (disabled in Fig 5.29) will be enabled. The documents that can be generated are sick leave certificate, pregnancy certificate, consultation certificate and medical record for the current consultation. These documents will be further discussed in Section 5.2.11.

5.2.10.1. Symptoms, Differentiation and Diagnosis

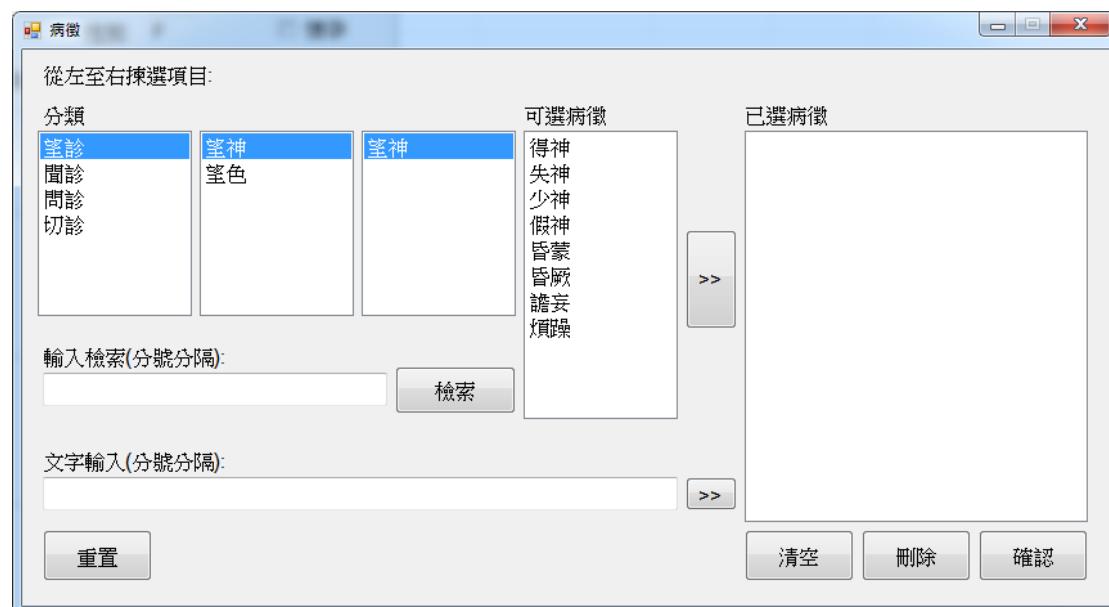


Fig 5.30 Screenshot of Symptoms Selection Form

從左至右揀選項目:

分類

- 八綱辨證
- 痘因辨證
- 氣血辨證
- 津液辨證
- 臘腑辨證
- 各科辨證
- 六經辨證

可選辨證

- 陰證
- 陽證
- 陰陽失調證
- 傷陽證
- 傷陰證
- 陰虛證
- 陽虛證
- 陰陽兩虛證
- 陰虛內熱證
- 陰虛火旺證
- 陰虛陽亢證

已選辨證

輸入檢索(分號分隔):

文字輸入(分號分隔):

檢索

>>

重置

清空

刪除

確認

Fig 5.31 Screenshot of Differentiation Selection Form

從左至右揀選項目:

分類

- 內科
- 外科
- 婦產科/產婦人科
- 兒科/小兒科
- 眼科
- 耳鼻喉口齒科
- 骨傷科

可選診斷

- 陰病
- 陽病
- 傷寒
- 雜病
- 新感
- 時疫
- 感冒
- 時行感冒
- 傷濕
- 痘疾
- 痘毒癟

已選診斷

輸入檢索(分號分隔):

文字輸入(分號分隔):

檢索

>>

重置

清空

刪除

確認

Fig 5.32 Screenshot of Diagnosis Selection Form

Doctor can use the forms shown above for entering symptoms, differentiation and diagnosis for the consultation. For these three items, doctor can use stored phrases based on WHO standard by choosing from the list boxes provided or text-based search. They also accept free-text entry. The free-text entry can be in Chinese phrase or single English word. No phrases can be used more than once in the same consultation. Both the display text string and the code for the phrase will be stored in the consultation record. The

display text string is stored because it might be changed from time to time or as a result of changing in standard. To ensure same record is retrieved at any time and the document can be regenerated, the display text strings are kept.

5.2.10.2. Prescription

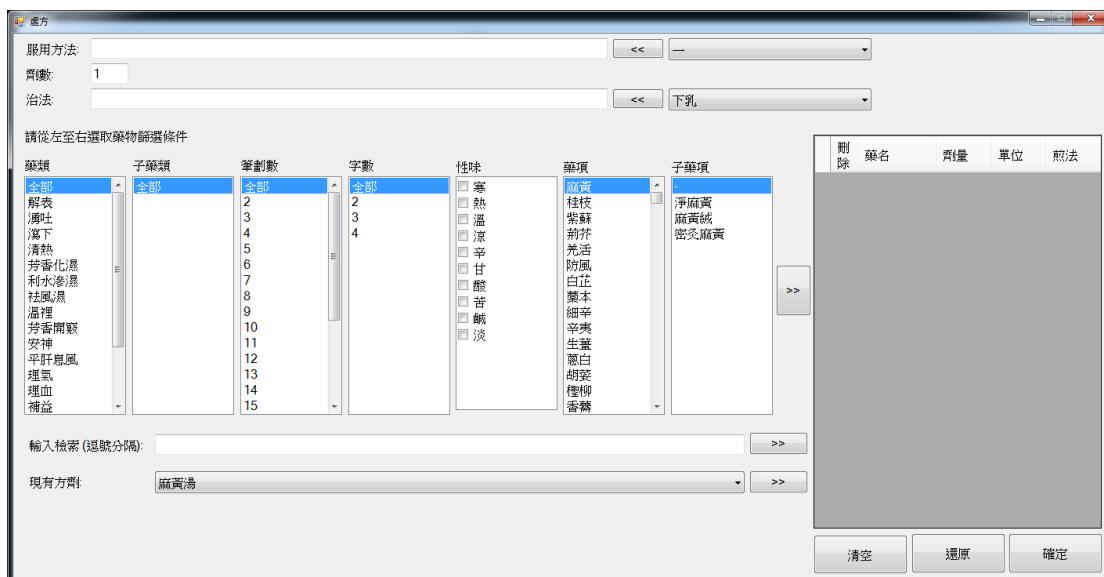


Fig 5.33 Screenshot of Prescription Form

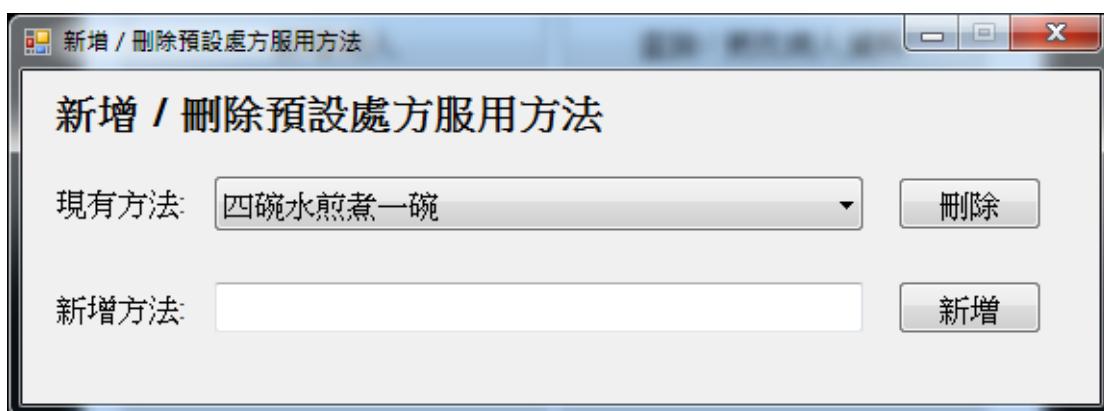


Fig 5.34 Screenshot of Add / Delete Stored Phrase for Prescription Using Directions Form

Each consultation can have more than one prescription. The prescription ID will be shown in the dropdown list in the consultation form. Doctor can click the amend button to view or amend the prescription, delete button to remove the prescription and new button to create a new prescription. In the prescription form above, doctor can enter the using direction and treating method by free-text or select some stored phrases from the dropdown list next

to it. The stored phrase for prescription using directions can be added or deleted using the stored phrase for prescription using directions form. Doctor should also enter the dosage of drugs that pharmacy should dispense to the patient. In this form, a prescription panel will be provided for users to make prescription. When user finish entering the prescription, the information will be stored to the database and perform safety checking. After that, the prescription ID will be added to the dropdown list in the consultation form.

This system equipped with prescription safety checking. The checking can check drug incompatibility, contraindication for G6PD deficiency and pregnant patient, matching patient's drug allergy history and dosage limits. If any rules are violated, a message will be shown to notify user the prescription has violate safety rule(s) and a log record will be kept. Users can choose to edit the prescription or ignore the warning. If the clinic is associated with a pharmacy using CMPMS, stock checking will be performed. A stored procedure that provided by AU-YEUNG's system in schema cmcis will be call to check whether the pharmacy possesses with enough stock for the prescription. If the data returned are low/no stock of certain drugs, message will be shown to notify the user. User can choose to change the prescription or not.

Before confirming and printing prescription(s), the system will perform safety check again to prevent user using past medical record to by-passed the safety checking implemented in stored procedures for making prescriptions.

Before the consultation finished, a drug stock check will be performed again if the clinic is associated with a pharmacy using CMPMS. User can still choose to edit the prescription if some drug used in those prescriptions are in low stock level or out of stock. If no drugs are out of stock, user can choose to reserve drug in the pharmacy. Stored procedure provided by AU-YEUNG's system in schema cmcis will be called for drug reservation. The system will notify the user with the reservation result.

5.2.10.3. Doctor's Remark

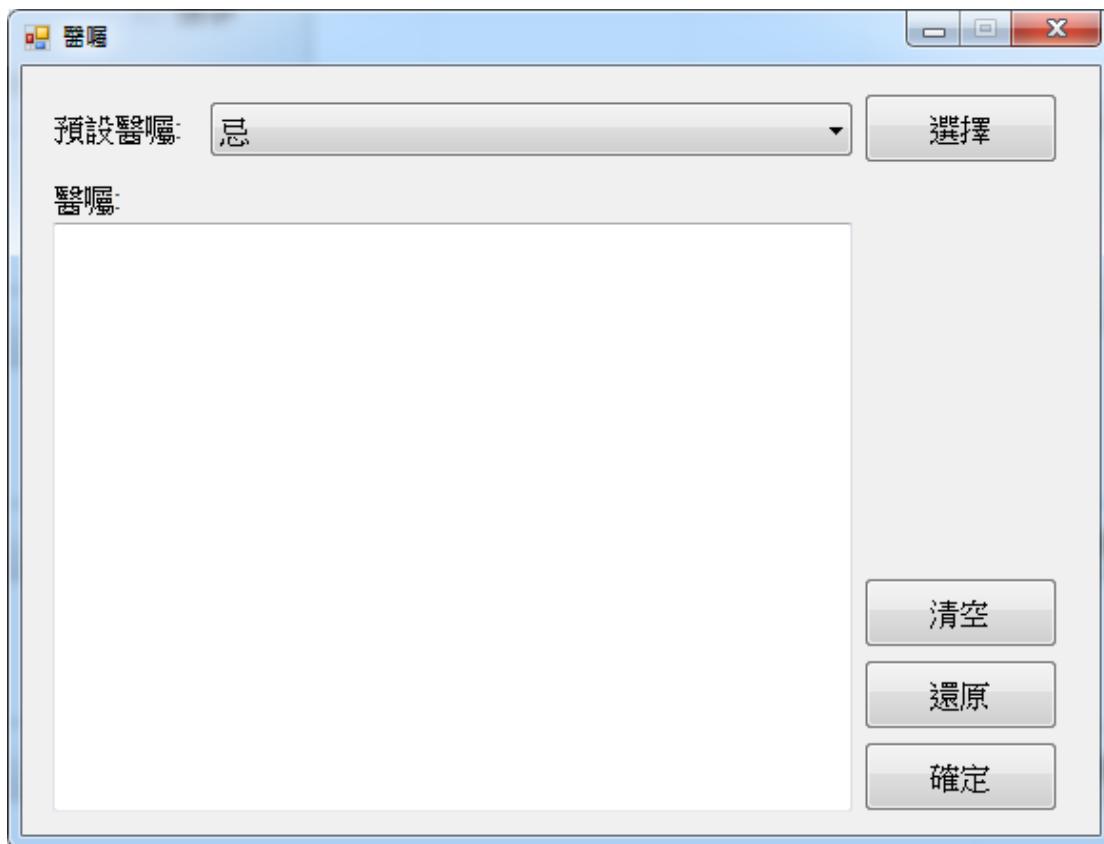


Fig 5.35 Screenshot of Doctor's Remark Entry Form

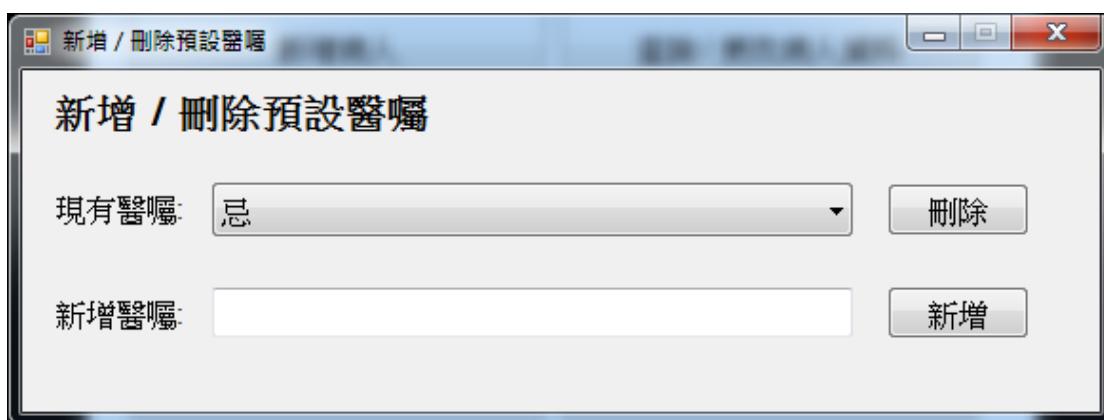


Fig 5.36 Screenshot of Add / Delete Stored Phrases for Doctor's Remark Form

Usually, doctor will give some remarks or reminders for the patient in order to have a better treatment result. Doctor can enter the remark by free-text or choose stored phrases from the dropdown list. The stored phrases for doctor's remark can be added or deleted using the add / delete stored phrases for doctor's remark form

5.2.10.4. Acupuncture

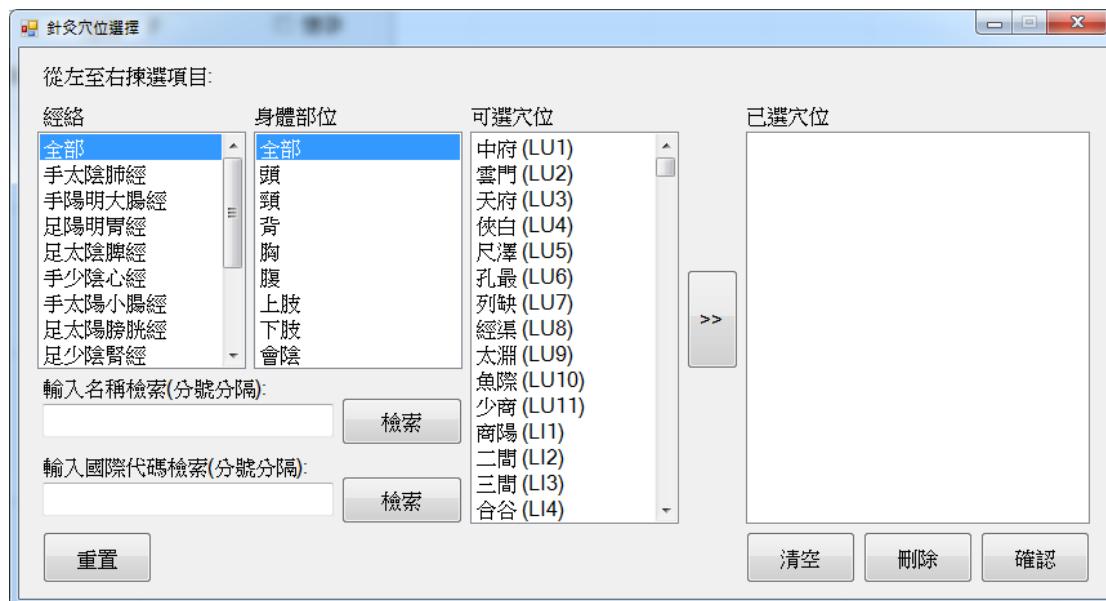


Fig 5.37 Screenshot of Acupuncture Point Selection Form

Nowadays, Chinese Medicine is not only providing drug for treatment but also acupuncture. Doctor can choose acupuncture points for treatment from the form above. There are three ways for choosing the points. The first one is choosing by selecting criteria using the list boxes. The other two are searching by name and international code respectively. The data provided are based on WHO standard. Therefore, no free-text input or addition of points is allowed by user as the data should include all permissible acupuncture points.

5.2.10.5. Database

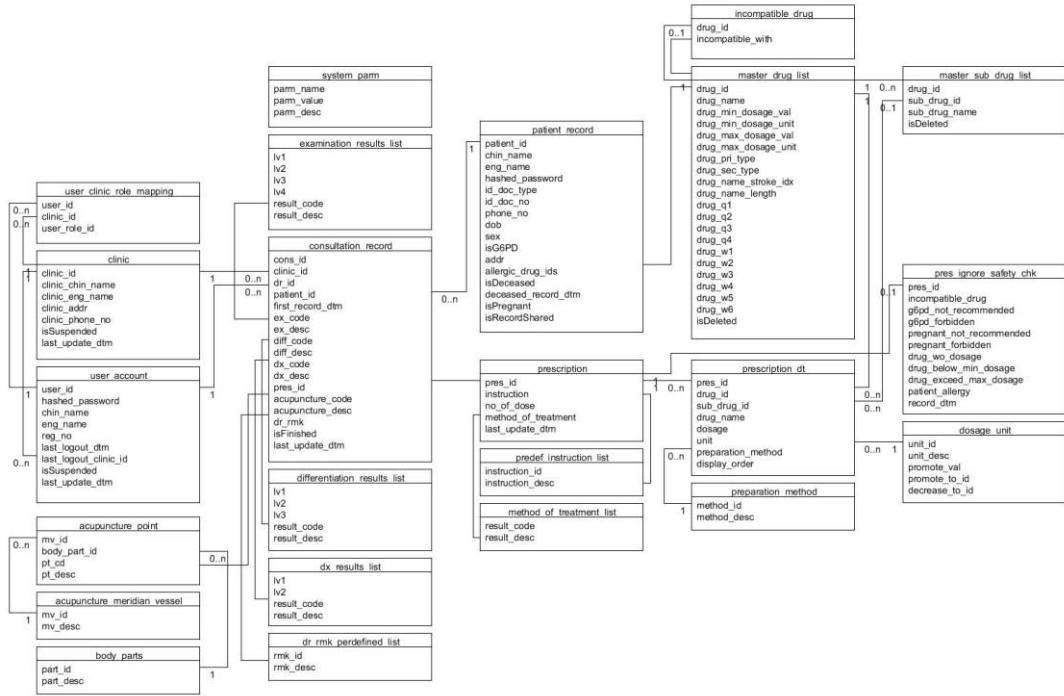


Fig 5.38 Database Tables Related to Consultation

Consultation records are stored in Consultation record table (consultation_record). The consultation ID generation is similar to that of patient ID mentioned in Section 5.2.3.4. The entry in system parameter table used for the ID generation is “consultation_cnt”. The clinic ID (clinic_id) are based on the login clinic, which should be an entry in clinic table. The doctor ID (dr_id) is based on the login user ID, which should be an entry in user account table with doctor role with the login clinic in the user-clinic-role mapping table. The patient ID is based on the data in patient record table. The symptom code (ex_code) and symptom description (ex_desc) are based on the data in symptom list (examination_results_list) if they are selected from the list. The differentiation code (diff_code) and differentiation description (diff_desc) are based on the data in differentiation list (differentiation_results_list) if they are selected from the list. The diagnosis code (dx_code) and diagnosis description (dx_desc) are based on the data in diagnosis list (dx_results_list) if they are selected from the list. If they are free text, the code will be “FreeText”. The codes for symptoms, differentiation and

diagnosis are stored by concatenating all the code selected with delimiter “||” and the description for them are concatenated with “; ” as delimiter. The prescription IDs (pres_id) are stored by concatenating all the related IDs with “||” as delimiter. The acupuncture code and description (acupuncture_code and acupuncture_desc) are based on the acupuncture point table (acupuncture_point). The acupuncture code are stored by concatenating all the code selected with delimiter “||” and acupuncture description are concatenated with “; ” as delimiter. The doctor's remarks (dr_rmk) are stored in plain text. The finished flag (isFinished) are with values -1, 0, 1 or 2. -1 means the consultation not finished but the patient leaved. 0 means the consultation started but not yet finished. 1 means the consultation data has been confirmed and prescription printed. 2 means the consultation is successfully finished. When the consultation starts, the record is inserted with value 0 for the finished flag. Each update on the record will trigger the update of the last update date time (last_update_dtm) field. Plain text description are stored is for ensuring the information is reproducible at any time.

The way of storing prescription data are similar to that of formula. The two tables are prescription table (prescription) and prescription detail table (prescription_dt). Prescription table stores prescription ID (pres_id), using directions (instruction), number of dose (no_of_dose), method of the treatment (method_of_treatment) and the last update date time (last_update_dtm). Prescription detail table stores data like formula detail. The difference is prescription detail stores 2 more data, they are the drug name and display order (display_order). These two fields are used for ensuring the information is reproducible at any time and resistance to changes of data in the drug data tables.

Any prescription which cannot pass the safety check, an entry will be add to the ignore safety check log (pres_ignore_safety_chk). This table will store the prescription ID, rules violated and the record date time.

All the prescription removed in consultation form or not confirmed to add to

the consultation record will not be removed immediately after the consultation. The prescriptions are removed by a scheduled job which runs every day. The scheduled job calls a stored procedure to remove those prescriptions with last update date time earlier than 24 hours before the current date time. The 24 hours buffer time is used for preventing any consultations that are not yet confirmed, which have prescriptions not yet added to the prescription ID field for reference. After cleaning up the prescription tables, 2 parameters in system parameter table will be updated. They are “pres_clean_up_to_dtm” and “pres_clean_up_error”. The first one records the current clean up covering up to which date time. This will make the following executions faster as it only needs to clean prescriptions with last update date time later than this. The second one is a flag for database administrator or developer to know any error occurred during the last clean up. If these two parameters do not exist in the system parameter table, they will be created during runtime.

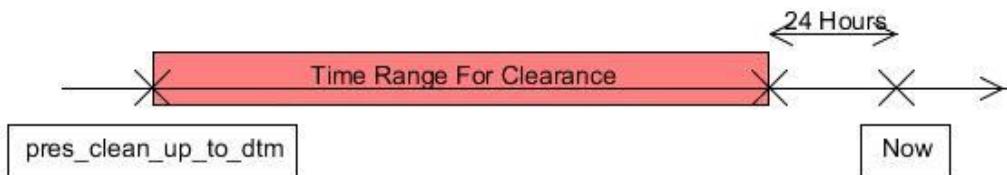
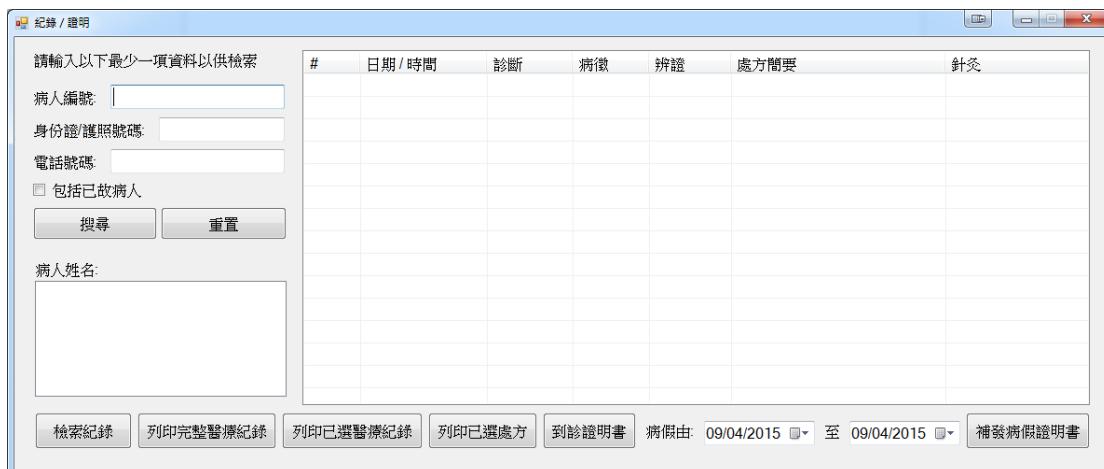


Fig 5.39 Prescription clean up time range

5.2.11. Documents and Reports



This screenshot shows a Windows application window titled '紀錄 / 證明' (Record / Certificate). On the left, there is a search panel with fields for '病人編號' (Patient ID), '身份證/護照號碼' (ID Card/Passport Number), '電話號碼' (Phone Number), and a checkbox for '包括已故病人' (Include deceased patients). Below these are buttons for '搜尋' (Search) and '重置' (Reset). To the right is a large grid table with columns labeled '#', '日期 / 時間' (Date / Time), '診斷' (Diagnosis), '病徵' (Symptoms), '辨證' (Differentiation), '處方簡要' (Prescription Summary), and '針灸' (Acupuncture). At the bottom of the search panel, there are several buttons: '檢索紀錄' (Search Record), '列印完整醫療紀錄' (Print Full Medical Record), '列印已選醫療紀錄' (Print Selected Medical Record), '列印已選處方' (Print Selected Prescription), '到診證明書' (Attendance Certificate), and '病假由: 09/04/2015 至 09/04/2015' (病假由: From 09/04/2015 to 09/04/2015). A '補發病假證明書' (Print Out Attendance Certificate) button is also present.

Fig 5.40 Screenshot of Record / Certificate Issue Form

This system can produce numbers of documents and reports. Some of them can be re-printed or re-issued. For those related to consultations except pregnancy certificate, Clinic Administrator, Doctor and Staff can (re-)print them by using the form above. For other reports, they can be viewed or printed by using the main menu or reporting menu depends on roles. All the documents are viewed and printed through an embedded Crystal Report Viewer. All documents possess with a header showing the clinic information.



Fig 5.41 Screenshot of Reporting Menu for Clinic Administrator

5.2.11.1. Prescription

Prescriptions can be printed during consultation using consultation form by the doctor. They can be reprinted using the form shown in Fig 5.40 by Clinic Administrator, Doctor and Staff.

The prescription possess a section showing the consultation summary included consultation ID, patient and doctor's name, diagnosis and last update date time. Under this section will be the prescription detail including the prescription ID, treatment method, drug items with corresponding dosage, using directions and number of dose prescribed. If the consultation does not have prescription, this section will be replaced by message "This consultation does not have prescription". Then, the next section will be doctor's remark and placeholder for doctor's signature. The following sections would only be shown when the consultation have prescription. At the end of each prescription, a barcode is provided. This barcode is for the related pharmacy using CMPMS to get the prescription details or procedure done in the consultation with verification. Stored procedures are compiled in schema cmcis for these purpose. If the clinic associated with pharmacy using CMPMS and the address of the pharmacy is not the same as the clinic, the pharmacy will be printed under the barcode for reference. For the sample of prescription, see Appendix C.

The barcode data format is <clinic ID>/<doctor ID>/<patient ID>/<consultation ID>/<prescription ID>/<last update date time in yyyyMMddHHmmss format>. These data will be pass to the stored procedure for retrieving the required data. If all the data can match with the record in the database, the prescription hardcopy is valid and the prescription detail and procedures done in the consultation will be returned to the caller depends on which stored procedure is called. If the data cannot match with the record in the database, the prescription hardcopy may be outdated or not issued from the same system. The details will not be returned to the caller.

5.2.11.2. Consultation Certificate

Consultation certificate can be printed during consultation using consultation form by the doctor. They can be reprinted using the form shown in Fig 5.40 by Clinic Administrator, Doctor and Staff.

The certificate would possess with patient's name, personal identification document number, consultation date, diagnosis, date of issue and a placeholder for doctors signature. This certificate is to proof the patient has visited the clinic for consultation instead of using sick leave certificate as sometimes the patient may not be prescribed with sick leave. For the sample of the certificate, see Appendix D.

5.2.11.3. Sick Leave Certificate

Sick leave certificate can be printed during consultation using consultation form by the doctor. They can be reprinted using the form shown in Fig 5.40 by Clinic Administrator, Doctor and Staff.

User can select the sick leave inclusive start and end date using the date pickers provided. The total number of days will be calculated and shown to the user if using the consultation form. According to the Reference Guide on Issuance of Sick Leave Certificate by Registered Chinese Medicine Practitioners (Chinese Medicine Council of Hong Kong, 2003), doctor shall not issue a date back sick leave certificate. Therefore, the sick leave start date cannot be set to date before the consultation start date. After selecting the dates can clicking the "issue" button, the certificate information will be inserted to the sick leave certificate table in the database and a Crystal Report viewer with the certificate will be shown. For re-issue of the certificate, the issue time should within 24 hours after the consultation ends. The 24 hours buffer time is balanced for some patient forget to request for the certificate during consultation and prevent date back the certificate. The following illustrate the time validity regarding sick leave certificate.

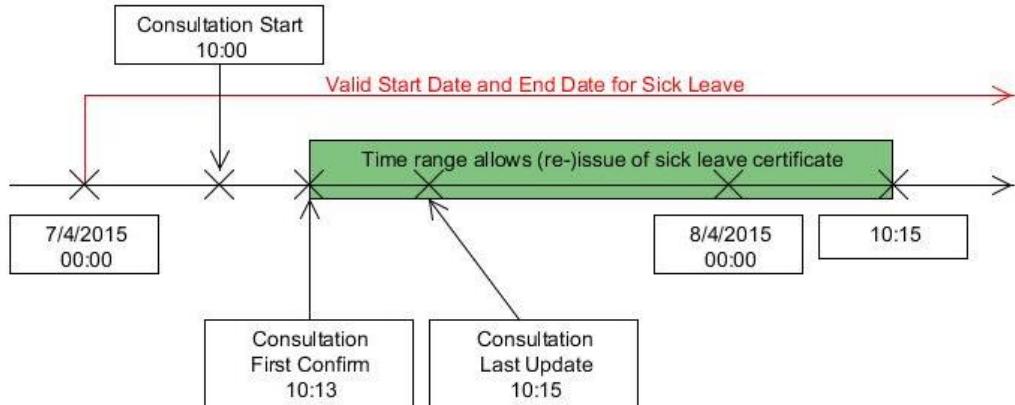


Fig 5.42 Time Validity Regarding Sick Leave Certificate

According to the Reference Guide on Issuance of Sick Leave Certificate by Registered Chinese Medicine Practitioners (Chinese Medicine Council of Hong Kong, 2003), sick leave certificate should include patient's name, ID number, diagnosis, date range, number of days, clinic and doctor's information. The certificate issued by this system would follow the above standard. For the sample of sick leave certificate, see Appendix E.

The database will record the certificate data in the sick leave certificate table (sick_leave_cert). It includes certificate ID (cert_id), consultation ID (consultation_id), start date (start_date), end date (end_date), number of days (nDays) and a voided flag (isVoided). The certificate ID generation is similar to that of patient ID mentioned in Section 5.2.3.4. The entry in system parameter table used for the ID generation is “sick_leave_cert_cnt”. The consultation ID is based on data in consultation record table. The voided flag is used for further development to void some wrongly issued certificate.

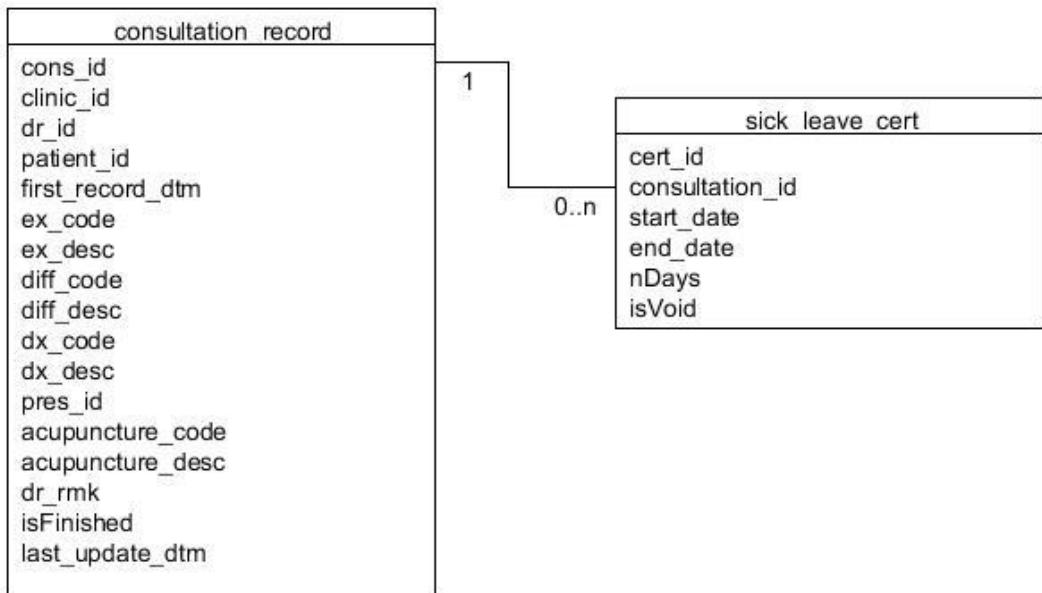


Fig 5.43 Database Tables Related to Sick Leave Certificate

5.2.11.4. Pregnancy Certificate

Pregnancy certificate can only be printed during consultation using consultation form by the doctor.

If the patient is pregnant (pregnant checkbox is checked), the checkbox and date picker for estimated date of confinement (EDC) will be enabled in the consultation form. Doctor can choose to enter the EDC information to the certificate. When “confirm and issue” button is clicked, the certificate information will be inserted to the pregnancy certificate table in the database and a Crystal Report viewer with the certificate will be shown to the doctor. For patient is not pregnant, a certificate certify he/she is not pregnant will be issued.

According to the Reference Guide on Issuance of Sick Leave Certificate by Registered Chinese Medicine Practitioners (Chinese Medicine Council of Hong Kong, 2003), pregnancy certificate should include patient's name, date of consultation and confirmed pregnancy and the date of issue. If EDC is confirmed, the certificate can include the EDC. For the sample of pregnancy certificate, see Appendix F.

The database will record the certificate data in the pregnancy certificate table (pregnant_cert). It includes certificate ID (cert_id), consultation ID (consultation_id), pregnant flag (isPregnant), EDC (edc) and a voided flag (isVoided). The certificate ID generation is similar to that of patient ID mentioned in Section 5.2.3.4. The entry in system parameter table used for the ID generation is “preg_cert_cnt”. The consultation ID is based on data in consultation record table. The voided flag is used for further development to void some wrongly issued certificate.

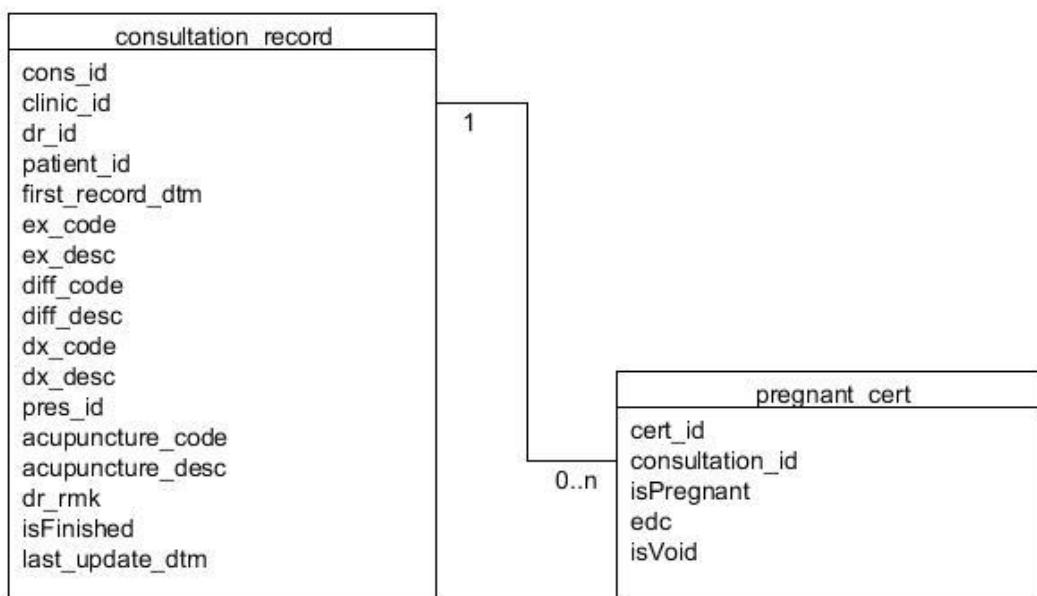


Fig 5.44 Database Tables Related to Pregnancy Certificate

5.2.11.5. Medical Record and Consultation History

Medical records can be printed using the form shown in Fig 5.40 by Clinic Administrator, Doctor and Staff. Single medical record for the current consultation can also be printed during consultation using consultation form by the doctor.

This document provides a more detailed information about consultations. It includes consultation ID, doctor's name and registration number, start and end date time, symptoms, differentiation, diagnosis, acupuncture, doctor's remark and prescription details for each consultation. For the sample of medical

record, see Appendix G. A similar unofficial document, Consultation History, which is used for viewing the past consultation history for doctor's reference, and its sample is in Appendix H.

5.2.11.6. Suspicious Prescription Listing

All the prescription which violated safety rules will be logged in ignore safety check log (see Section 5.2.10.5). This report is for Clinic Administrator to view these log records. The sample of the report is in Appendix I.

Records in the ignore safety check log which the prescriptions are issued in the viewing clinic will be shown in the report. Only those records associated with completed consultation will be shown, i.e. finish flag equals 2 and which cannot be altered with the user interfaces. The record details include the prescription ID, doctor's name, patient ID, consultation ID, rule(s) violated and the record date time. The rules are as follows.

1. Prescription contains incompatible drugs
2. Prescription contains not recommended drug(s) for G6PD deficiency patient where the patient possesses with G6PD deficiency
3. Prescription contains prohibited drug(s) for G6PD deficiency patient where the patient possesses with G6PD deficiency
4. Prescription contains not recommended drug(s) for pregnant patient where the patient is pregnant
5. Prescription contains prohibited drug(s) for pregnant patient where the patient is pregnant
6. Prescription contains drug(s) with 0 dosage
7. Prescription contains drug(s) with dosage lower than the suggested minimum dosage limit
8. Prescription contains drug(s) with dosage exceeding the suggested maximum dosage limit
9. Prescription contains drug(s) which matched the record in patient's drug allergy history

Once medical incident occurs, this report can provide information for Clinic

Administrator some clues for tracing the source of error.

5.2.11.7. Statistic Report of Daily Consultation in the Past 30 Days

This report can be viewed by Clinic Administrator and Staff. The report shows the number of patient headcount, number of prescription issued, number and percentage of patient headcount with prescription issued and acupuncture treatment. This report can let the Clinic Administrator and Staff to have an overview on the business. The report sample is in Appendix J.

5.2.11.8. Diagnosis Statistics in the Past 30 Days

This report shows the statics for patient headcount by diagnosis. The numbers included are system total headcount, system new case headcount, clinic total headcount, clinic new case headcount and clinic new case included in system new case headcount for different diagnosis in the past 30 days, using consultation start date time as reference date. The definition of the items are as follows.

Study Period:

Previous 30 days using report running as reference.



Fig 5.45 Study Period for Diagnosis Statistics in the Past 30 Days

System Total Headcount:

Total number of patient headcount who have received consultation within the study period and having the diagnosis code in any clinics in the system. This is equivalent to the total number of first diagnosis in the system within the study period as the first must within 30 days before the following diagnosis within the study period.

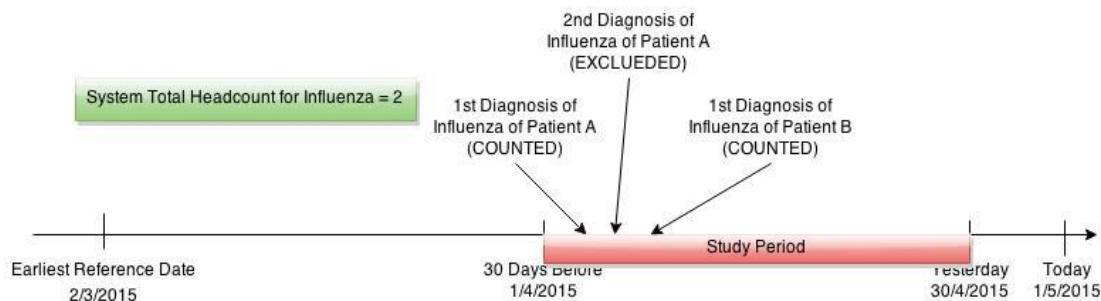


Fig 5.46 System Total Headcount for Diagnosis Statistics in the Past 30 Days

System New Case Headcount:

Number of patients with same diagnosis is not found in the 30 days before the first diagnosis within the study period in any clinics in the system.

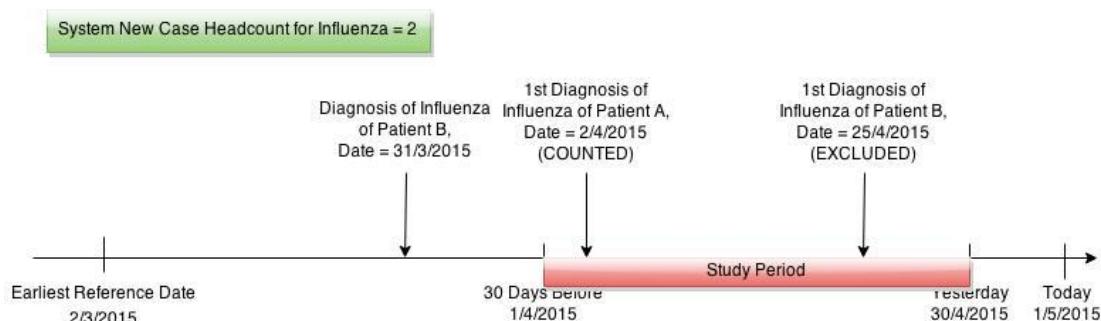


Fig 5.47 System New Case Headcount for Diagnosis Statistics in the Past 30 Days

Clinic Total Headcount:

Total number of patient headcount who have received consultation within the study period and having the diagnosis code in the report running clinic. This is equivalent to the total number of first diagnosis in the clinic within the study clinic.

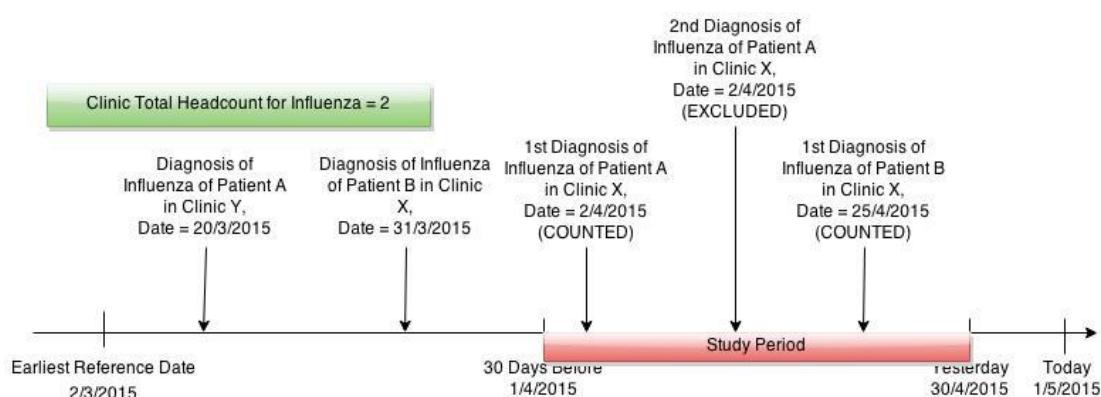


Fig 5.48 Clinic Total Headcount for Diagnosis Statistics in the Past 30 Days

Clinic New Case Headcount:

Number of patients with same diagnosis is not found in the 30 days before the first diagnosis within the study period in the same clinic.

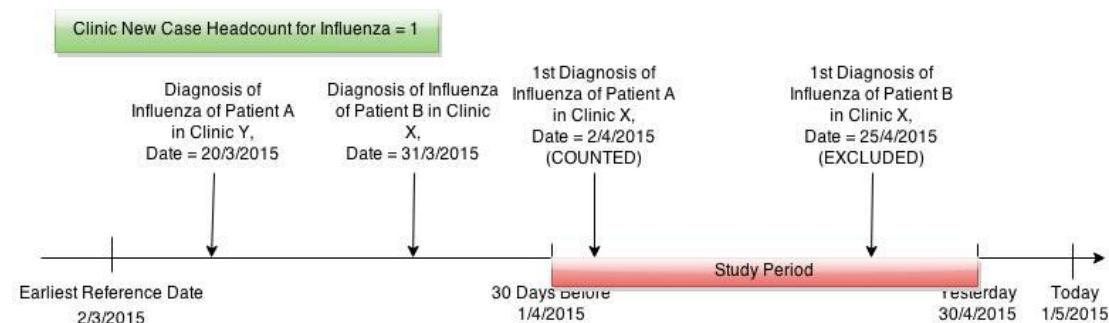


Fig 5.49 Clinic New Case Headcount for Diagnosis Statistics in the Past 30 Days

Clinic New Case Included in System New Case Headcount:

Number of patient both counted in System New Case and Clinic New Case.

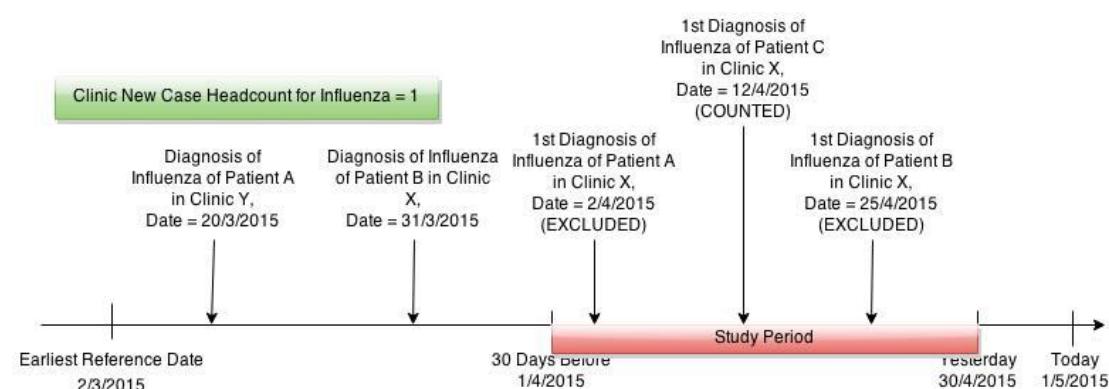


Fig 5.50 Clinic New Case Included in System New Case Headcount for Diagnosis Statistics in the Past 30 Days

This report can let users to know what cases are the clinic's doctors are following and also can help in detecting any outbreak and predict the trends of a certain diseases like influenza. By comparing the system-wide and clinic-wide data, user can know whether it is an individual surge in a clinic or in a community. As this report included some system-wide data, only Clinic Administrator can generate this report. However, they can circulate it in the clinic with other colleagues. For the sample of this report, see Appendix K.

5.2.11.9. Patient Listing

This report can be viewed by System Administrator, Clinic Administrator and

Staff. System Administrator can retrieve all the patient records in the system while Clinic Administrator and Staff can only retrieve patient records that those patient have had consultation in the current login clinic before. The report aims at letting the users know who are recorded in the system and have used their services, therefore only parts of the records are listed out in order to protect personally identifiable information (PII). The data includes patient ID, Chinese and English name, phone number, date of birth, sex, G6PD deficiency flag, address, last consultation date and decease flag. For the sample of the report, see Appendix L.

5.2.11.10. User Listing

This report can be viewed by System Administrator and Clinic Administrator. Only the user account under his/her management will be listed. The user ID, Chinese and English name, Chinese Medicine Practitioner Registration Number, last update date time, suspended flag, last logout date time and clinic and clinic-role mapping of the user account will be listed out. For Clinic Administrator's version, only the clinic-role mapping with currently login clinic will be shown and the last logout clinic will be masked as “***” if the clinic is not the current one. For the sample of the report, see Appendix M.

5.2.11.11. Clinic Listing

This report can be viewed by System Administrator and Clinic Administrator. All the clinics in the system will be listed. The clinic ID, Chinese and English name, address, phone number(s), suspended flag, last update date time and number of users of the clinics will be shown. For Clinic Administrator's version, the number of users will be masked as “***” if the clinic is not the current one. For the sample of the report, see Appendix N.

5.2.11.12. Drug Listing

This report can be viewed by System Administrator, Clinic Administrator and Doctor. It list out all the drug and sub-drug items which are available or had been available in the system with their dosage limits. As Doctors cannot

perform drug administrator, this report may be useful for them as a reference. For the sample of the listing, see Appendix O.

5.2.12. Co-operation with CMPMS

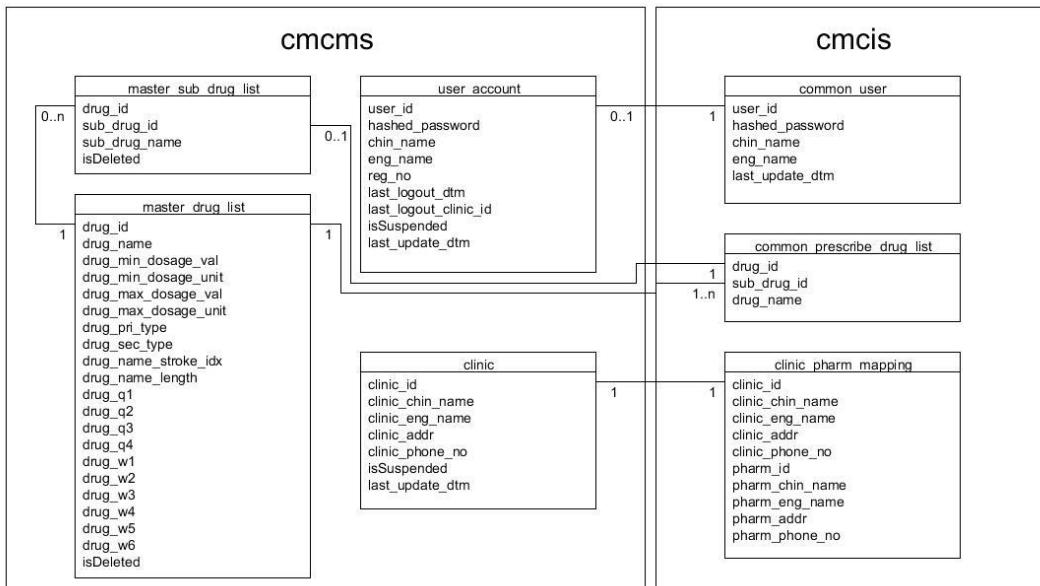


Fig 5.51 Database Tables Related to cmcis

The schema cmcis is a place for sharing data with CMPMS. All the tables in cmcis can be accessed by both system users.

The table `common_user` holds the basic user account information from both systems. It contains user ID (`user_id`), hashed passwords (`hashed_passwords`), Chinese and English name (`chin_name` and `eng_name`) and the last update date time (`last_update_dtm`). Once the account is going to be created or information updated, a stored procedure in schema cmcis will be called to update the `common_user` table. The update `common_user` table should be done before the user account table to ensure the last update date time syncs as the stored procedure in cmcis uses system date time (calling `sysdate()` function provided by MySQL) for update this field.

The `common_prescribe_drug_list` holds the basic information of drugs that required by CMPMS. It contains drug ID, sub-drug ID and the item name

(drug_name). The data is actually the basic information of items by combining those in master drug list and master sub-drug list. When data updated in master drug list and master sub-drug list in cmcms, a stored procedure in cmcis will be called for updating the common_prescribe_drug_list. The update only can be done by CMCMS.

The table clinic_pharm_mapping is a table holding the mapping between clinics in CMCMS and pharmacies in CMPMS. When clinic record is created or updated in cmcms, a stored procedure in cmcis for CMCMS will be called to add or update the entry in clinic_pharm_mapping table. The mapping is done manually or by another sub-system which is outside the project scope. The clinic and pharmacy mapping is a many-to-one mapping, i.e. one clinic can be mapped to at most one pharmacy and one pharmacy can be mapped to unlimited number of clinics. A stored procedure is also compiled in cmcis for CMPMS to update the pharmacy information in the table.

In the some functions, for example printing prescription, the associated pharmacy information will be printed. A stored procedure is called for retrieving these information by providing the clinic ID. A similar stored procedure is compiled in cmcis for CMPMS to retrieve clinic information by pharmacy ID.

Before calling the stored procedures provided by CMPMS in cmcis, checking the existence of CMPMS will be done. This is done by checking the existence of schema cmpms in the database system. If CMPMS is not exists, those stored procedures will not be called and those value-added features of co-operation will not be provide.

Five more stored procedures is compiled in cmcis for CMPMS to retrieve data from cmcms for providing its functions. The following table listed the stored procedures with their usage.

Stored Procedure	Usage
sp_get_prescription_by_id	Get the details and total amount of drug of

Stored Procedure	Usage
	prescription for a finished consultation using the prescription ID and number of dose to be dispensed
sp_get_prescription_by_id_for_check_stock	Get the details and total amount of drug of a prescription for stock enquire
sp_get_prescription_by_pres_barcode	Get the details and total amount of drug specified in the prescription using the prescription barcode. Verification will be done to ensure the copy is the latest and valid version.
sp_get_procedures_done_in_cons_by_pres_barcode	Get the chargeable procedures/treatment done in the consultation by pharmacy ID and prescription barcode, Verification will be done to ensure the copy is the latest and valid version.
sp_get_procedures_done_in_cons_by_pharm_id_cons_id	Get the chargeable procedures/treatment done in the consultation by pharmacy ID and consultation ID

Fig 5.52 Stored Procedures Provided for CMPMS to retrieve Prescription and Consultation

Data

6. Review

6.1. User Testing

The system prototype has given to four potential users for trial use.

Questionnaires are done and feedback are collected. The sample of questionnaire question can refer to Appendix P. Most questions are ranking with a statement claiming the function is useful / is easy and convenient to use / is important / is adequate for work. The ranking is using a 5-point scale, where 1 stands for strongly disagree, 3 stands for neutral and 5 stands for strongly agree.

From the questionnaire result (see Appendix Q), users quite happy with the system prototype as average score for questions regarding functionality is 4.4 out of 5. The functions provides for each roles are enough for their works (score = 4.4 out of 5). Most of the function implemented are suitable for the users. User interfaces provided are not difficult to use. The user interfaces provided for Doctors are suitable and easy to use (score = 4.33 out of 5). The system can issue adequate types of documents for daily routine works. The potential users would suggest clinics to use this system (score = 4.5 out of 5).

During the testing, the users found the constraints implemented are quite complete and suitable for the working environment, especially for prescription safety checking. Also, they are amazed by the diagnosis statistic report provided and they found it very useful.

The followings are feedbacks from the users:

- For drug selection panel, an extra list box should be added for selection of batch or origin as it affects the drug effectiveness and price a lot
- For free-text input regarding consultation related functions, English phrases input should be supported
- For prescription form, allowing selection of stored phrase instead of typing words is useful and convenient. However, when add phrase to the

- textbox, the selected phrase should insert to the cursor position or replace the highlighted words instead of append at the end.
- For the prescription print-outs, function for selection of pharmacy can be added for user as sometimes doctors may refer the patient to other pharmacy instead of the associated pharmacy for some better quality of drugs
 - Design of sick leave certificate is good
 - It is great to have a report for diagnosis statistics in the past 30 days
 - System message can be more specific and use more layman terms
 - Better to support screen with low resolution

6.2. Limitations

6.2.1. Not Supporting Monitors with Low Resolutions

As there are a lot of information need to be shown in a single windows form, it is packed with a lot of controls and panels. The largest windows size for this application can just fit into a monitor of a normal notebook computer with resolution 1366 x 768 pixels. If user using a monitor with resolution lower than that, inconvenient may cause or some functions cannot be used.

6.2.2. Security Threats when Connecting Database through Internet

This system are handling sensitive data and PII and stored those data in the database. The database and the network should be host and maintained by a trustable party. Therefore, the suggested setting and connection to the database is within an Intranet. If the scope is extended to Internet, extra effort should be put on handling the security issues.

6.2.3. Change Supporting Database by Users is

not Available

The function and panels for user to change supporting database is not yet implemented. Each change would lead to a deployment or compilation of the application.

6.2.4. Customization is not Fully Supported

Some selection items like drug categories and dosage units are static items and they cannot be changed and added by users through the application's user interfaces. Those changes require database administrator to alter the table content directly in the database.

6.2.5. User Authorities and Roles are Fixed

In this system, only four roles with fixed authorities are provided for users to choose. The authorities and roles may be varied for different clinics. As it does not support customization, it may cause some inconvenience to users.

7. Conclusion

7.1. Achievements

In conclusion, this application can help Chinese Medicine Practitioners and related staff for their daily routine works.

This system provides various panels and controls for users to enter information with ease. User can store some frequently used items like different phrases and formulas for fast entry. Most of the data input is within consultation section, the most important part of this system, can be done by using various selection panels like drug selection panel without typing Chinese characters. Even user without adequate ability in Chinese input, they still can use with ease. This can also encourage experienced doctors in using IT solutions.

Medical record sharing is the trend in healthcare services. This system allows the sharing of the medical records across different clinics within the system. It allows the doctors to have a more complete picture on patients' situation and provide better treatments.

Reporting functions can help users with their works. This system provides different listing and statistic reports which can help user in managerial and disease control works. For example, the diagnosis statistic report provided can help users to figure out any outbreak of infectious diseases. Then, users can take action actively to do some preventive and controlling measures.

As this system allows users to use free-text input for some items, the data collected can be used for finding some commonly used terminologies and help in figuring out a standard for Hong Kong's Practitioners.

7.2. Future Improvement

7.2.1. Support Multiple Language for Document Print-outs

Nowadays, people in Hong Kong are come from all over the world. For Westerners, they may also use TCM services provided in Hong Kong. However, they may not able to read Chinese. They have the right to know what drug they are going to take and what the documents is about. Therefore those documents should be available in different language, at least in English.

7.2.2. Provide More Statistical Reports

Statistical reports can provide important operational and managerial information for users as reference. The system can provide more statistical reports like turn-around time of each doctor, drug usage which can reduce users' effort for doing statistical analysis.

7.2.3. Auto Generation for User ID and Clinic ID

When number of user and clinic increase, it will be difficult for user to think of any unused User ID and Clinic ID. The system can generate those ID with some systematic methods like using the initial of the user with a number count of user using the initial to make up a new User ID.

7.2.4. Functions for Patients

Functions for patients like registration and booking services can go online. Alternatively, mobile apps can be developed for those purposes. In Hong Kong, people would like to do a lot of things in a very limited time. If online system or mobile apps are available to patients, they can book or queue for consultation without waiting in the clinic and waste time.

7.2.5. Implement Penalty Mechanism for Missing

Calls

Some patients may register for consultation before their available time. And this trick can let them have the consultation immediately when they enter the clinic which is not fair to other waiting patients. In order to prevent this trick, mechanism should be implemented for missing calls over a certain number. For example, over 5 missed calls will be removed from the queue.

7.2.6. Implement Functions for Verifying and Voiding Certificates

Final receiver of those certificates may want to verify that the certificate is a true and valid copy or not. For this prototype system, it is not equipped with function for verify the certificate(s). Moreover, if the certificate(s) are issued incorrectly, the mechanism for voiding them are not implemented. These can only be recorded and done manually.

7.2.7. Allow Customization for Different Clinics

Different clinics may have different practices. For example, the penalty mechanism suggested in the previous part. Some may not want to have this feature, some may want to have this feature triggered at different missed call counts and some may want to have different penalty. Therefore, one practice cannot fit all clinics. Customization for clinics can be provided.

7.2.8. Support Different Screen Resolution

Different scale and types of business would use different types of computers for their works. They usually possess with screens of different resolutions. It may be important to support those with low resolutions and enlarge the content for those with high resolution for easier reading.

7.2.9. Improve Drug Selection Panel

The origin of the drug would greatly affect the effectiveness and price. Take

Panax ginseng (人參) as an example. The price for the one from Jilin, China and the one from Korea may differ in 5 to 10 times. When comparing the effectiveness, one is totally stronger than the other. Therefore, a list box should be added for user to specify the origin of the drug.

7.2.10. Connect to eHR

The eHR sharing system developed by the HA for the government is launched for Modern Medicine. And it is going to support TCM in the future. Once it is ready, this system can connect to it and have the ability to get a more comprehensive profile of the patients. Thus, to provide a better healthcare service.

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Appendix

Appendix A – Monthly Log

Month/Year	Monthly Log
October 2014	<ul style="list-style-type: none">- Literature review- Requirement capturing- Interim Report I- Preliminary design
November 2014	<ul style="list-style-type: none">- Revise Interim Report I
December 2014	<ul style="list-style-type: none">- Coding for Patient's Application and Administrator's Application
January 2015	<p>The coding of basic functions of the followings have been finished:</p> <p>For patient:</p> <ul style="list-style-type: none">- patient registration and changing personal particulars- patient queuing <p>For all staff roles:</p> <ul style="list-style-type: none">- patient administration (registration / amend patient information) <p>For all administrators and doctors:</p> <ul style="list-style-type: none">- drug data administration (add / amend / suspend drug items)- pre-defined prescription administration (add / amend / suspend formula) <p>For system administrators:</p> <ul style="list-style-type: none">- user administration (create / amend user account for all clinic)- clinic administration (add / amend / suspend clinic)

	<p>For clinic administrators:</p> <ul style="list-style-type: none"> - user administration (create / amend user account for own clinic) - amend clinic information for own clinic <p>For doctors:</p> <ul style="list-style-type: none"> - enter consultation record and prescriptions - view consultation history summary of the patient (same doctor or same clinic only) - use past consultation entry as template - print prescription, sick leave certificate and consultation certificate <p>For normal staff:</p> <ul style="list-style-type: none"> - Patient queuing management (calling patient for consultation / register for consultation)
February 2015	<ul style="list-style-type: none"> - Print pregnancy certificate in consultation function - Bug fix - Shared patient record - drug compatibility checking Interim Report II
March 2015	<p>Development</p> <ul style="list-style-type: none"> - Prescription checking - absolute contraindication for pregnant and G6PD patient - Prescription checking - Drug allergy - Prescription checking - Dosage - Password check when patient amend personal information and leave waiting queue by using patient system - Add acupuncture items for consultation function - Add input validation - Prevent SQL Injection - Reprint Medical Certificates

	<ul style="list-style-type: none"> - Reporting - Complete Medical Record - Reporting - Statistic Report on Consultations in last 30 Days - Reporting - Statistic Report on Diagnosis in last 30 Days - Reporting - Suspicious Prescription Information Listing - Reporting - User Listing - Reporting - Clinic Listing - Reporting - Drug Listing - Reporting - Patient Listing - Prescription Clean-up stored procedure - Co-operate features - Bug fix <p>Documentation</p> <ul style="list-style-type: none"> - Final Report
April 2015	<ul style="list-style-type: none"> - Bug Fix - User Testing - Final Report

Appendix B – Patient Status Flow Diagram

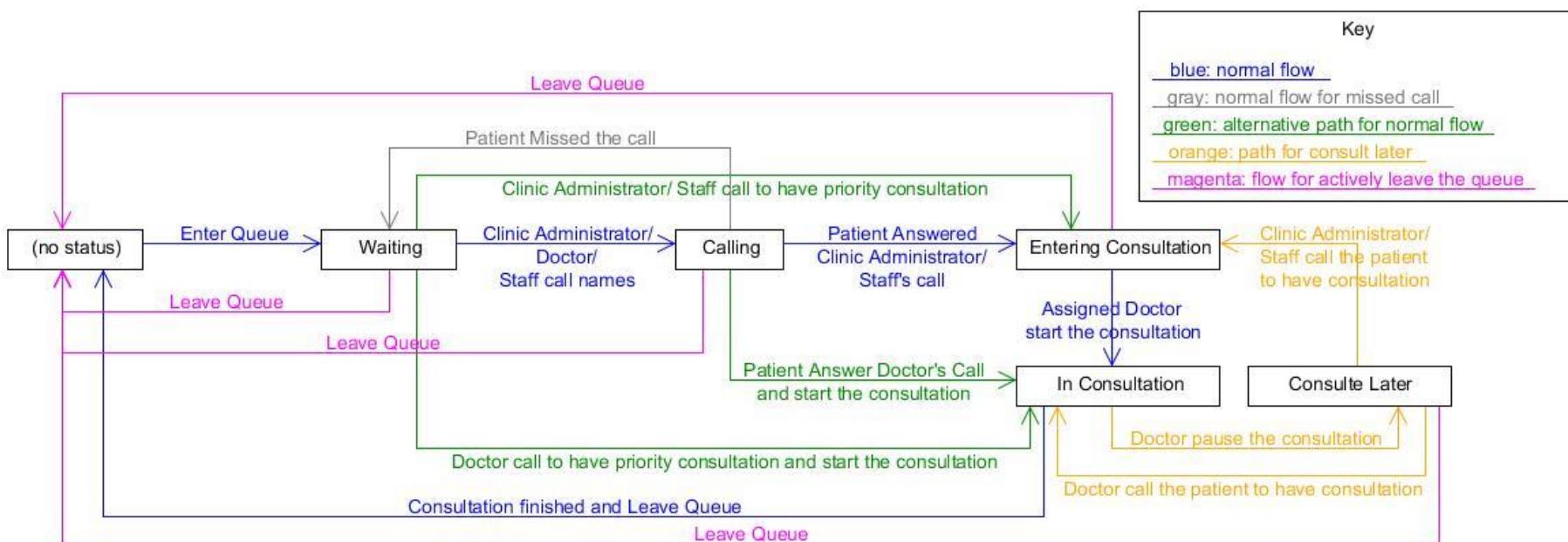


Fig 5.27 Patient Status Flow Diagram

Appendix C – Prescription Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

診症編號: 15



病人: 陳大文 (2)

中醫師: 陳小明

診斷: 感冒;

日期/時間: 03/04/2015 17:26:27

處方編號: 50



治法:

正常煎煮

連翹	1.5 分	薄荷	8 分	甘草	8 分
桑葉	2.5 錢	菊花	1 錢	苦杏仁	2 錢
桔梗	2 錢	蘆根	2 錢		

服用方法:

劑數: 1

醫囑: 忌生冷食物

處方須醫師簽署後方為有效。

陳小明中醫師

(中醫註冊編號: 99999999)



CSM/CSM/2/15/50/20150403172627

藥房資料 藥房: 新生藥房(總行)
地址: 九龍塘又一城地下二樓

電話: 852-3XXX XXXX

第 1 頁 / 共 1 頁

Appendix D – Consultation Certificate

Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

診症編號: 19



到診證明書

茲證明 陳大文 (護照號碼: A71922992) 於 05/04/2015 在本診

所接受診治，診斷結果如下：

感冒；

07/04/2015

簽發日期

陳小明 中醫師
(中醫註冊編號: 99999999)

Appendix E – Sick Leave Certificate

Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

診症編號: 25



編號: 19



病假證明書

姓名: 關希欣 (香港身份證號碼: A233123(6))

到診日期: 07/04/2015

診斷: 感冒;

病假: 由 07/04/2015 至 07/04/2015 止, 共 1 天

07/04/2015

簽發日期

陳小明 中醫師
(中醫註冊編號: 99999999)

Appendix F – Pregnancy Certificate

Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

診症編號: 25



編號: 11



懷孕證明書

茲證明 關希欣 (香港身份證號碼: A233123(6)) 於 07/04/2015

在本診所求診，並證實已懷孕。

預產日期為 07/12/2015。

07/04/2015

簽發日期

陳小明 中醫師
(中醫註冊編號: 99999999)

Appendix G – Medical Record Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

醫療紀錄

病人資料

姓名: 胡芯藍
性別: F
出生日期(日/月/年): 14/01/1992
身份證明文件號碼: Y987654(3)
病人編號: 4

診症紀錄

診症編號: 23
主診醫師姓名: 陳小明
主診醫師中醫註冊編號: 99999999
診症開始日期/時間(日/月/年 時:分:秒): 07/04/2015 01:14:30
紀錄最後修改日期/時間(日/月/年 時:分:秒): 07/04/2015 01:51:37

病徵:

辨證:

診斷: 感冒;

針灸穴位: -

醫囑:

處方編號: 55

治法:

服用方法: 四碗水煎煮一碗, 每日一次, 每次一服每次一服

劑數: 3

正常煎煮

麻黃 ————— 1.5 錢 桂枝 ————— 1 錢 苦杏仁 ————— 2 錢 甘草 ————— 1 錢 —————

此紀錄須蓋有診所印鑑方為有效。

09/04/2015 19:28:13

發出日期/時間(日/月/年 時:分:秒)

診所印鑑

第 1 頁 / 共 1 頁

Appendix H – Consultation History Sample

城市診所

地址: 1 CITY RD

電話: 233456788, 23456789, 23000001

詳細診症紀錄

(非正式文件, 只供醫師參考之用)

病人姓名: 陳大文 (2)

身份證明文件號碼: A71922992

診症編號: 2

主診醫師: 陳小明 (CSM)

診症日期/時間: 29/01/2015 03:29:32

修改日期/時間: 29/01/2015 23:29:17

病徵: 得神; 語聲重濁; 神疲; 畏寒; 平脈;

辨證: 陰證;

診斷: 感冒;

針灸穴位:

醫囑: 宜醫囑一

是次診症沒有處方

Appendix I – Suspicious Prescription Listing

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

懷疑問題處方列表

處方編號	醫師姓名	病人編號	診症編號	處方最後修改日期時間	R1	R2	R3	R4	R5	R6	R7	R8	R9	紀錄日期時間
59	陳小明	4	24	07/04/2015 02:41:59							✓			07/04/2015 02:42:01
54	陳小明	1	21	06/04/2015 16:47:05		✓							✓	06/04/2015 16:47:06
53	陳小明	2	19	05/04/2015 03:42:59		✓							✓	05/04/2015 03:43:01
52	陳小明	2	17	04/04/2015 18:11:46		✓					✓			04/04/2015 18:11:47
51	陳小明	2	16	04/04/2015 18:10:35		✓								04/04/2015 18:10:36
50	陳小明	2	15	03/04/2015 17:26:27		✓					✓			03/04/2015 17:26:28
47	陳小明	2	13	25/03/2015 10:53:30		✓						✓		25/03/2015 10:53:31
46	陳小明	8	12	25/03/2015 10:45:23							✓			25/03/2015 10:45:24
45	陳小明	2	10	23/03/2015 00:55:40		✓						✓		23/03/2015 00:55:41
44	陳小明	2	9	19/03/2015 22:12:34		✓								19/03/2015 22:12:35
33	陳小明	2	9	19/03/2015 22:12:34		✓					✓			19/03/2015 22:12:34
42	陳小明	2	9	19/03/2015 22:12:34		✓						✓		19/03/2015 22:12:34
43	陳小明	2	9	19/03/2015 22:12:34		✓					✓	✓		19/03/2015 22:12:34
1	陳小明	2	9	19/03/2015 22:12:34		✓					✓	✓		19/03/2015 22:12:34

處方數量：14

注備：

R1: 處方含藥物配伍禁忌

R4: 處方含孕婦慎用/不建議用藥

R7: 處方含藥物項目低於系統建議下限

R2: 處方含G6PD缺乏症/蠶豆症慎用/不建議用藥

R5: 處方含孕婦禁用藥

R8: 處方含藥物項目超出系統建議上限

R3: 處方含G6PD缺乏症/蠶豆症禁用藥

R6: 處方含「0劑量」/沒有輸入劑量藥物項目

R9: 處方含病人藥物敏感史中列明之藥物項目

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Appendix J – Statistic Report of Daily Consultation in the Past 30 Days

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

過去三十日之診症統計報告

日期(日/月/年)	人次	發出處方	獲發處方人次	百分比(%)	針灸人次	百份比(%)
10/03/2015	0	0	0	-	0	-
11/03/2015	0	0	0	-	0	-
12/03/2015	0	0	0	-	0	-
13/03/2015	0	0	0	-	0	-
14/03/2015	0	0	0	-	0	-
15/03/2015	0	0	0	-	0	-
16/03/2015	0	0	0	-	0	-
17/03/2015	0	0	0	-	0	-
18/03/2015	0	0	0	-	0	-
19/03/2015	0	0	0	-	0	-
20/03/2015	0	0	0	-	0	-
21/03/2015	1	1	1	100.00	1	100.00
22/03/2015	0	0	0	-	0	-
23/03/2015	1	1	1	100.00	1	100.00
24/03/2015	0	0	0	-	0	-
25/03/2015	3	3	3	100.00	2	66.67
26/03/2015	0	0	0	-	0	-
27/03/2015	0	0	0	-	0	-
28/03/2015	0	0	0	-	0	-
29/03/2015	0	0	0	-	0	-
30/03/2015	0	0	0	-	0	-
31/03/2015	0	0	0	-	0	-
01/04/2015	1	1	1	100.00	1	100.00
02/04/2015	0	0	0	-	0	-
03/04/2015	0	0	0	-	0	-
04/04/2015	2	2	2	100.00	1	50.00
05/04/2015	3	1	2	66.67	1	33.33
06/04/2015	2	1	2	100.00	1	50.00
07/04/2015	4	4	4	100.00	1	25.00
08/04/2015	0	0	0	-	0	-
總計	17	14	16	94.12	9	52.94

Appendix K – Diagnosis Statistics in the Past 30 Days Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

過去三十日之診斷統計報告

診斷代碼	診斷描述	系統紀錄		診所紀錄		
		總人數	新症人數	總人數	新症人數	含系統新症
3.1.7	感冒	2	1	2	2	1
3.1.8	時行感冒	1	1	1	1	1
3.2.2	瘡	1	1	1	1	1
3.6.3	旋耳瘡, 月蝕瘡	1	1	1	1	1

定義：

系統紀錄 - 總人數：於過去三十日曾於任何一間參與診所求診而診斷包含該診斷代碼之人數總計

系統紀錄 - 新症人數：診症日期前三十日並未於任何一間參與診所獲得該診斷，而於過去三十日在任何一間參與診所獲得該診斷之人數總計

診所紀錄 - 總人數：於過去三十日曾於列印報告之診所求診而獲得該診斷之人數總計

診所紀錄 - 新症人數：診症日期前三十日並未於列印報告之診所獲得該診斷，而於過去三十日在列印報告之診所獲得該診斷之人數總計

診所紀錄 - 含系統新症：診所紀錄的新症人數中，同樣被計算在系統紀錄之新症人數的人數總計

Appendix L – Patient Listing Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

診所病人列表

編號	中文姓名	英文姓名	電話	出生日期	性別	G6PD	住址	最後診症日期	已故
2	陳大文	CHAN TAI MAN	22222222	11/01/1995	F	是	黃埔花園6期A座100020室	07/04/2015	否
8		LEE YAT SUM	23452345	25/03/1990	F	否	CITYU	25/03/2015	否
3	蘭希欣	MAGGIE KWAN	99938171	11/01/1984	F	否	屯門屯門新村4期4座4樓4室	07/04/2015	否
7	吳廣德	NG KWONG TAK	51005102	29/02/2008	M	否	Rm 20003, Kam Long Building, Sai Kung	25/03/2015	否
1	上官思賢	SHEUNG KOON SZE YIN	33010000	09/01/1990	M	是	Below Fat Kwong Street Flyover	07/04/2015	否
4	胡志藍	WU SUM NAM	98765432	14/01/1992	F	否	RM1, ABC BLDG, 1 ABC ST, ABC CITY	07/04/2015	否

人數: 6

Appendix M – User Listing Sample

中醫診所系統管理

地址: -

電話: 23000000

用戶列表

用戶代號	中文姓名	英文姓名	中醫註冊編號	用戶資料更新日期時間	停用	上次登出日期時間	登出診所
AYWS	AYWS	AYWS	987654	29/03/2015 14:35:20	否		
	診所/身份:	ABC	- 職員				
AYWS2	歐陽	AU YEUNG		29/03/2015 14:24:00	否		
	診所/身份:	ABC	- 職員				
CITYCA1	管理員甲	CITYC ADM A		18/03/2015 03:41:39	否	18/03/2015 04:18:48	CITYC
	診所/身份:	CITYC	- 診所管理員				
CITYCD1	醫師甲	CITYC DOCTOR A	1234567	13/03/2015 03:08:58	否	06/02/2015 04:42:16	CITYC
	診所/身份:	CITYC	- 醫生				
CITYCS1	職員甲	CITYC STAFF A		06/04/2015 16:47:26	否	06/04/2015 16:47:37	CSM
	診所/身份:	CITYC	- 職員				
	診所/身份:	CSM	- 職員				
CSM	陳小明	CHAN SIU MING	99999999	01/04/2015 04:29:26	否	07/04/2015 17:23:09	CSM
	診所/身份:	CITYC	- 醫生				
			- 診所管理員				
	診所/身份:	CSM	- 職員				
			- 醫生				
			- 診所管理員				
CTM	陳大文	CHAN TAI MAN		29/03/2015 14:34:51	否		
	診所/身份:	-					
LTM	李大文	LEE TAI MAN		29/03/2015 14:26:07	否		

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□ 1 □ / □ 2 □

Appendix N – Clinic Listing Sample

陳小明中醫診所

地址：香港中環高士威道3號環宇大廈1003室

電話：21010101

系統診所列表

診所代號	診所中文名稱	診所英文名稱	診所地址	診所電話號碼	停用	最後更新日期時間	用戶人數
ABC	ABC CLINIC	ABC CLINIC	ABC RD	23456712	是	31/03/2015 02:20:07	***
ALL	中醫診所系統管理	CMCMS SYSTEM ADMIN	-	23000000	否	22/03/2015 20:43:28	***
CITYC	城市診所	CITY CLINIC	1 CITY RD	233456788, 23456789, 23000001	否	22/03/2015 20:43:32	***
CSM	陳小明中醫診所	CHAN SIU MING TCM CLINIC	香港中環高士威道3號環宇大廈1003室	21010101	否	23/03/2015 23:54:30	2

診所數量: 4

註: '***'為沒有權限檢視該項資料

Appendix O – Drug Listing Sample

中醫診所系統管理

地址：-

電話：23000000

可選用藥物列表

藥項	建議劑量範圍	已刪除?	藥項	建議劑量範圍	已刪除?
解表					
辛溫解表					
2字			葛根	[1錢 - 6錢]	否
白芷	[1錢 - 3錢]	否	薄荷	[1錢 - 3錢]	否
生薑	[1錢 - 3錢]	否	蟬蛻	[1錢 - 3錢]	否
子藥項: 煙生薑			牛蒡子	[1錢 - 3錢]	否
防風	[1錢 - 3錢]	否	子藥項: 生牛蒡子		否
羌活	[1錢 - 3錢]	否	炒搗牛蒡子		否
辛夷	[1錢 - 2錢]	否	淡豆豉	[3錢 - 5錢]	否
荊芥	[1錢 - 3錢]	否	蔓荊子	[1錢 - 3錢]	否
子藥項: 乾荊芥			4字		
胡荽	[1錢 - 2錢]	否	大豆黃卷	[3錢 - 5錢]	否
子藥項: 乾胡荽			涌吐		
香薷	鮮胡荽		2字		
桂枝	[1錢 - 3錢]	否	瓜蒂	[5分 - 15分]	否
麻黃	[1錢 - 3錢]	否	食鹽	[3錢 - 6錢]	否
子藥項: 淨麻黃			常山	[15分 - 3錢]	否
麻黃絨			膽礬	[1分 - 3分]	否
密炙麻黃			藜蘆	[3分 - 5分]	否
細辛	[5分 - 2錢]	否	3字		
紫蘇	[1錢 - 3錢]	否	人參蘆	[2錢 - 3錢]	否
子藥項: 蘇葉			瀉下		
蔥白	[2枚 - 8枚]	否	2字		
檉柳	[1錢 - 3錢]	否	大黃	[1錢 - 4錢]	否
藁本	[1錢 - 3錢]	否	子藥項: 制大黃		否
辛涼解表					
2字			酒洗大黃		否
升麻	[1錢 - 2錢]	否	煨大黃		否
木賊	[1錢 - 3錢]	否	芒硝	[3錢 - 5錢]	否
桑葉	[2錢 - 4錢]	否	蘆薈	[5分 - 1錢]	否
子藥項: 生桑葉			3字		
蜜炙桑葉			番瀉葉	[1錢 - 2錢]	否
浮萍	[1錢 - 2錢]	否	潤下		
柴胡	[1錢 - 3錢]	否	3字		
子藥項: 北柴胡			大麻仁	[3錢 - 1兩]	否
南柴胡			郁李仁	[1錢 - 4錢]	否
竹葉柴胡			峻下逐水		
菊花	[1錢 - 6錢]	否	2字		
子藥項: 白菊花			大戟	[5分 - 1錢]	否
黃菊花			子藥項: 綿大戟		否
野菊		否	紅芽大戟		否

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Appendix P – Questionnaire Sample

1

Questionnaire 問卷調查

Please kindly fill in this questionnaire after a trial use of the Chinese Medicine Clinic

Management System (CMCMS), thank you.

煩請於試用中醫診所管理系統後填寫此問卷，多謝合作。

1. Your Occupation is:

你的職業是：

- Chinese Medicine Practitioner 中醫師
- Chinese Medicine Clinic Staff 中醫診所職員
- Service Provider 服務供應者/服務供應商職員
- Chinese Medicine Student 中醫學生
- Others 其他

2. Your Name is: (optional)

你的姓名: (選填)

3. Which role(s) you have used for the trial use of the CMCMS?

你曾以下列哪些身份試用系統？

- System Administrator 系統管理員 (Answer Q4, 8 – 12/回答第 4, 8 – 12 題)
- Clinic Administrator 診所管理員(Answer Q5, 8 – 12/回答第 5, 8 – 12 題)
- Doctor 醫生 (Answer Q6, 8 – 12/回答第 6, 8 – 12 題)
- Staff 職員 (Answer Q7 – 12/回答第 7 – 12 題)

The following questions are going to be answered in 5-point scale or text.

For 5-point scale answers, please choose the best option for rating the statement.

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

以下問題採用 5 分制選項或文字作答。

5 分制選項題，請選擇最合適之答案為陳述評分。

(1 = 非常不同意，2 = 不同意，3 = 中立，4 = 同意，5 = 非常同意)

4. Please fill in the followings if you use as a System Administrator.

如以系統管理員身份試用，請填寫以下部份。

- a. Patient Management functions are useful for System Administrator's work.

病人管理功能對系統管理員的工作是有用的。

1 2 3 4 5

- b. Drug Management functions are useful for System Administrator's work.

藥物管理功能對系統管理員的工作是有用的。

1 2 3 4 5

- c. Formula Management functions are useful for System Administrator's work.

方劑管理功能對系統管理員的工作是有用的。

1 2 3 4 5

- d. Method for selecting drugs are easy and convenient.

選擇藥物之方法是易於且方便的。

1 2 3 4 5

- e. Clinic Management functions are useful for System Administrator's work.

診所管理功能對系統管理員的工作是有用的。

1 2 3 4 5

- f. User Management functions are useful for System Administrator's work.

用戶管理功能對系統管理員的工作是有用的。

1 2 3 4 5

- g. Reporting functions are useful for System Administrator's work.

報告功能對系統管理員的工作是有用的。

1 2 3 4 5

- h. Overall, functions provided for System Administrator are useful and adequate for their work.

整體而言，系統提供給系統管理員之功能對其工作是有用並足夠的。

1 2 3 4 5

- i. Overall, user interface for System Administrator are easy to use.

整體而言，供系統管理員使用之介面是易於使用的。

1 2 3 4 5

5. Please fill in the followings if you use as a Clinic Administrator.

如以診所管理員身份試用，請填寫以下部份。

- a. Patient Management functions are useful for Clinic Administrator's work.

病人管理功能對診所管理員的工作是有用的。

1 2 3 4 5

- b. Drug Management functions are useful for Clinic Administrator's work.

藥物管理功能對診所管理員的工作是有用的。

1 2 3 4 5

- c. Formula Management functions are useful for Clinic Administrator's work.

方劑管理功能對診所管理員的工作是有用的。

1 2 3 4 5

- d. Method for selecting drugs is easy and convenient.

選擇藥物之方法是易於且方便的。

1 2 3 4 5

- e. Patient queue management functions are useful for Clinic Administrator's work.

病人序列管理功能對診所管理員的工作是有用的。

1 2 3 4 5

- f. Patient queue management functions are easy to use.

病人序列管理功能是易於使用的。

1 2 3 4 5

- g. User Management functions are useful for Clinic Administrator's work.

用戶管理功能對診所管理員的工作是有用的。

1 2 3 4 5

- h. Reporting and document reprint functions are useful for Clinic Administrator's work.

報告及文件重印功能對診所管理員的工作是有用的。

1 2 3 4 5

- i. Overall, functions provided for Clinic Administrator are useful and adequate for their work.

整體而言，系統提供給診所管理員之功能對其工作是有用並足夠的。

1 2 3 4 5

- j. Overall, user interface for Clinic Administrator are easy to use.

整體而言，供診所管理員使用之介面是易於使用的。

1 2 3 4 5

6. Please fill in the followings if you use as a Doctor.
如以醫生身份試用，請填寫以下部份。
- a. Patient Management functions are useful for Doctor's work.
病人管理功能對醫生的工作是有用的。
 1 2 3 4 5
- b. Patient queue management functions are useful for Doctor's work.
病人序列管理功能對醫生的工作是有用的。
 1 2 3 4 5
- c. Patient queue management functions are easy to use.
病人序列管理功能是易於使用的。
 1 2 3 4 5
- d. In Consultation panel, the method for choosing symptoms, differentiation and diagnosis is suitable and easy to use.
診症版面中，用於選擇病徵、辨證及診斷的方法是合適且易於使用。
 1 2 3 4 5
- e. In Consultation panel, the method for making prescription(s) is suitable and easy to use.
診症版面中，用於進行處方的方法是合適且易於使用。
 1 2 3 4 5
- f. In Consultation panel, the method for entering doctor's remark is suitable and easy to use.
診症版面中，用於輸入醫囑的方法是合適且易於使用。
 1 2 3 4 5
- g. In Consultation panel, the method for record acupuncture treatment is suitable and easy to use.
診症版面中，用於紀錄針灸治療的方式是合適且易於使用。
 1 2 3 4 5
- h. Having acupuncture treatment record is necessary and it helps in providing better treatment.
針灸治療紀錄是必須的並有助於提供更有效的治療。
 1 2 3 4 5
- i. The system can issue adequate types of certificates and documents for daily routine works.
系統能發出足夠種類的證明書及文件以供日常運作之用。
 1 2 3 4 5

- j. Prescription safety checking feature (drug combination, G6PD/pregnancy contraindication and patient allergy history checking) can reduce mistakes.
處方安全檢查 (藥物配伍、G6PD/孕婦禁忌及病人敏惑史檢查)能減少錯誤。
 1 2 3 4 5
- k. Overall, user interface for Consultation functions are easy to use.
整體而言，供診症功能使用之介面是易於使用的。
 1 2 3 4 5
- l. Viewing patients' medical records from other clinics can help providing better treatment.
參閱病人於其他診所之醫療紀錄有助於提供更有效的治療。
 1 2 3 4 5
- m. Formula Management functions are useful for Doctor's work.
方劑管理功能對醫生的工作是有用的。
 1 2 3 4 5
- n. Reporting and document reprint functions are useful for Doctor's work.
報告及文件重印功能對醫生的工作是有用的。
 1 2 3 4 5
- o. Overall, method for selecting drugs are easy and convenient.
整體而言，選擇藥物之方法是易於且方便的。
 1 2 3 4 5
- p. Overall, functions provided for Doctor are useful and adequate for their work.
整體而言，系統提供給醫生之功能對其工作是有用並足夠的。
 1 2 3 4 5
- q. Overall, user interface for Doctor are easy to use.
整體而言，供醫生使用之介面是易於使用的。
 1 2 3 4 5

7. Please fill in the followings if you use as a Staff.

如以職員身份試用，請填寫以下部份。

- a. Patient Management functions are useful for Staff's work.

病人管理功能對職員的工作是有用的。

1 2 3 4 5

- b. Patient queue management functions are useful for Staff's work.

病人序列管理功能對職員的工作是有用的。

1 2 3 4 5

- c. Patient queue management functions are easy to use.

病人序列管理功能是易於使用的。

1 2 3 4 5

- d. Overall, functions provided for Staff are useful and adequate for their work.

整體而言，系統提供給職員之功能對其工作是有用並足夠的。

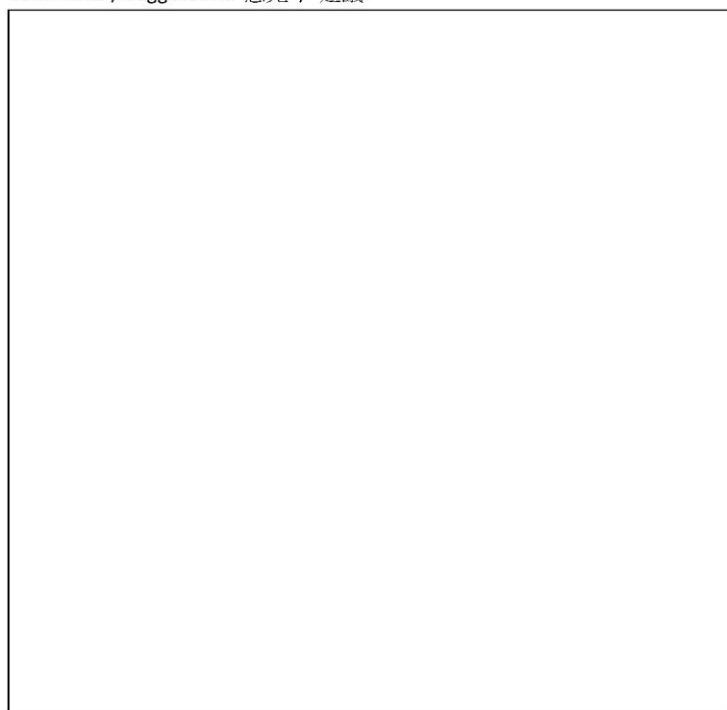
1 2 3 4 5

- e. Overall, user interface for Staff are easy to use.

整體而言，供職員使用之介面是易於使用的。

1 2 3 4 5

8. Overall, this system can help in clinic's daily operation.
整體而言，此系統有助於診所日常運作。
 1 2 3 4 5
9. Overall, this system is easy to use.
整體而言，此系統是易於使用的。
 1 2 3 4 5
10. Sharing medical records across different clinics is beneficial to patients.
病歷互通對病人有益。
 1 2 3 4 5
11. I will suggest Chinese Medicine Clinics adopt this system.
我會建議中醫診所採用此系統。
 1 2 3 4 5
12. Comments / Suggestions 意見 / 建議:



This is the end of the questionnaire, thank you for your participation.
您已完成所有問題，感謝您的參與。

Appendix Q – Questionnaire Result

Question	Item	Average Rate (5 point scale)
4	a	4
	b	4.25
	c	4.25
	d	4.25
	e	4.25
	f	4.25
	g	4
	h	4.25
	i	3.75
5	a	4.25
	b	3.75
	c	3.75
	d	4
	e	4.75
	f	4.5
	g	4.25
	h	4.5
	i	4
6	j	4.25
	a	4
	b	4
	c	4.33
	d	5
	e	4.33
	f	5
	g	4.33
	h	4.67
	i	5

Question	Item	Average Rate (5 point scale)
6	j	4.67
	k	4.67
	l	4.67
	m	4.67
	n	5
	o	4.33
	p	4.33
	q	4.33
	r	4.33
7	a	5
	b	5
	c	4.5
	d	5
	e	4.75
	f	4.75
	g	4
	h	4.75
	i	4.5
8	-	4.75
	-	4
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
9	-	4
	-	4
	-	4
	-	4
	-	4
	-	4
	-	4
	-	4
	-	4
10	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
	-	4.75
11	-	4.5
	-	4.5
	-	4.5
	-	4.5
	-	4.5
	-	4.5
	-	4.5
	-	4.5
	-	4.5

For the question details, please refers to Appendix P.

Appendix R – Database Schema “cmcms”

