



# An automated management system for the community health service in China

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## Abstract

**Objective:** To explore a useful tool for health administrative departments to manage the community health service (CHS).

**Methods:** On the basis of existing health laws and regulations in China, we describe the design of an automated management system for the CHS with a supervision system and an evaluation system using computer technology and corresponding design software.

**Results:** Four changes to the management of the CHS were made: repetitive work became automated, complicated work became simplified, nonregular services decreased, and obscure instructions became clear and specific.

**Conclusion:** The automated management system will promote the development of CHS management.

**Keywords:** Community health service; health laws and regulations; automated management system; China

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## Introduction

### *Management of the community health service in developed countries*

The community health service (CHS) is the best health care model in the world, and has been chosen by developed countries after decades of study [1]. The implementation of a CHS, which emphasizes the harmonious relationship between medicine and residents' health conditions, has already proved that a CHS can not only raise the equity and efficiency of health care but can also increase the health level of residents and control medical expenses in the United States, England, Australia, and Canada. It is important for the government to have a proper management tool for the CHS to ensure the sustainable

development of the CHS in China [2]. To promote the development of a CHS, developed countries have implemented a series of management methods for their own situation. In England, the number of new registered general practitioners (GPs) ranges from 1800 to 3200 each year (2008), and service quality supervision is mainly done by the Community Health Committee and the Primary Care Trust. In England, to prevent GPs from issuing too many prescriptions, there are strict medicine prescription regulations. To improve the technical expertise of GPs, GPs have 4 weeks of off-job training annually. In Australia, the CHS organization must be assessed periodically so that it can provide a high-quality service.



GPs account for two-fifths of all physicians in Australia, and there is a strict national authentication and review system for GPs' qualifications. Japan particularly pays much attention to the efficiency of health laws and regulations in the implementation and management of the CHS so as to standardize the basic procedures of the CHS and guarantee the CHS operates in an orderly manner [3–7].

### Current status of CHS management in China

The CHS started late in China. In 1981, cooperation between the United States and China on CHS development in Shanghai began with the first health service survey. From the late 1990s, with the development of the social economy and increasing health needs of people, the CHS developed rapidly in metropolises such as Beijing, Shanghai, and Tianjin [8]. At present, the implementation of the CHS in China is at the stage of system frame construction after the completion of pilot projects and their expansion [9]. During the development of the

CHS in China, the public reached a consensus on the importance of standardized management. However, the qualitative and abstract principles of CHS management needs a theoretical basis and practical operation. The proper mode of standard management of the CHS in China is still being explored in accordance with the health law, and there is a lack of targeted systematic research, overall evaluation, and substantial discussions. Although some cities have developed a regulation management approach for the CHS, the contents of this approach are not systemic and complete, involving only individual laws such as the “Management Regulations for Medical Organizations.” In addition, the management regulations of the CHS in some districts are not standardized [10]. At present, software for CHS management is concentrated on internal management in the CHS organization (Fig. 1), such as software from Gang Zheng, Cheng Zhi, and CHS Management 2006. Software with which the health administrative department could manage the CHS automatically is unavailable (Fig. 2).

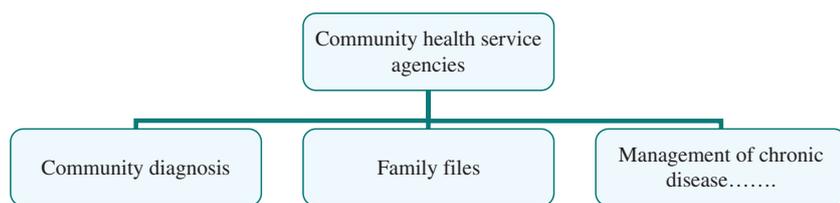


Fig. 1. Software available for community health service management.

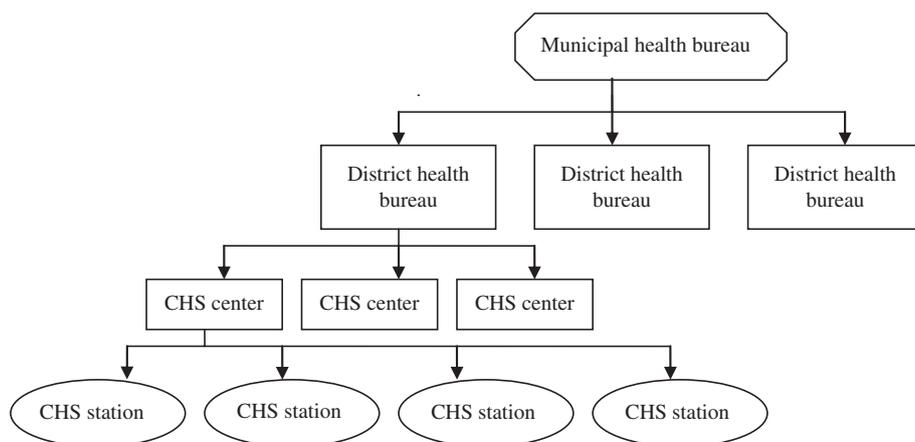


Fig. 2. Software unavailable for community health service (CHS) management.



Therefore with expert consultation, the goal of CHS management is to establish an integrated target system and develop an automated management system [11] (Fig. 3).

### *Current problems and their causes in CHS management in China*

In China, the lack of a well-established CHS supervision and management model, especially in CHS management, has seriously hampered the development of the CHS. There are three main problems in CHS management. Firstly, the health laws and regulations have not been implemented completely, and there are illegal situations in the following three aspects:

1. Some urban CHS agencies employ personnel who are not health technicians, and they may perform diagnoses and treat patients without the “Practice License of Medical Institution of the People’s Republic of China.” For example, serious problems have been found in aspects of admittance criteria and supervision management in Shaowu in Fujian province.
2. One license is shared by many CHS organizations in some cities.

3. The locations, names, and even medical specialities of registration of physicians do not accord with the actual ones, and many physicians treat patients with diseases they are not good at treating.

Secondly, medical record writing and disinfection are not standardized, and medical disputes have increased year by year. Thirdly, the CHS management procedure by law is tedious, such as repetitive work in registration and daily supervision. Automation and normalization of a good management evaluation system by law is unavailable in China [12, 13]. The causes of the aforementioned problems are mainly as follows: there are too many health laws and regulations relevant to the CHS; the CHS is relatively new in China, and no methods for dealing with its problems can be found in the existing laws and regulations; the daily management work of the CHS is trivial and tedious.

### *Necessity of establishing a management system for the CHS by law*

The development of the CHS is of great significance for facilitating the masses to seek medical treatment and for setting up a harmonious relationship between physicians and patients,

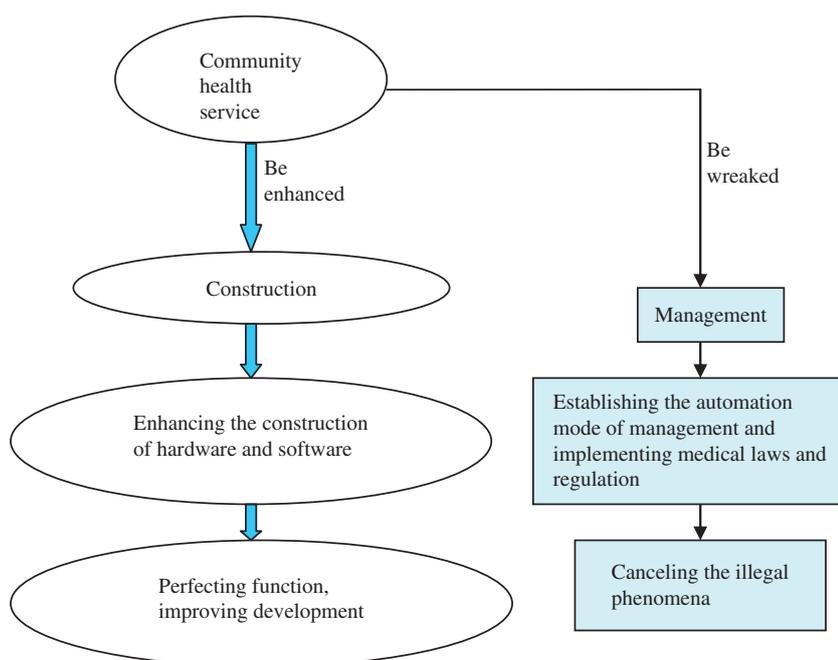


Fig. 3. The work model that enhances construction and ignores management.



so at the same time, a complete supervision and management system for the CHS should be established to ensure the sustainable development of the CHS. Especially since the implementation of the “Management Regulations for Medical Malpractice,” people’s awareness of the law and self-protection consciousness has become ever greater. Therefore managers of CHS organizations should be more familiar with related laws and regulations so as to avoid inappropriate medical practices. The CHS is a complicated social health infrastructure, and because the social economy, politics, culture, and health care background are different among countries, it is particularly important to develop a management system for the CHS that matches the conditions in China [14, 15].

#### Practical significance of this study

The CHS is not only an important part of urban health work but also the foundation of achieving primary health care for everyone. The development of the CHS is beneficial to the establishment of a new urban health service system with rational

division and close cooperation of CHS organizations, hospitals, and health care agencies. Furthermore, it is beneficial for the health policy aimed at prevention and treatment emphatically in optimizing the urban health service structure. To promote the development of the CHS, in February 2006 the State Council issued “Guidance on the Development of an Urban Community Health Service” and mentioned that supervision and management of the CHS should be enhanced, the fundamental infrastructure of the CHS should be standardized, the admittance of CHS organizations, employees, and technical items should be controlled strictly by law, and the evaluation system should be improved to encourage the development of the information management system for the CHS. This study exactly accords with the spirit of the guidance to develop an automated management system for the CHS all over the country combining computer techniques and health laws and regulations in China for the first time. In this study a new management tool is developed and implemented to enhance the supervision and management of the CHS. The development of

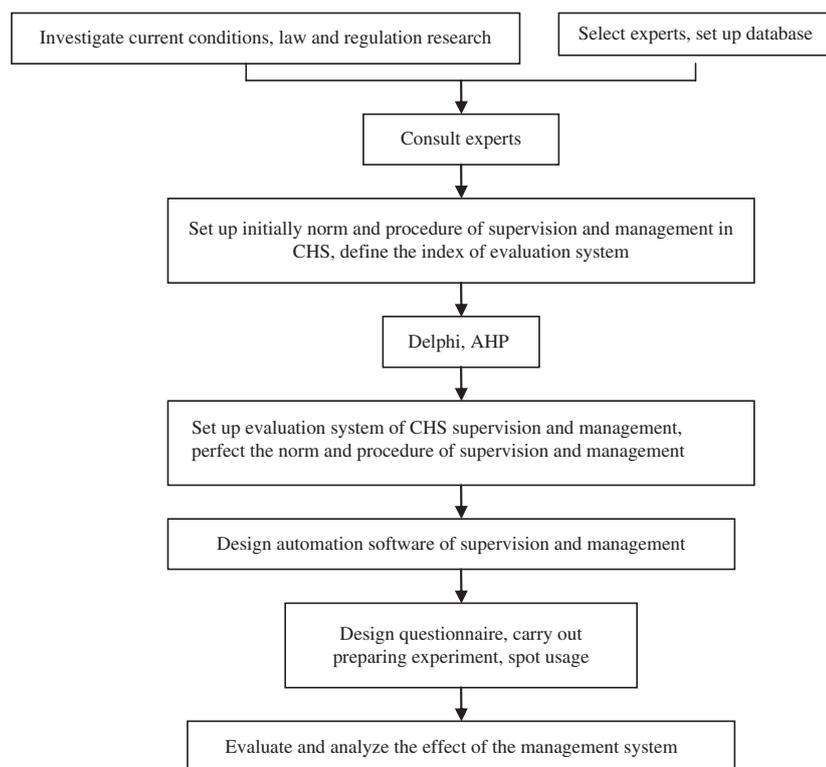


Fig. 4. Technology involved in the study. AHP, analytic hierarchy process; CHS, community health service.



the CHS is promoted by this automated management system in improving the whole quality of the CHS, optimizing the health service structure, and finally solving the problem of medical difficulties and decreasing medical expenses (Fig. 4).

## Study goals

### Total goals

On the basis of the principles of objectivity, practicability, and creativity, an integrated management system for the CHS is to be developed. This system should accord with the current situation of management and should also solve many problems of CHS management to prove the legalization, standardization, and automation of the CHS.

### Specific goals

This study aimed to develop a CHS supervision and management norm, a CHS supervision and management evaluation system, and a procedure for CHS supervision and management. Automated CHS management software is also expected to be designed. The CHS supervision and management evaluation system is expected to be implemented on-site to enhance CHS management.

## Study contents

### The management regulations of the CHS

The regulations include (1) the legal standard of CHS organizations, (2) demanding approvals of medical projects, (3) strict requirements for personnel qualifications (the registered workplace, the scope of medical practicing categories, and methods by which the physicians are trained), (4) specific qualifications for CHS organizations to open a service agency for maternal and infant health care, (5) principles for the use, purchase, selling, and storage of drugs, especially stupeficient, psychotropic drugs and radioactive drugs, (6) rules for the issue of prescriptions and medical writing, (7) processes for medical waste management and disinfection management in CHS organizations, (8) prevention and treatment of infectious diseases in the community, and (9) prevention of medical malpractice.

### The management procedure of CHS organizations

This procedure includes (1) specific requirements of application materials for the approval of the CHS organization,

(2) admittance standards, registration qualifications, and record items of the CHS organization, (3) specific methods and time limitation of administrative management, and (4) practicing rules of CHS organizations and procedures for daily supervision.

## Study norms

We performed a systematic study of health laws and regulations and theories in China by our searching for policies, laws, and regulations regarding the CHS both in China and abroad on the Internet, and then we classified and analyzed the questions concerning the CHS in China combining the current situation of CHS management to develop the norm for supervision and management of the CHS in China. There are ten medicine laws, 32 health regulations, and 92 sanitation rules in China, and among them five medicine laws, 18 health regulations, and 22 sanitation rules are relevant to the CHS, such as the “Law of the People’s Republic of China on Medical Practitioners,” the “Law of the People’s Republic of China on Prevention and Treatment of Infectious Diseases,” the “Law of the People’s Republic of China on Maternal and Infant Health Care,” the “Drug Administration Law of the People’s Republic of China,” the “Blood Donation Law of the People’s Republic of China,” the “Managerial Regulations for Medical Institutions,” the “Regulation on the Handling of Medical Accidents,” the “Regulations on the Administration of Medical Waste,” and the “Management Regulations for Nurses.” The books on systematic theories of CHS management mainly include “Management of Community Health Service” (Wannian Liang), “Management Theories and Marketing of Community Health Service” (Quanxi Liu, Xing Qin), “Community Health Service” (Wenxiu Yang), “Overseas Community Health Service” (Zuxun Lu, Shengguo Jin), and “Guidebook of Community Health Service” (Yong Bao).

## Current situation of the CHS in China

The targets investigated were directors in charge of CHS organizations from the Beijing Municipal Commission of Health and Family Planning, and its district municipal commissions of health and family planning (Dongcheng District, Xicheng District, Haidian District, Chaoyang District, Fengtai District, Fangshan District, and Daxing District). Two hundred



CHS organizations and their directors in the aforementioned districts were selected through a stratified random sampling method. The study was conducted by searches for information, individual interviews, questionnaires, and investigations.

### *Selection of experts and building up the database of experts*

Sixty experts were selected to build up a database of experts that includes experts' names, ages, contact information, professions, working seniority, etc. (Table 1).

### *Expert consultation*

On the basis of current research of health laws and regulations and theories regarding the CHS, we used expert consultation to define the evaluation system and automated management of the CHS. These health laws and regulations were converted into specific operation procedures and standards. Obscure instructions became clear information with details. The management norm of the CHS and the management procedure of

the CHS were established roughly, and indexes to evaluate CHS management were confirmed [16].

### *Use of an analytic hierarchy process and the Delphi method to establish the evaluation system for CHS management*

The evaluation items were confirmed by an analytic hierarchy process. The total evaluation items were composed of items from each evaluation level. The items from the lowest level were used as reference indexes to measure the degree of CHS management.

The Delphi method was applied to screen items and calculate the weight coefficients. The Delphi consultation method [17] was used in more than three rounds of expert consultation. The initial weight coefficients and normalized weight coefficients in each level were calculated according to the points given by experts. The combined evaluation coefficients were calculated according to different points for each level in the CHS management. The items for each level were synthesized, and the allocation list of weight coefficient for CHS management by law was established.

For the evaluation model synthesized by the analytic hierarchy process, the formula is

$$CI = \sum_{i=1}^n C_i P_i,$$

where  $P$  is a measure of evaluation index  $i$  and  $C$  is the weight of evaluation index  $i$ .

### *Design of automated management system software for the CHS*

This system includes four subsidiary systems: the administrative management system, the evaluation system, the query system, and the statistical analysis system. The last two systems generate tables automatically on the basis of the administrative management system according to the predesigned table forms [18–21].

### *Administrative management system*

The administrative management system [22–25] includes the application system of the CHS station (center) (Fig. 5), the examination system of the CHS station (center), the audit and

Table 1. Allotment of experts

| Experts                   | Number | Admission conditions          |
|---------------------------|--------|-------------------------------|
| CHS managers              | 6–8    | This is the specialty         |
| Medical managers          | 6–8    | distribution of experts.      |
| General practice experts  | 6–8    | We can adjust the number      |
| Computer experts          | 6–8    | of experts, as the case       |
| Lawyers                   | 3–5    | may be. The number of         |
| Family physicians         | 3–5    | experts remains at 60 or so.  |
| Health policy experts     | 3–5    | Moreover, the criteria by     |
| Health managers           | 3–5    | which the experts are chosen  |
| Social medicine experts   | 3–4    | are as follows: (1) they      |
| Epidemiology experts      | 1–2    | should be engaged in related  |
| Health statistics experts | 1–2    | professions; (2) they should  |
| Health educators          | 1–2    | have a secondary professional |
| Directors of health       | 3      | title; (3) the professional   |
| bureaus                   |        | working seniority should be   |
|                           |        | more than 5 years; (4) they   |
|                           |        | should be interested in this  |
|                           |        | research and should wish to   |
|                           |        | answer the questions          |
| Total                     | 45–65  |                               |

CHS, community health service.

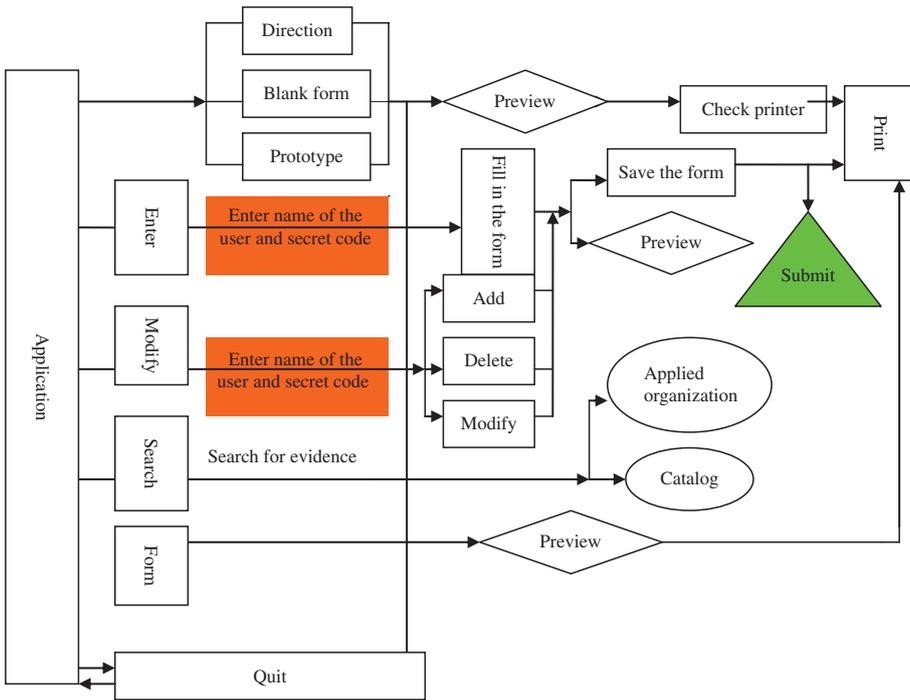


Fig. 5. Application flowchart.

approval system of the district public health bureau, and the filing system of the municipal public health bureau. The data are transmitted level by level (Fig. 6). The CHS application

system includes an establishment application, a registration application, an annual examination application, an alteration application, and a cancellation application.

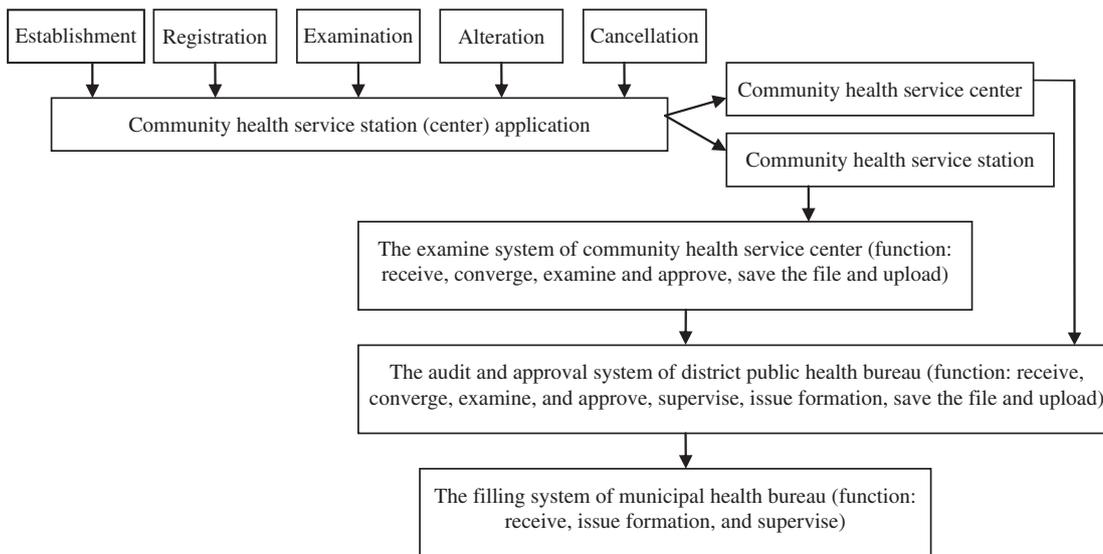


Fig. 6. Administrative management system flowchart.



### *Automated evaluation system*

After the questionnaire data on CHS management have been input into the computer, the software will calculate the comprehensive indexes of the evaluated units (CHS stations and centers, district and municipal public health bureaus), and the best and the worst items of each evaluated unit will be displayed. The computer will rank evaluated units according to comprehensive indexes as well as indexes of individual items.

### *Query system*

1. Basic data search. When the administrative department clicks on the name of one CHS organization in the name list of the query system, the basic information (including the location, telephone number, register category, personnel, and basic current situation of the medical practice) of this organization will be displayed.
2. Personnel search. Once the names or ID numbers of the physicians who have been registered in the automated management system are input into the query system, the physician qualification certificate number, professional titles, and medical practice category and the time when the physician qualification certificate was obtained and the issuing organization can be shown. If the person does not have a physician qualification certificate or has not registered with any CHS organizations, no information will be shown in the system.
3. Administrative results search. This includes the establishment information of CHS organizations, the registration information, the annual calibration result, and the periodic supervision result.

### *Statistical analysis system*

The statistical analysis is performed on the information from CHS stations to accurately understand the resources of CHS stations. In addition, various statistical analysis charts can be provided on request, such as an educational background chart and a daily work chart. It can provide the basis for decision making for the administrative departments with regard to the rational allocation of CHS resources.

### *Preparatory experiment [26]*

The aforementioned contents were included in an investigation questionnaire about the evaluation system and automated

management of the CHS. Four CHS stations in one CHS center in one district in Beijing were chosen for the preparatory experiment. Through comparison of the differences before and after the implementation of the system and analysis of the implementation effect, we examined and completed the indexes of the system.

The general questions were included in the first part of the questionnaire and the specific ones were included in the second part; easy questions were included in the first part, and difficult ones were included in the second part; frequently asked questions were included in the first part, and others were included in the second part. At the same time, questions in the same field were displayed together as far as possible in proper order.

Basic information was included in the first part, such as addresses and names of the CHS organizations, followed by management tasks of CHS organizations, such as registration, annual calibration, alteration, and cancellation.

### *The implementation of the automated management system in CHS organizations*

Two districts in Beijing were chosen as the experimental group and two districts were chosen as the control group. The study targets were four district health bureaus, four CHS centers, and 16 CHS stations. The methods of typical sampling and random sampling were applied in the selection of these study targets. The study areas were divided into two major types according to the characteristics of CHS management in the area. The districts in the first type were those that have completed the establishment of an automated management system in CHS organizations. The districts in the second type were those that have not implemented an automated management system in CHS organizations. The practice process flowchart of the automated management system for the CHS is shown in Fig. 7.

### *Data sorting and analysis*

#### *Index code*

For convenience, a code is added to the indexes of each grade to mean the corresponding indexes. The indexes of the first grade are replaced by A; the indexes of the second grade are replaced by B; etc. The first number after the letter (A, B, C, D) means

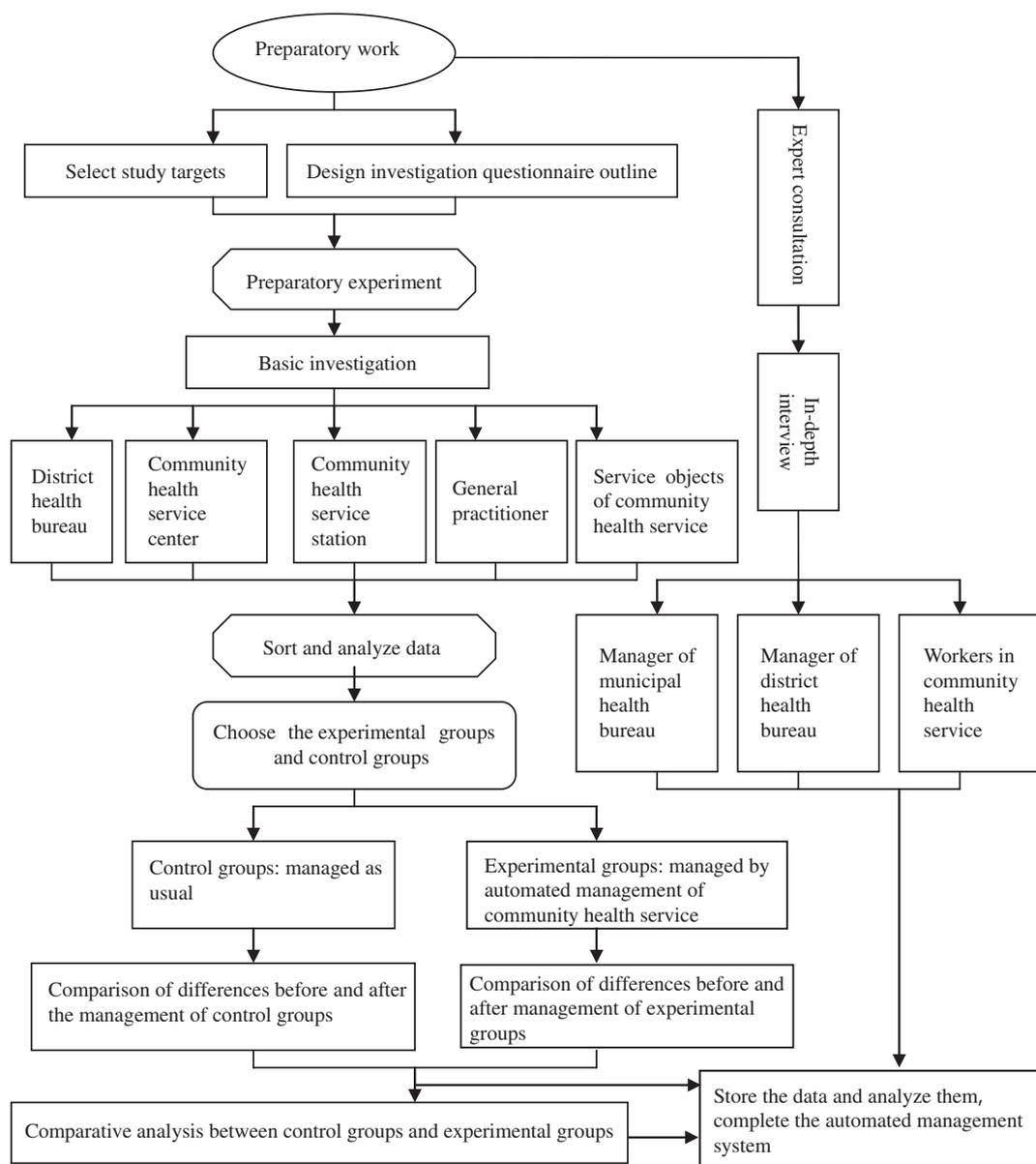


Fig. 7. The practice process flowchart of the automated management system for the community health service.

the second index; the second number after the letter means the third index.

### Data sorting and analysis

Data from all questionnaires in this study were input and checked as well as tidied up by trained postgraduate students from Capital Medical University. The corresponding quantitative analysis methods were used to analyze these data. Then all

quantitative data were transformed into words and checked by professionals. Questionnaires with answers to more than 20% of questions missing were removed. Data analysis included the study situation of the health laws and regulations and theories regarding the CHS, the investigation information, the expert consultation results, the basic information from experts, the coefficient calculation of the management system, and the situation of the preparatory experiment.



### Data processing and statistical analysis

Collected data were input into EpiData6.0 and analyzed by SPSS for Windows version 12.0 after data sorting. Some data that need to be compared with each other were analyzed by the *t* test and the chi-square test.

### Innovations of the study

Combined with a computer technique, this study developed an automated management system for the CHS in China for the first time on the basis of existing health laws and regulations, and tried to explore a new administrative model for the CHS. Through the establishment of automated management of the CHS, four breakthroughs have been realized: repetitive work became automated, complicated work became simplified, nonregular services decreased, and obscure instructions became clear and specific. The management of the CHS could be enhanced by use of the automated management system in district and municipal health bureaus. Finally, the management of the CHS will be improved in China.

### Major technical difficulty

The technical difficulty was mainly in the design of the automated management software.

### Quality control of the study

#### Design stage

The design of the automated management system for the CHS was modified by experts' suggestions and then evaluated by experts again. A preparatory experiment was conducted in several communities to modify the implementation plan, questionnaires, study method, and study indexes.

#### Implementation stage

Before implementation of the plan, all researchers were trained and study goals were explained to the organizations and people involved so as to obtain their cooperation. All research work was performed with the help of and under the supervision of municipal and district health bureaus in Beijing. Researchers checked the questionnaires in a timely manner to ensure all questionnaires had been filled in completely. After

the collection, the data were transformed into words and input into a computer. Four percent of samples were rechecked, and the concordance rate was required to reach 95%.

#### Data input stage

All data were input twice to ensure accuracy of the analysis.

### Conflicts of interest

The authors declare that they have no conflicts of interest.

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