



Research on Early Warning Monitoring Model of Serious Mental Disorder Based on Multi-source Heterogeneous Data Sources

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Abstract. Patients with severe mental disorders are sudden and aggressive, and the means may be more cruel. The data shows that the number of serious mental disorders is increasing. In order to prevent the occurrence of accidents and disasters in patients with mental illness, active intervention should be carried out to design an early warning and monitoring system for serious mental disorders. By collecting administrative departments of health and family planning at all levels, it is necessary to cooperate with the political and legal, public security, civil affairs, human resources, social security, and the Disabled Persons' Federation. The established platform information is used to summarize multi-source heterogeneous data. Establish an early warning monitoring model, classify 10 risk factors from four levels, establish a risk factor assessment model, and set up different levels of treatment intervention programs. It is described from the perspectives of design ideas, design principles, and architecture design. The construction of an early warning and monitoring mechanism for serious mental disorders can effectively integrate the high-quality resources of mental health institutions at all levels, guide the rational allocation of resources, improve the management of serious mental disorders, detect the morbidity of patients with mental disorders early, and promptly intervene to reduce the risk of accidents.

Keywords: Severe mental disorders · Disease surveillance · Disease warning · Data fusion

1 Introduction

Psychiatric patients, who are dominated by hallucinations and delusions, often lose their sense of self-control and have uncontrollable consequences for their own and social safety. Severe mental disorders are classified into schizophrenia, schizoaffective disorder, paranoid psychosis, bipolar disorder, mental disorder caused by epilepsy, mental retardation accompanied by mental disorder [1]. Severe mental disorders are sudden and aggressive, and the means may be more cruel. Nearly 90% of the victims are close relatives; from 2013 to 2016, the provincial courts tried 304 cases of compulsory treatment, resulting in 243 cases of casualties. Pieces, accounting for 79.9%, of which 118 people were killed. According to the National Mental Health Epidemiological Survey data, the prevalence of severe mental disorders in China is about 1%,

and the prevalence of any one mental disorder is 9.32%. The situation of the country: February 18, 2017, Hubei Province The head of the store near Wuhan Wuchang Station was beheaded; on February 2, 2018, there were 3 deaths and 1 injury in Chenghai District, Shantou City, Guangdong Province; on July 26, 2018, the southeast gate of the US Embassy in Chaoyang District, Beijing The vicinity of the visa office exploded; in November 2019, a 9-year-old boy was killed in Changsha, Hunan Province.

Suzhou currently has 34,424 people with mental illness, 22,604 patients with stable disease; 28,364 patients with confirmed serious diseases; 851 with mild troubles; and 336 with accidents. See Fig. 1.

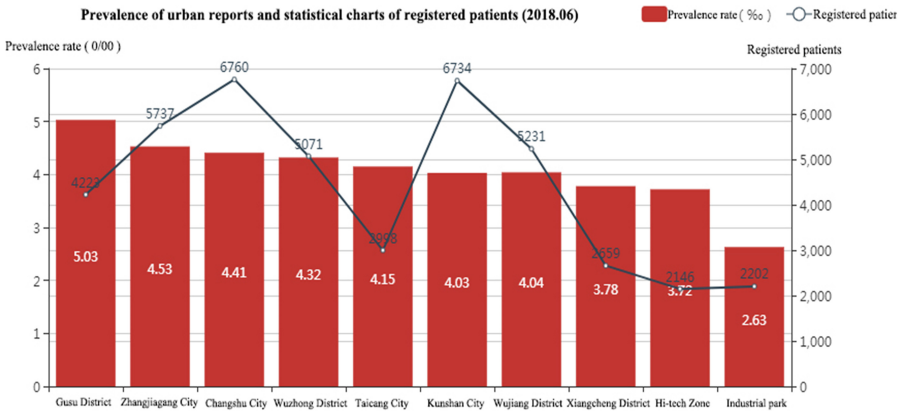


Fig. 1. Prevalence of urban reports and statistical charts of registered patients.

2 Purposes

Adhere to the work principle of prevention-oriented, prevention and treatment, key intervention, extensive coverage, and legal management [2, 3]. Through information technology, relying on the comprehensive management platform for serious mental disorders and the data sharing analysis mechanism of each system platform, establish a serious mental disease early warning monitoring system and establish Street leaders, relevant department cooperation, social participation work mechanism and mental illness prevention and control system based on mental disease prevention and control, community (village)-based, family-based, and strengthen psychological interventions for key mental illnesses and key populations To reduce the occurrence of accidents and illnesses in patients with mental illness [4, 5].

Recently, the National Health and Wellness Committee issued the “Regulations on the Management and Treatment of Severe Mental Disorders (2018 Edition)” (National Guardian Control (2018) No. 13) combined with the National Basic Public Health Service Regulations (Third Edition) [6–8].

The management of patients with severe mental disorders requires the implementation of new norms, requiring medical staff in primary health care institutions to timely standardize the management and treatment of patients with severe mental disorders [9].

At the same time, the administrative departments of health and family planning at all levels must establish information sharing mechanisms with the departments of politics, public security, civil affairs, human resources, social security, and the Disabled Persons’ Federation to coordinate the comprehensive management of mental health [10–12]. This provides data support for the early warning system for severe mental disorders.

3 Design of Early Warning Monitoring Model

3.1 Classification of 10 Risk Factors in Four Levels: See Table 1

Table 1. Four levels and 10 categories.

Level	Serial number	Content
A	1	Weak guardian (care) family (caregiver or guardian age ≥ 65 years old, social agent guardian)
	2	No previous home visit record in previous years
	3	In the past year, outpatient clinics were all dispensed by family members
B	1	In the past year, he was treated repeatedly (≥ 2 times) due to illness (six major categories);
	2	Have had a risk rating of Level 3 and above in the past 1 year;
	3	In the recent two consecutive follow-ups, the mode of administration was “dark medication” with unstable condition;
	4	There have been minor incidents in the past year
C	1	At the last follow-up, he was found to have not taken the drug or refused to take the drug and had a risk rating of Grade 3 or higher in the past 1 year;
	2	There were no visits or dispensing records for more than two months and there were more than three grades of dangerous behavior in the past 1 year
D	1	Persons who have historically recorded incidents of misconduct or are in the police officer’s information base

3.2 Risk Factor Assessment Model

By collecting the multi-platform information established by the administrative departments of health and family planning at all levels and the departments of politics, public security, civil affairs, human resources, social security, and the Disabled Persons’ Federation, data collection and analysis are carried out [13, 14]. Classified according to risk factors. Determine the level of risk for mentally ill persons for further treatment. See Fig. 2.

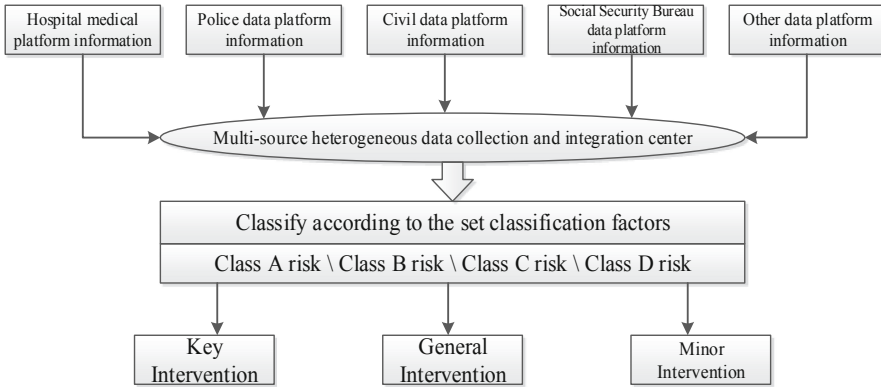


Fig. 2. Multi-source data collection and integration classification model.

3.3 Classification and Classification Event Handling Settings

Data collection, data processing, data classification, and data processing are performed in a closed loop operation [15].

Disposal settings for early warning of alarm objects at all levels:

- a. a slight intervention in the subject. The grassroots psychiatrist completed the intervention within one month.
- b. General intervention targets. The district led the Jingwei Office and the grassroots fine prevention doctors to complete the intervention under the guidance of the sugar candy office within 2 weeks.
- c. Key intervention targets. City, county and township three-level fine prevention network, grassroots joint intervention, 72 h integrated management team completed the intervention.

Interventions include emergency treatment of patients with mental disorders who have suspected or diagnosed mental disorders who are harming themselves, harming the safety or safety of others, relapsed, acute or severe adverse drug reactions. Emergency prevention personnel, civilian police, members of the village (residential) committee, grid staff and other members of the care support team and psychiatrists, nurses and other emergency response teams to carry out emergency response.

4 System Overall Design

4.1 Design Ideas

According to the particularity of severe mental illness, the importance and necessity of early warning and monitoring of mental patients' accidents and accidents are carried out, and the design of early warning monitoring system is carried out. The system is designed primarily by following the classification of risk factors and the risk rating model [16, 17].

Data availability: The early warning and monitoring system for severe mental disorders is connected to various hospitals such as HIS, and the platform information established by departments such as politics, public security, civil affairs, human resources and social security, and the Disabled Persons' Federation, and other information systems from different vendors. There are multiple connections between the data link layer and the transport layer to the network layer. Different data format standards are adopted based on different data interconnection methods, which makes the interconnection relationship between systems complicated. So data governance starts with the underlying data structure and contains the type attribute of the data. Create a library element that contains assemblies, spaces, types, data structures, and so on, and the naming guidelines should use these elements to determine the naming rules: for example, capitalization conventions, identifier case styles, name conflict avoidance, and so on.

Follow the overall design philosophy of advanced, targeted, integrated, secure, expansive, normative, and practical.

This project uses JAVA technology, combined with a powerful oracle database. Strictly define all the business logic processing objects and unify the data storage rules. On this basis, the platform is divided into the background data processing layer, the intermediate business logic processing layer, the foreground business logic processing layer and the presentation layer. The business module adopts the B/S architecture, and the simple operation of WEB browsing query and business operation further enhances the practicability and ease of use of the software.

In order to adapt to the needs of interface changes caused by changes in data specifications in the later period, the expansion capability of this system is also a major feature. Based on the in-depth study and induction of relevant normative documents in the national fine defense field, we have formulated uniform data processing rules. The existing business logic objects are also uniformly encapsulated, and a simple and flexible access interface is provided for other government departments to access data in the future. In the later stage, the new functions are expanded without direct manipulation of the database, thereby ensuring the integrity of the database. Sex and safety.

4.2 Design Principles

Security principle: The system should be based on a large data center, a powerful information processing environment and a high-speed network. Since the entire system involves a large amount of confidential data, and part of the data sharing is based on the network environment, information security must be considered in the design process. The confidentiality measures ensure that the information resources in the system are not illegally stolen and tampered, the data center is not destroyed, and the user is required to use the shared resources in the system to provide the information services that should be provided. In order to ensure the security of the system, effective security and confidentiality technologies must be adopted in addition to establishing a sound security management system. The system adopts a set of scientific and convenient security management mode. The system strictly defines the permissions of the end users, and the permissions of the end users are refined to each function of each module.

On this basis, the system flexibly uses the group management mode. It greatly simplifies the work complexity of system administrators [15]. See Fig. 3.

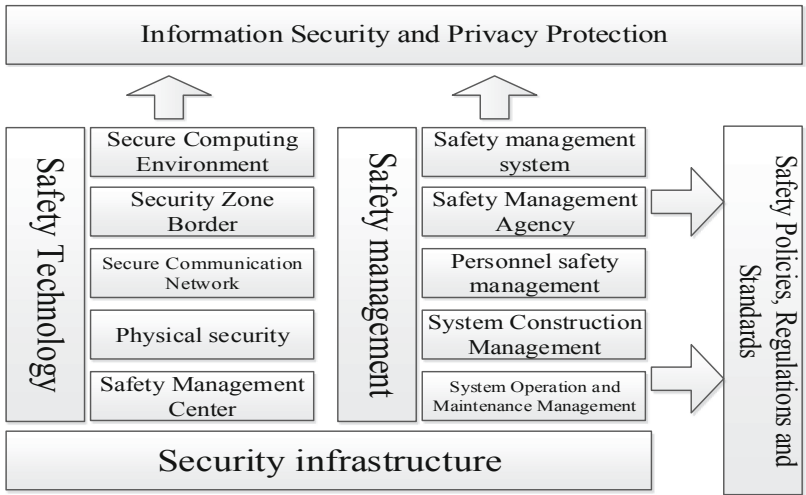


Fig. 3. Severe mental disorder early warning monitoring security system

Normative principle: In the system design process, the data structure and data coding settings conform to strict technical specifications, the data coding adopts the national standard, and the design is designed according to the “Minimum Data Set of Jiangsu Province Defense Platform Management Part”.

Practicality principle: According to the comprehensive user demand research and expert analysis results, the business operation module adopts the WEB end form of the B/S architecture, and the data exchange level adopts the WEBSERVICE standard interface. Has powerful data processing and business management functions. From the beginning to the end, focusing on the integrity of the system, consider the links between Jiangsu Province’s fine defense platform, Suzhou’s fine defense platform, psychiatric hospital, other medical institutions, civil affairs, public security, social security, community, etc., and the internal relationship between their businesses. Make it an organic whole.

4.3 Architecture Design

According to the Ministry of Health’s “Regulations on the Management and Treatment of Severe Mental Disorders (2018 Edition)”, “National Basic Public Health Service Regulations (Third Edition)”, “Implementation Plan for the Rescue and Relief Work for Severe Mental Disorders in Suzhou City” and “The Spirit” The Health Law is a blueprint for business and builds a system. The system adopts the B/S framework to establish a city-level mental health data center business integration system. Each district and county security office, medical and health institutions, and grassroots health

organizations access through a private network or VPN. The city's severe mental disorder early warning and monitoring system to carry out business management. The project system and other information platforms are in the form of interfaces for data interconnection.

5 Summary

Taking the three-level psychiatric hospital of Suzhou Guangji Hospital as the main body, the construction of early warning mechanism for serious mental disorders can effectively integrate the high-quality resources of mental health institutions at all levels, guide the rational allocation of mental health resources, and thus improve the management of serious mental disorders. Early detection of patients with mental disorders fluctuations, and timely intervention; obtain a large number of potential high-risk patients data, and use different strategies according to the level of early warning risk; improve work efficiency, reduce the unnecessary work of grassroots prevention doctors, timely and accurate positioning of risk patients; Reduce the occurrence of accidents, incidents, and accidents, reduce the risk of accidents and prevent social risks.

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