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Analysis and measurements of irrational prescriptions for diabetes' patients in the outpatient and emergency

Shuhua Shi[1,2], Jie Liu[1], Zhizhong Yuan[2], Xiaoying Zhou[1,*]

[1]School of Pharmacy, Changzhou University, Changzhou, 213164, Jiangsu, China
[2]Department of Pharmacy, People's Hospital of Shangshui, 466100, Zhoukou, Henan, China
**Corresponding author: xiaoyingzhou@cczu.edu.cn*

Abstract: *Objective: Analyze the unreasonable prescriptions of diabetic patients in the outpatient and emergency department of our hospital, and provide references for the rational use of drugs by diabetic patients. Methods: The prescriptions (total 12704) for diabetic patients were collected in Outpatient and Emergency Pharmacy from January to December 2020, and several parameters were counted, such as the basic conditions of diabetic patients, the number, types and proportion of unreasonable prescriptions, and the distribution of different departments. Results: The average age of patients was (63.75±12.02) years old. There were 7692 patients between 60 and 79 years old, accounting for 60.55%, and there were more male patients than female patients; 1,291 unreasonable prescriptions, accounting for 10.16%; The top three in the distribution of irrational prescription departments were 913 in internal medicine of Traditional Chinese Medicine, accounting for 70.72%, 125 in respiratory medicine, accounting for 9.68%, and 98 in neurology, accounting for 7.59%. The prescription failure rates of general internal medicine was the lowest 7.44%, and the prescription failure rate of the dialysis center was the highest 43.75%; Among the unreasonable prescription types, there were 1106 prescriptions with inappropriate drug usage and dosage, accounting for 85.67%, followed by 160 prescriptions with inappropriate dosage form or route of administration, accounting for 12.39%. Conclusion: The prescriptions for diabetic patients in the Outpatient and Emergency Department of our hospital are basically reasonable, but some non-endocrine departments have a high rate of prescription failure. It is necessary to improve the problems of irrational prescriptions to improve the quality of prescriptions and the level of reasonably clinical use of drugs.*

Keywords: *Diabetes, irrational prescription, prescription analysis, rational use of drugs*

1. Introduction

According to the World Health Organization, rational use of medicines refers to the fact that patients will receive medicines at the right time and in the right doses that are appropriated for their clinical conditions, taking into account the cost of treatment. And up to 50% of medicines globally cannot be used rationally and properly, and even about 1/3 of those patients die each year due to irrational drug use rather than their own disease [1].The latest data onto the International Diabetes Federation (IDF) in 2020 shown that there were about 120 million diabetic patients in my country, the country with the largest number of diabetic patients in the world.[2].Diabetes mellitus is a chronic metabolic disease with complex etiology and pathogenesis, and requires patients to take long-term medication [3]. Irrationals use of drugs will not only increase in the economic burden of diabetic patients, but also bring hidden danger to the health of patients. For a long time, rational drug used has always been a hot topic in the field of pharmacy. With the increasing number of diabetic patients' year by year, it is particularly important to patients to be able to take medication reasonably and safely. In order to explore how diabetic patients can rationally use drugs, this paper statistically analyzes the prescription data onto the outpatient and emergency diabetic patients in Shangshui County Peoples Hospital of Henan Province (hereinafter referred to as "our hospital") in 2020, and finds problems and proposes improvements. Measures to provide reference to clinical rational drug use.

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

2. Materials and Methods

2.1. Research Materials

Through the hospital information management system (HIS), 12,704 prescriptions of all diabetic patients in the outpatient and emergency pharmacy of our hospital from January to December 2020 were collected as research data.

2.2. Research Methods

According to the "Prescription Management Regulations"[4], requirements of the Ministry of Health's "Hospital Prescription Review Management Specification (Trial)" and other documents [5], at the same time, the rationality of 12,704 prescriptions was reviewed and analyzed with reference to the hospital's rational drug use management system and drug instructions, and the unreasonable prescriptions were screened out and divided into the following types: inappropriate drug usage and dosage, inappropriate dosage form or route of administration, inappropriate indications, inappropriate combination medication, repeated administration and contraindications. Then Excel2010 was used to classify and summarize the basic information about patients (sex, age), distribution of unreasonable prescription departments and the types of unreasonable prescriptions.

2.3. Statistical processing

Data were classified and summarized using Excel 2010 softwares. GraphPad Prism Version 7 software for data analysis and graph preparation.

3. Results

A total of 12,704 prescriptions for the outpatient and emergency diabetic patients from January to December 2020 were collected, of which 1,291 were unreasonable prescriptions, accounting for 10.16%.

3.1. Basic information of diabetic patients

There were 12,704 prescriptions for diabetes' patients, and the average age of patients was (63.75±12.02) years old. Among them, 365 patients were younger than 40 years old, accounting for 2.87%; 3776 patients were 40-59 years old, accounting for 29.72%; 7692 patients were 60-79 years old, accounting for 60.55%; 871 patients were older than 80-year-old people, accounting for 6.86%; including 7219 male patients, accounting for 56.82%; 5485 female patients, accounting for 43.18%. See Table 1.

3.2. Distribution and proportion of departments with unreasonable prescriptions

The total number of prescriptions for diabetic patients were 12,704 of which 1,291 unreasonable prescriptions were distributed in 13 departments. In these prescriptions, internal medicine of Traditional Chinese Medicine had the largest distribution of 913 sheets, accounting for 70.72%, followed by respiratory medicine with 125 sheets, accounting for 9.68%, and neurology with 98 sheets, accounting for 7.59%. %. Among the 13 departments, the general internal medicine department had the lowest prescription failure rate of 7.44%, and the dialysis center had the highest prescription failure rate of 43.75%. See Table 2 and Figure 1.

3.3. Distribution and composition ratio of irrational prescription types

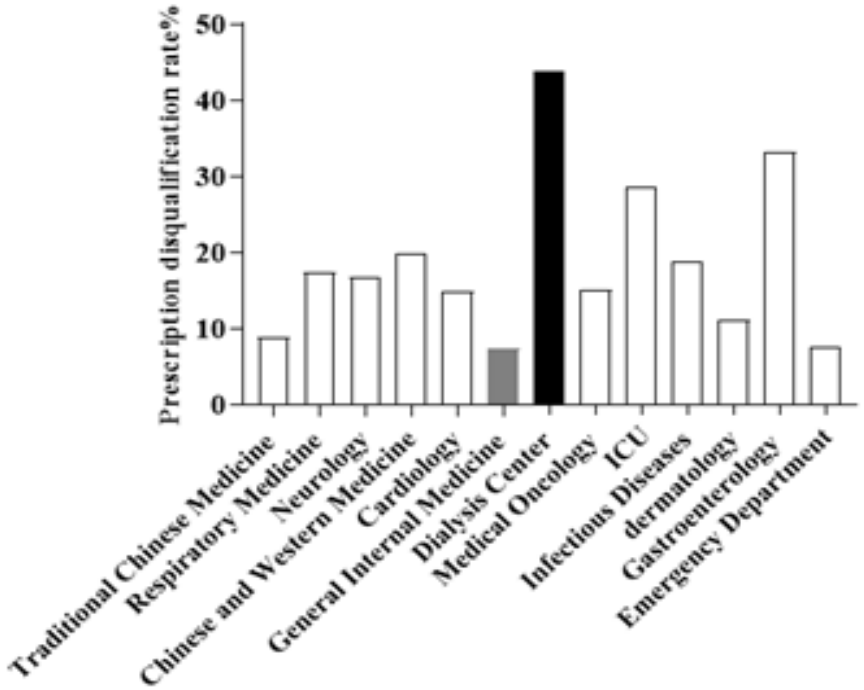
Table 1: Age and gender distribution of diabetic patients

Ages	＜40	40~59	60~79	＞80	Total
Male	180	2366	4143	530	7219
Female	185	1410	3549	341	5485
Total	365	3776	7692	871	12704
Proportion%	2.87	29.72	60.55	6.86	100.00-

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

Table 2: Distribution of unreasonable prescription in departments

Department	Unreasonable prescription		General prescriptions	
	Number of prescriptions/ sheet	Proportion (%)	Number of prescriptions/ sheet	Proportion (%)
Traditional Chinese Medicine	913	70.72	10318	81.22
Respiratory Medicine	125	9.68	715	5.63
Neurology	98	7.59	587	4.62
Chinese and Western Medicine	39	3.02	197	1.55
Cardiology	35	2.71	234	1.84
General Internal Medicine	30	2.32	403	3.17
Dialysis Center	28	2.17	64	0.50
Medical Oncology	10	0.77	66	0.52
Intensive Care Unit	4	0.31	14	0.11
Infectious Diseases	3	0.23	16	0.21
dermatology	3	0.23	27	0.21
Gastroenterology	2	0.15	6	0.05
Emergency Department	1	0.08	13	0.10
Total	1291	100.00	12704	100.00



Note: The unqualified rate is the ratio of the number of unreasonable prescriptions divided by the total number of prescriptions in the department. ICU is the abbreviation of the intensive care unit.

Figure 1: The unqualified rate of prescriptions in different departments (%)

According to the classification of unreasonable prescriptions, the types and proportions of unreasonable prescriptions are analyzed and counted as follows: the maximum number of prescriptions with unsuitable usage and dosage of medicines is 1106 sheets, accounting for 85.67%, followed by 160 prescriptions with unsuitable dosage forms or routes of administration, accounted for 12.39%. There are 12 prescriptions with unsuitable use and dosage and unsuitable drug dosage form or route of administration, accounting for 0.93%, and 5 prescriptions with unsuitable indications, accounting for 0.39%. There are 2 inappropriate prescriptions for repeated administration and combination medication, accounting for 0.15% and 0.15% respectively. See Table 3 and Figure 2.

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

Table 3: Types and proportion of unreasonable prescriptions (%)

Unreasonable prescription types (%)	General Internal Medicine	Traditional Chinese Medicine	Cardiology	Medical Oncology	Neurology	Respiratory Medicine	Chinese and Western Medicine	Dialysis Center	Other departments	Total
Inappropriate dosage of medicines	21 (1.9)	817 (73.87)	26 (2.35)	10 (0.90)	94 (8.50)	64 (5.79)	37 (3.35)	26 (2.35)	11 (0.99)	1106 (85.67)
Inappropriate dosage form or route of administration	8 (5.00)	77 (48.13)	8 (5.00)	0 (0.00)	4 (2.50)	57 (35.63)	2 (1.25)	2 (1.25)	2 (1.25)	160 (12.39)
Both of the above coexist	0 (0.00)	7 (58.33)	1 (8.33)	0 (0.00)	0 (0.00)	4 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)	12 (0.93)
Inappropriate indications	0 (0.00)	5 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	5 (0.39)
Repeated dosing	0 (0.00)	2 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.15)
Combination medication is not suitable	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.15)
Contraindications	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.08)
Other types	0 (0.00)	3 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.23)
Total	30 (2.3)	913 (70.72)	35 (2.71)	10 (0.77)	98 (7.59)	125 (9.68)	39 (3.02)	28 (2.17)	13 (1.01)	1291 (100.00)

Note: (General internal medicine, traditional Chinese medicine, cardiology, oncology, neurology, respiratory medicine, Chinese and Western medicine, dialysis centers and other departments in parentheses refer to the proportion of each unreasonable prescription type; other types refer to the simultaneous occurrence of contraindications, inappropriate drug usage and dosage, and inappropriate dosage forms or routes of administration; other departments refer to emergency department, gastroenterology, intensive care unit, dermatology and infectious diseases.)

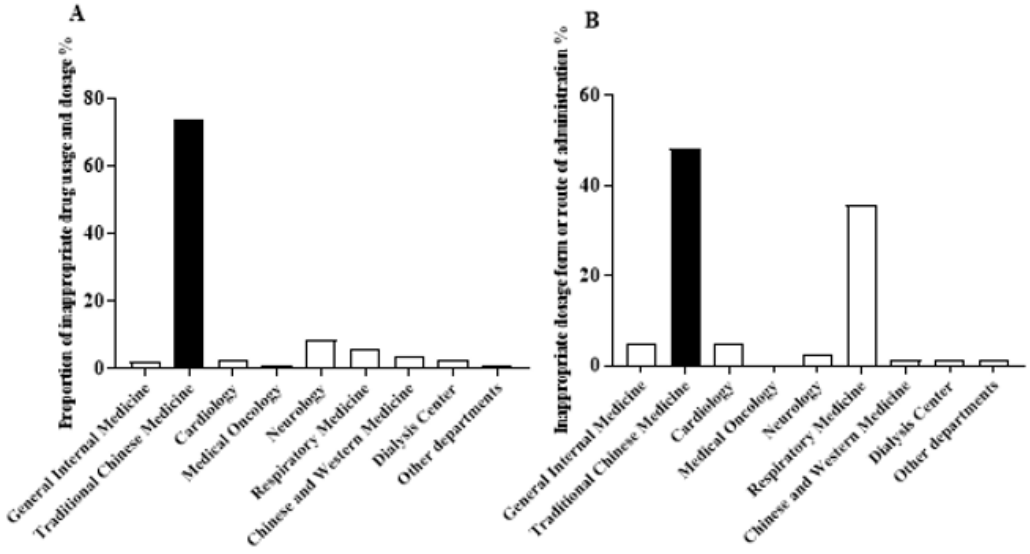


Figure 2: Two types of unreasonable prescriptions accounted for in different departments (%)

4. Discussion

4.1. Analysis of the basic situation of diabetic patients

As can be seen from Table 1, from the age distribution point of view, most of the diabetic patients that came to our hospital were older than 40 years old, mainly concentrated in 60-79 years old, followed by 40-59 years old. The number of diabetic patient increases with age, and the middle-aged and elderly people are the main population. In terms of gender, the overall proportion of male patients is higher than that of female patients, and there is a significant difference in the age group of 40-59 years. It can be seen that age and gender are closely related to diabetes [6].

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

4.2. The distribution of unreasonable prescription departments

The top three departments with unreasonable prescriptions are internal medicine of Traditional Chinese Medicine, respiratory medicine, and neurology. Diabetes is a chronic disease with a long course and many complications, thus increasing the number of visits to departments related to diabetes' complications. The results showed that the total number of prescriptions in internal medicine of Traditional Chinese Medicine were the largest, and the number of unreasonable prescriptions was relatively large. The proportion of unreasonable prescriptions was as high as 70.72%, followed by respiratory medicine and neurology, accounting for 9.68% and 7.59% respectively. Department of internal medicine of Traditional Chinese Medicine is the main department in our hospital that prescribes chronic disease drugs (hypoglycemic drugs, antihypertensive drugs, hypolipidemic drugs, etc.) for patients with chronic diseases. The number of prescriptions written by diabetic patients is the most, and the number of unreasonable prescriptions is relatively high; From Table 1, it can be seen that the number of diabetic patients who come to our hospital is mostly middle-aged and elderly patients. According to relevant literature, respiratory diseases are one of the most common diseases in the elderly [7], diabetic neuropathy is one of the most common chronic complications of diabetes [8].Therefore, the number of unreasonable prescriptions in these two departments is also high.

It can be seen from Figure 1 that the general internal medicine department has the lowest prescription failure rate of 7.44%. The general internal medicine department of our hospital is mainly a department for treating and diagnosing diabetes. The number of unreasonable prescriptions issued by professional endocrinologists is relatively small; the highest prescription failure rate is Dialysis center 43.75%. Diabetic nephropathys is one of the most serious complications to diabetes. At present, the treatment of diabetic nephropathy is mainly to give symptomatic treatment such as control of blood sugar and blood pressure to delay the progress of the disease. There is a lack of treatment for the diabetic nephropathy itself. [9] In addition, the patient's own renal metabolic function is poor, so doctors are less selective when prescribing drugs, and the incompatibility rate of prescriptions is high.

In addition to prescribing hypoglycemic drugs for diabetic patients, doctors in non-endocrinology departments such as traditional Chinese and western medicine, respiratory medicine, and neurology(the total number of prescriptions in the emergency department, gastroenterology department, ICU, dermatology department and infection department is relatively small, and no comparison is made) should also prescribe drugs related to their complications. This is also one of the reasons for the high number of unreasonable prescriptions in non-endocrinology departments. Relevant literature shows [10] Medical staff in non-endocrinology departments are relatively lacking in diabetes-related knowledge, so the unqualified rate of prescriptions in non-endocrinology departments is relatively high. This requires pharmacists to strengthen communication with doctors in non-endocrinology departments, timely feedback relevant drug knowledge, and strengthen the publicity of diabetes-related knowledge, so as improving the awareness of diabetes in relevant departments, so as reducing the number of unreasonable prescriptions, to better promote rational drug use in diabetic patients.

4.3. Analysis of Types of Unreasonable Prescriptions

4.3.1. Inappropriate use and dosage

Inappropriate usage and dosage of drugs are the main types of unreasonable prescriptions in our hospital, with a total of 1106 prescriptions, accounting for 85.67%, of which the top three departments are internal medicine of Traditional Chinese Medicine (817 prescriptions, accounting for 73.87%), neurology (94 prescriptions) accounting for 8.50%) and respiratory medicine (64 prescriptions, accounting for 5.79%). Such unreasonable prescriptions mainly focus on the taking methods of sustained-release and controlled-release preparations. For example, the taking method of metformin hydrochloride sustained-release tablets 0.5g*24 tablets is prescribed as 1.0g Tid (three times a day), which exceeds the maximum daily use of the drug. The amount is 2.0g, suitable for Qd (once a day) or Bid (twice a day), and cannot exceed the maximum amount of the drug used in a single day. Metformin is the drug of choice of the treatment of type 2 diabetes, especially in obese patients, and it is seen as an insulin-sparing drug. It has the advantages of not affecting body weight and not intrinsically related to hypoglycemia, but it can also cause gastrointestinal adverse reactions, and even the rare and serious adverse reactions of lactic acidosis. Therefore, when using metformin, the dosage and use should be strictly controlled to ensure the safety of patients.[11] When a doctor prescribes atorvastatin calcium tablets, the dosage method is written as "20 mg Tid", orally, and the correct dosage method should be 10 or 20 mg each time, once a night, before going to bed. When prescribing levamlodipine besylate tablets, the taking method is written as "5

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

mg Bid", which should be "5 mg Qd". The most common reasons may be that some elderly patients with older age, poor physical condition, and inconvenient mobility, or the patient's home is too far from the hospital, they need to prescribe more medicines and take it home for backup. Therefore, doctors increase the prescribed amount of medicines to meet the patient's requirements by increasing the single dosage or increasing the number of dosages.

4.3.2. Inappropriate dosage form or route of administration

There were 160 prescriptions with inappropriate dosage form or routes of administration, accounting for 12.39%. The top three departments were internal medicine of Traditional Chinese Medicine (77 prescriptions, accounting for 48.13%) and respiratory medicine (57 prescriptions, accounting for 35.63%), cardiology (8 prescriptions, accounting for 5.00%) and general internal medicine (8 prescriptions, accounting for 5.00%). For example, when nitroglycerin tablets is prescribed, the route of administration is oral administration, oral nitroglycerin tablets have poor efficacy and low bioavailability, and must be taken under the tongue. If it is taken orally, the drug will be decomposed by the liver after being absorbed by the digestive tract, and cannot play a first-aid role. The correct usage should be sublingual to achieve the purpose of rapid onset.

Insulin Aspart 30 Injection is a low-premixed insulin analog with 30% insulin aspart and 70% protamine binding, which is closer to the release law of human physiological insulin, and can control blood sugar stable for 24 hours[12]. And it is more convenient to use in outpatient clinics, and it is the insulin injection those clinicians in our hospital choose more. Some doctors prescribe subcutaneous injections as oral or intradermal injections when prescribing these and other medications. This obvious error is not due to the lack of professional knowledge of physicians, but is caused by randomness, operational errors or negligence when prescribing electronically. Especially when prescribing high-risk drugs such as insulin, physicians should pay special attention to ensure the safety of patients' medication.

There were 12 prescriptions with unsuitable usage and dosage and unsuitable dosage form or route of administration at the same time, accounting for 0.93%, which were distributed among internal medicine of Traditional Chinese Medicine (7 prescriptions, accounting for 58.33%) and respiratory medicine (4 prescriptions, accounting for 33.33%)) and cardiology (1 prescription, accounting for 8.33%). For example, when a doctor prescribes insulin aspart 30 injections, he was negligent or improperly operated at first, and the subcutaneous injection was written as oral or intradermal injection. And then due to the patient's request to prescribe more drugs, 10-12 u Bid was written as 22u Tid, and the prescribed amount was increased by changing the number of doses.

4.3.3. Inappropriate indications

There were 5 unreasonable prescriptions with unsuitable indications, accounting for 0.39%, and only appeared in the department of internal medicine of Traditional Chinese Medicine. For example, doctors prescribe mecobalamin for patients. Although diabetic peripheral neuropathy is one of the most common complications to diabetes, mecobalamin can be used clinically as an adjuvant drug, but the clinical diagnosis is only diabetes, not specific to diabetic peripheral neuropathy. [13] This may be because some outpatient physicians only write one main diagnosis and do not indicate other comorbidities due to the large number of consultations, resulting in unreasonable prescriptions issued.

4.3.4. Repeated dosing

There were 2 unreasonable prescriptions for repeated administration, accounting for 0.15%, all of which occurred in internal medicine of Traditional Chinese Medicine. For example, metformin hydrochloride extended-release tablets and metformin hydrochloride tablets (two different dosage forms of one drug) are prescribed together in one prescription. This apparently unreasonable repeated drug use is not only due to the negligence of doctors, but also due to the laxness of pharmacy staff in reviewing prescriptions and failing to play a gatekeeping role. Although the number of occurrences is small, it should also be paid attention to.

4.3.5. Combination medication is not suitable

There were 2 prescriptions that were not suitable for combination medication, accounting for 0.15%. Distribution appears in internal medicine of Traditional Chinese Medicine and general internal medicine. For example, the doctor prescribed Metformin tablets 0.85g*20s and Atorvastatin Calcium tablets 10mg*28s. Relevant literature points out that statins should be used in patients with type 2 diabetes regardless of their blood lipid levels. The main reasons are that statins have vascular protection and reduce the occurrence of cardiovascular events in patients with diabetes [14]. However, the combination of metformin tablets and atorvastatin calcium tablets may lead to megaloblastic anemia [15]. Therefore,

ISSN 2618-1584 Vol. 4, Issue 10: 41-48, DOI: 10.25236/FMSR.2022.041008

this prescription is not suitable for combining to use. This may be because doctors do not know that the combination of the two is risky.

4.3.6. Unreasonable contraindications

There were 4 irrational prescriptions with contraindications and other irrational prescriptions, accounting for 0.31%. For example, a doctor prescribes metformin for elderly patients (over 80 years old). Metformin is contraindication in the elderly over 80 years old or with insufficiency of liver and kidney function. It is easy to cause severe lactic acidosis and should be avoided. At the same time, it should be used with caution in the elderly over 65 years old, and should be used in small doses. Considering that the renal function of the elderly has decreased, it is necessary to monitor their renal function[16]. In addition, aspirin is a commonly used drug for preventing cardiovascular events in the elderly, many doctors choose to prescribe it, but there is no evidence that the benefits outweigh the risks in the elderly over the age of 80, so it still needs to be used with caution [17]. This type of unreasonable prescription is rare, and mainly occurs in elderly patients who are older (over 80 years old). When choosing drugs, doctors should take into account the physical conditions of elderly patients, such as liver and kidney function, blood pressure, blood lipids, and cardiovascular diseases [18].

5. Conclusions

Through the statistical analysis of irrational prescriptions for the outpatient and emergency diabetic patients in our hospital, it is found that the phenomenon of irrational drug uses for diabetic patients in our hospital involves multiple departments. Special prescription reviews can be carried out for the departments with problems, especially the review and analysis of the main types of unreasonable prescriptions, so as reducing the number of unreasonable prescriptions and the rate of unqualified prescriptions. In addition, the hospital information system can also be improved on the aspects of hospitals, doctors, and pharmacists. When doctors issue electronic prescriptions, if the hospital information system can set up reminders of unreasonable drug use, it will greatly reduce the number of unreasonable prescriptions due to operational errors or negligence [19]; Strengthen the study of doctors' professional knowledge of diabetes' medication, especially for non-endocrinology doctors, and regularly organize relevant knowledge training; in addition, doctors should also pay attention when prescribing to improve the quality of prescriptions. As a pharmacist, it is more necessary to strengthen the study of professional knowledge of pharmacy, check the latest literature in time, learn about the latest developments in the field of rational use of diabetes. At the same time, it is also necessary to strengthen communication with clinicians, and timely feedback the occurrence or possible irrational drug use, so as reducing the occurrence of irrational prescriptions, thereby improving the level of clinical rational drug uses, and providing guarantee for the rational use of drugs by diabetic patients.

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