Research on utilization of Enteral Nutrition in China: current status and perspectives

by

SUO Sizhuo

Doctor of Philosophy in Biomedical Sciences

2019

Institute of Chinese Medical Sciences

University of Macau

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Abstract

The Medical Nutrition industry has been characterised as a growth industry with ample innovation opportunities. At the public policy level, sincemedical nutrition is considered of high societal value, defining industry boundaries may have an indirect public health benefit thereby reducing healthcare costs. As a result, there is often a mismatch between research driven by the interests of scientists, funders and powerful interest groups and the health needs of the population.

Despite the importance of enteral nutrition in hospitalised patients, current data on the pattern of enteral nutrition use in China is limited. This study aimed to identify the trends of enteral nutrition used in Chinese hospitals and to identify aspects warranting further research for improving enteral nutrition practice. Medical record from four Grade 3 Class A general hospitals in Guangzhou China in 2015 was analysed retrospectively. Patients hospitalised for more than 24 hours were included in this study. Patient characteristics, enteral nutrition products, admitted departments, and disease diagnosis was investigated.

To characterise the utilisation of enteral nutrition in Chinese hospitals from 2013 to 2017 from a national perspective. With the development of nutritional support, the sales volume and sales value of enteral nutrition in tertiary and secondary hospitals have been increasing and showed an upward trend in China from 2013 to 2017. There were noticeable differences in the average sales value of enteral nutrition in hospitals, which were the hospital-level difference and regional difference. Although there is a total of 15 domestic and 43 imported enteral nutrition approvals approved by the State Food and Drug Administration in China. However, three types of TPF, TPF-D and SP

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played a dominant role in the enteral nutrition market. The study of the causes of this "knowledge practice gap" has helped improve the quality of clinical practice. The questionnaire survey method to acquire physicians' opinions about how to improve enteral nutrition usage in China.

Currently, at the healthcare professional level, awareness concerning malnutrition and nutritional support is considered low. This directly influences patient perception since patients are informed about nutritional support possibilities by their healthcare professional. The majority of enteral nutrition use in the hospital in China has been shown to confine to a small number of products, departments and disease diagnosis, suggesting essential areas for future investigations about improving enteral nutrition practice in the hospital settings.

Keywords foods for special medical purpose, enteral nutrition formula, sectoral innovation system, China, industry innovation, nutrition economics, prescription pattern, hospital, policy

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Declaration

I declare that the thesis here submitted is original except for the source materials explicitly acknowledged and that this thesis as a whole or any part of this thesis has not been previously proposed for the same degree or a different degree.

I also acknowledge that I have read and understood the Rules on Handling Student Academic Dishonesty and the Regulations of the Student Discipline of the University of Macau.

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List of Abbreviations

AA	Amino Acid
EN	Enteral Nutrition
FSMP	Foods for Special Medical Purpose
MN	Medical Nutrition
SP	Short peptide
TP	Total protein
TPF	Total protein and fibre
TPF-T	Total protein and fibre, tumour
TP-MCT	Total protein, high medium chain triglyceride
TPF-D	Total protein and fibre, diabetes
TPF-DM	Total protein and fibre, diabetes mellitus
TP-HE	Total protein, heart diseases, empyrosis
TPSDA	Total protein, short peptide and amino acid
WHO	World Health Organization

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Chapter 1 Introduction

1.1 Research Background

Through the retrospective analysis of the development of China's foods for special medical purposes, we can find that there are three challenges in the event of foods for special medical purposes in China: First, the lack of scientific research support and evidence-based evidence of the status of insufficient evidence restricts the growth of the industry. Second, foreign-funded enterprises to dominate the market, local enterprises are facing barriers to entry. At present, foreign brands dominate the market, while the domestic brand products accounted for only about 10% of the market. Third, the current state-related policies, regulations and standards are inadequate, product approval, production and market regulation is deficient.

1.1.1 Definition

Foods for Special Medical Purpose (FSMP), or enteral nutritional products, are foods specially formulated and processed to meet the nutritional or dietary requirements of individuals who suffer from restricted food intake, absorption disorders, metabolic disorders or some other diseases. These products are entirely different from ordinary or functional foods in composition, physiological function or final effect. They must be taken alone or in combination with other foods under the guidance of a doctor or clinical nutritionist (Weenen, 2014).

FSMP, as a particular category of foods providing nutrients for people with diseases or special health conditions, are developed over time with medical development and social need change. Since the 1970s, the successful application of FSMP in clinical treatment has led many countries to establish relevant standards and supporting

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management policies (Schutz, 2006). Especially, since 2000, this product category has become a focus in the medical field, encouraging the rapid development of the industry globally. Early identification of malnutrition and nutritional support can effectively accelerate recovery from disease and shorten hospital stay (Neelemaat, 2014).

FSMP has been applied in China for more than 30 years. Its market has been continuously expanding. In particular, from 2004 to 2015, it has increased from 120 million RMB to 2 billion RMB. Since 2013, China's National Health and Family Planning Commission have issued a series of relevant standards, including G29922-2013 National Food Safety Standards: General rules for FSMP. The whole industry in China is still underdeveloped, however. Moreover, there is a lack of systematic research in this industry. Against this background, this paper, from the perspective of the industrial innovation system, analyses the current status of foreign and local FSMP companies in China and the development of local research institutions and policies, hoping to provide some suggestions on FSMP development in China.

1.1.2 Status of foreign FSMP companies in China

At present, several multinational companies are monopolising China's FSMP market, occupying more than 90% of the market share. Nutricia, SSPC, Abbott Laboratories, and Nestlé (as shown in Table 1.1) are the leading ones of them. These companies have launched 69 registered products in the China market, covering 19 categories, most of which are approved and labelled as drugs. Products sold in China were mainly researched and developed in the 1980s. Abbott's Ensure Complete has been legally tagged as FSMP complying with the new standards and is now being tentatively sold at selected points. Both Nutricia and SSPC have large production bases in Wuxi, Jiangsu, which also produce products sold in other countries, but their R&D

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departments are located outside China.

Table 1.1 Status of foreign FSMP companies in China

Company name	When entering China market	Ownership	Main products
Sino-Swede Pharmaceutical Company (SSPC)	1982	Joint venture	Fresubin Energey Fibre; Fresubin; Supportan; Fresubin 750 MCT; Fresubin Diabetes
Ajinomoto Co., Inc.	1984	Wholly foreign-owned	Elental
Novartis AG	1996	Joint venture	Impact
Abbott Laboratories S.A.	1998	Wholly foreign-owned	Jevity; Ensure; Glucerna; Ensure Complete; Pulmocare
Nutricia Pharmaceutical (Wuxi) Co., Ltd.	2000	Wholly foreign-owned	Nutrison Fibre; Diason; Stresson Multifibre; Peptisorb Liquid; Peptisorb; Nutrison; Nutrison MCT; Neocate
Nestle HealthCare Nutrition	--	Wholly foreign-owned	Vivonex; Nutren

1.1.3 Status of China's FSMP companies

China's FSMP companies (including Qingdao Haihui and Guangzhou Lehel, see Table 2 for a list of them) account for about 10% of the domestic market share. Their products are approved and labelled as "foods" and mainly used in the nutrition departments of hospitals. Currently, the local companies, due to their late entry into the industry, focus on producing products similar to those of foreign companies. They have only a small market share, few independent intellectual property rights, backward technologies, low investments and minimal brand influence. However, it should be mentioned that, since the release of the new national standards, some local companies have made some progress in their R & D of new products. For example, the new compound nutritional suspension and enteral nutritional suspension developed by Shanghai Daisy have been approved by China Food and Drug Administration (CFDA) as drugs with a therapeutic effect.

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Table 1.2 Status of representative Chinese FSMP companies

Company name	Founded in	Ownership	Main products
Qingdao Haihui Biochemical Pharmaceutical Co., Ltd.	1958	Limited liability company Privately owned	Compound nutritional suspension
Xi'an Li Bang Clinical Nutrition Co., Ltd.	1999	Company limited by shares	Leskon products for in-hospital patients
Shanghai Richen Nutritional Co., Ltd	1999	Company limited by shares	Richen complex nutritional supplements
Zhejiang Hailisheng Biotech Co., Ltd.	2000	Limited liability company Privately owned	Junjiangshan; Fish collagen polypeptide; Deep sea fish collagen – for hospitals
Guangzhou Enternutr Biotech Co., Ltd.	2008	Company limited by shares	Newjian composite protein powder; Homodiabet; Kangpuximai; Enternutr pepti; Enternutr Homogenate; Enternutr Whole; Jimian; Purouting; Niufutai; Jirou Banlv; Jirou; Jichang
Guangzhou Bossd Biotech Co., Ltd.	--	Directly owned by Sanjiu Enterprise Group	Junjiangshan; Trensine
Shanghai Daisy FSMP Co., Ltd.	2013	Company limited by shares	Dongzeping; Dongzeli

1.1.4 Status of products

FSMP may focus on providing specific nutrients such as amino acid, short-chain peptide or whole protein. They may also be balanced or disease-specific (for example, specific for diabetes, tumour, burn injury, liver disease or kidney disease).

In the domestic market, the FSMP products of foreign companies are mainly non-elemental diets with whole protein as the nitrogen source, such as Nutrison Fibre,

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Nutrison, Supportan, Fresubin Diabetes, and Ensure. There are also some short-chain peptide and amino acid products (including Elental, Stresson Multifibre, Peptisorb); and a few specific diets, such as Fresubin Diabetes, Diason, Fresubin 750 MCT, which are mainly developed for people with diabetes. The products of domestic companies mostly follow the pattern of those launched by foreign companies.

1.1.5 Status of research institutions

Some research institutions in Guangdong, Hubei, Zhejiang, Jiangsu, Shandong and Beijing, have carried out studies and product development for FSMP and made some progress. The R & D of FSMP by national organisations are still on the initial stage. FSMP products are mainly used to provide nutritional support for patients and are closely related to a clinical application. However, the data on clinical research and basic research related to FSMP in China are insufficient. More relevant studies are needed to determine whether the newly developed products are well suited for clinical application in Chinese patients.

Local companies have also begun to cooperate with research institutions. To give some examples, Guangzhou Lehel Clinical Nutrition Co., Ltd. is working with Sericulture, and Agricultural Products Processing Institute, Guangdong Academy of Agricultural Sciences, and Tianjin Zhon'en Technology Co., Ltd. is working with the Institute of Biophysics, Chinese Academy of Sciences.

Table 1.3 A list of FSMP research institutions

Location	Name	Research subject
Beijing	China National Center for Food Safety Risk Assessment	Study on standards and management of FSMP
Beijing	Beijing Institution of Nutritional Resources	Analysis and R & D of powder food for the particular medical purpose
Guangdong	Sun Yat-sen Memorial Hospital, Sun Yat-sen University	Effect comparison of clinical application of different FSMP

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Hubei	Wuhan Tallyho Biotech Co., Ltd Hubei Peptide Engineering Technology Research Center	Study on the application prospect of food-borne peptides in FSMP
Zhejiang	Beingmate Baby & Child Food Co., Ltd. Zhejiang Provincial Key Lab for Chem & Bio Processing Technology of Farm Product	Study on the standards of domestic and foreign FSMP for infants
Jiangsu	Wuxi Jiante Pharmaceutical Co., Ltd	Study on the interference and elimination of potassium and sodium in FSMP using flame atomic absorption spectrometry
Shandong	Baolingbao Biology Co., Ltd.	Study on the application of dietary fibre in FSMP
Shandong	Institute of Agro-Food Science and Technology, Shandong Academy of Agricultural Sciences	Current status of FSMP industry

1.1.6 Status of policies

The policy environment is closely related to the development of the medical food industry. Reviewing the evolution of systems associated with FSMP in China, we can find the following three stages (see Table 4):

The first stage (1970s-2000): Initiation

At this stage, with the development of the study of clinical nutrition, a preliminary understanding of the clinical effect and social value of FSMP began to form. For example, in 1974, there was a report on the clinical application of FSMP in Beijing. In the 1980s and 1990s, the unique position of nutrition as a discipline and profession in the medical and health care system was clearly stated [6].

The second stage (2002-2009): Gradually increased attention

In 2002, the Chinese Medical Association (CMA) first classified FSMP [7]. And government agencies also began to clarify their health insurance policies. In 2006, the

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China Nutrition Improvement Action Plan clearly specified the importance of proper nutrient consumption for health; and the Clinical Diagnosis and Treatment Guidelines - Parenteral & Enteral Nutrition developed a systematic guideline for parenteral & enteral nutrition, which can assist the physicians in identifying the appropriate nutritional support program and use related standard operating procedures based on patient's clinical conditions. During this period, the technical and functional requirements for FSMP were also clarified. And the problems caused due to unmatched policies have been pointed out. This stage provided a scientific basis for China to adjust further and improve its procedures for FSMP [8].

The third stage (2009-2015): Policy improvement

In the new Food Safety Law, the "food" identity of FSMP is clearly defined. In contrast, FSMP were previously registered and managed as chemical drugs according to the Drug Administration Law [9]. FSMP mainly serve as nutritional support and have no therapeutic effect, thereby not meeting the requirements for drug registration. Unmatched policies seriously affected the development of domestic FSMP products and hindered the entry of foreign products. To solve the problems raised by product development and clinical needs, the National Health and Family Planning Commission (formerly the Ministry of Health) proposed a "2+1" standard management system [10]. And China Food and Drug Administration (CFDA) also issued the Regulations on the Registration of FSMP (Trial) [11] to provide institutional guarantee and technical support for enhanced supervision, make regulations comply with both the laws and the actual needs of regulatory authorities and producers, better meet the fundamental needs of ensuring the quality and safety of FSMP, and clarify the requirements on registration, company's production capacity, clinical trials and so on.

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Table 1.4 A summary of policies related to FSMP in China

Issued in	Department	Name	Aims/impacts
The Mid-1980s	Ministry of Health	Opinions on strengthening clinical nutrition work	Provided for the development of nutrition and nutrition professionals and the research of clinical nutrition.
The Mid-1990s		Implemented the hospital grade assessment system	The clinical nutrition departments develop well as a department that must be set up in grade A Class 3 hospitals.
2002	Chinese Medical Association (CMA)	The first seminar on enteral nutrition classification	Proposed classification of enteral nutrition that was considered reasonable at the time
2004	Ministry of Labor and Social Security	The Department of Medical Insurance and the Department of employment injury Insurance under the Ministry of Labor and Social Security developed the list of drugs covered by the medical, employment injury and maternity insurance.	Enteral nutrition was classified as 7.2 enteral nutrition, class B
2006	Ministries and commissions under the order of State Council	China Nutrition Improvement Action Plan	It was clearly stated to properly guide the nutrient consumption, optimise the dietary structure, promote healthy lifestyles, improve the nutritional status of residents overall, and prevent diseases related to nutrition.
2006	Chinese Society for Parenteral & Enteral Nutrition, CMA	Clinical Diagnosis and Treatment Guidelines - Parenteral & Enteral Nutrition	Developed systematic parenteral & enteral nutrition guidelines to help physicians to identify appropriate nutritional support programs and their operational practices based on patient's clinical conditions.
2007	CFDA	Section 3 of Measures for the Administration of Drug Registration provided for drug registration	Most of the enteral nutrition products were registered as Type III drugs to be launched in the domestic market.
2011	Ministry of Health	National Food Safety Standards - Standards of Using Food Additives	First standards related to FSMP, which included FSMP under the category of foods (This demand was proposed by companies previously, but not approved.)
2012	Ministry of Health	National Food Safety Standards - Standards of Using Nutrition Fortifiers	FSMP was under the sub-category "special dietary foods". These standards specified the compounds that could be used in FSMP as nutrition fortifiers.
2013	National Health and Family Planning Commission (NHFPC)	National Food Safety Standards – Labeling Prepackaged Special Dietary Foods	These standards specified the definition and classification of special dietary foods. Products meeting the definition and classification should be labelled accordingly.
2010	Ministry of Health	General rules for FSMP for Infants	Provided for the requirements on nutrient content, labelling, etc. of FSMP for infants under the age of one.
2013	NHFPC	General rules for FSMP	Defined "applicable to individuals over

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			the age of one" and three categories of FSMP for individuals over the age of one as well as requirements on their nutrient content, pollutant, mycotoxins, microbial limits, etc.
2013	NHFPC	Good Market Practice for FSMP	It aimed to ensure the safety of FSMP and standardise the production of enterprises.
2015	National People's Congress	The PRC's Food Safety Law	Section IV Special Foods, Chapter IV Food Production and Management Articles 74, 80, 82, and 83 clarified the supervision and management of FSMP and related registration regulations.
2015	CFDA	Rules on the Registration of FSMP (Trial)	Provided for requirements on FSMP, and clarified requirements on registration, company's production capacity, clinical trials, etc.

1.2 Literature review

In recent years, as a blue ocean in the field of general health, more and more companies have begun to get involved in the field of special medical food. China's management of special medical formula foods has risen to the level of national strategy, from strict supervision in accordance with drug management methods to the implementation of special medical formula food registration systems, and the development of original medicines through the establishment of special medical food categories Supplementation, thereby expanding the audience, especially the release of the "Healthy China 2030 Plan Outline" has provided support for the development of the industry, China's large population base and the continuous increase in the overall demand for special medical products has brought new development opportunities. In addition, China is gradually entering an aging society. How to meet the nutritional needs of the elderly and improve their quality of life will be another opportunity and challenge for special medical food.

The core concept of the modern innovation system is the result of the interactive

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process, which involves many participants at the micro level. Many of these interactions are not only controlled by market forces, but also by non-market institutions. Because at a macro level, the efficiency of the interaction process depends on the behaviour of individual participants and the system of managing participants' interactions and collaboration issues. Research scholars mainly adopt historical comparative analysis methods and begin to adopt such systematic innovation ideas. Scientists who study traditional innovation systems (Freeman, 1987 Lundva Hill,1992) and scholars who study evolutionary theory (Metcalfe, 1988 Nelson and Winter, 1982) In their view, the innovation system is an ongoing process in which institutions (conventions and practices), learning, and networks play a central role in promoting innovation and technological change.

1.3 Research objective and Research Design

This study systematically reviews the data for enteral nutrition patent, and provide clarity surrounding the role of technology integration and development, aims to compare the development strategy in China of the leading companies and analyze a quintessential example should be cited that one kind of enteral nutrition innovation process, can assist the forecast of the development of enteral nutrition industry. Exploring medical nutrition firms' innovation and commercialisation strategy in China.

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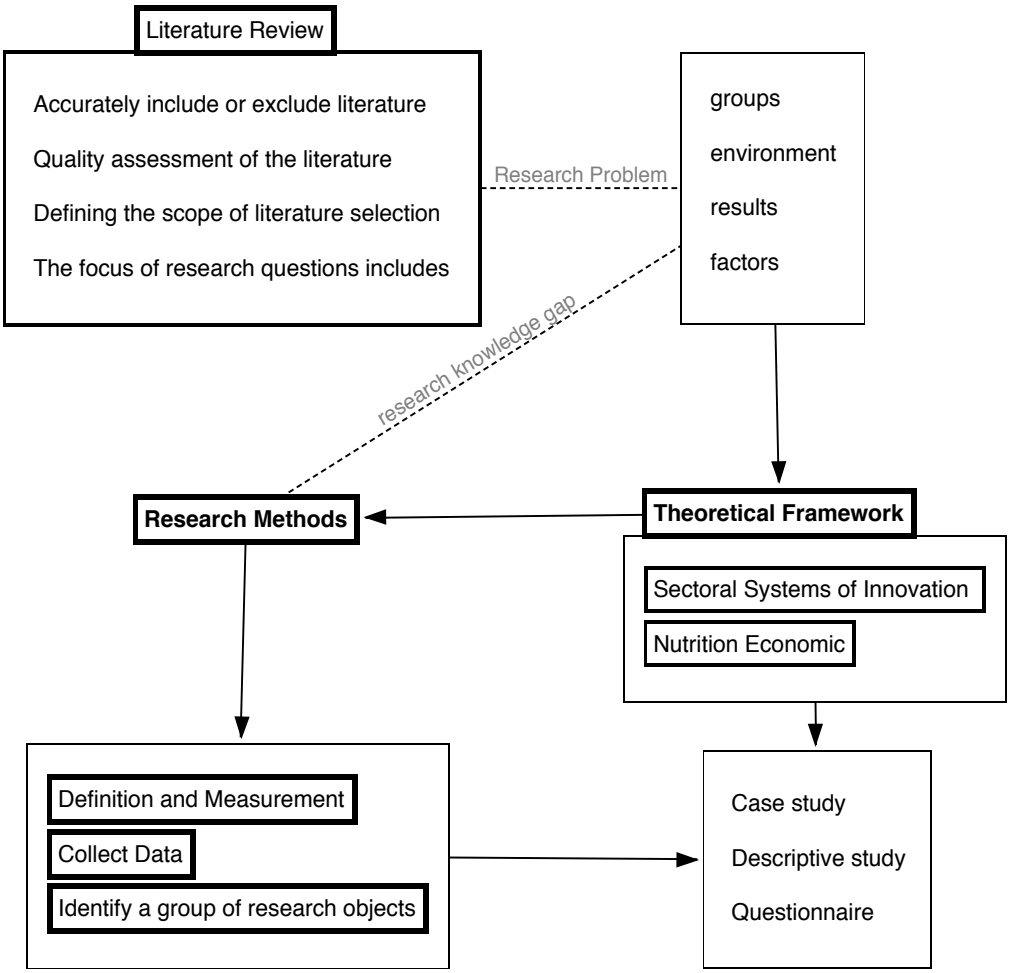

Figure 1.1 Research framework

In this research, at micro level, it analyses the clinical utilization characteristics at several Class A hospitals in Guangzhou City. At national level, the procurement data of enteral nutrition in different regions of China to give deeper understanding about utilization variation across China. Finally, the questionnaire survey method to acquire physicians' opinions about how to improve enteral nutrition usage in China. In general, the research presents a comprehensive picture about how enteral nutrition can be used to improve clinical outcomes in China.

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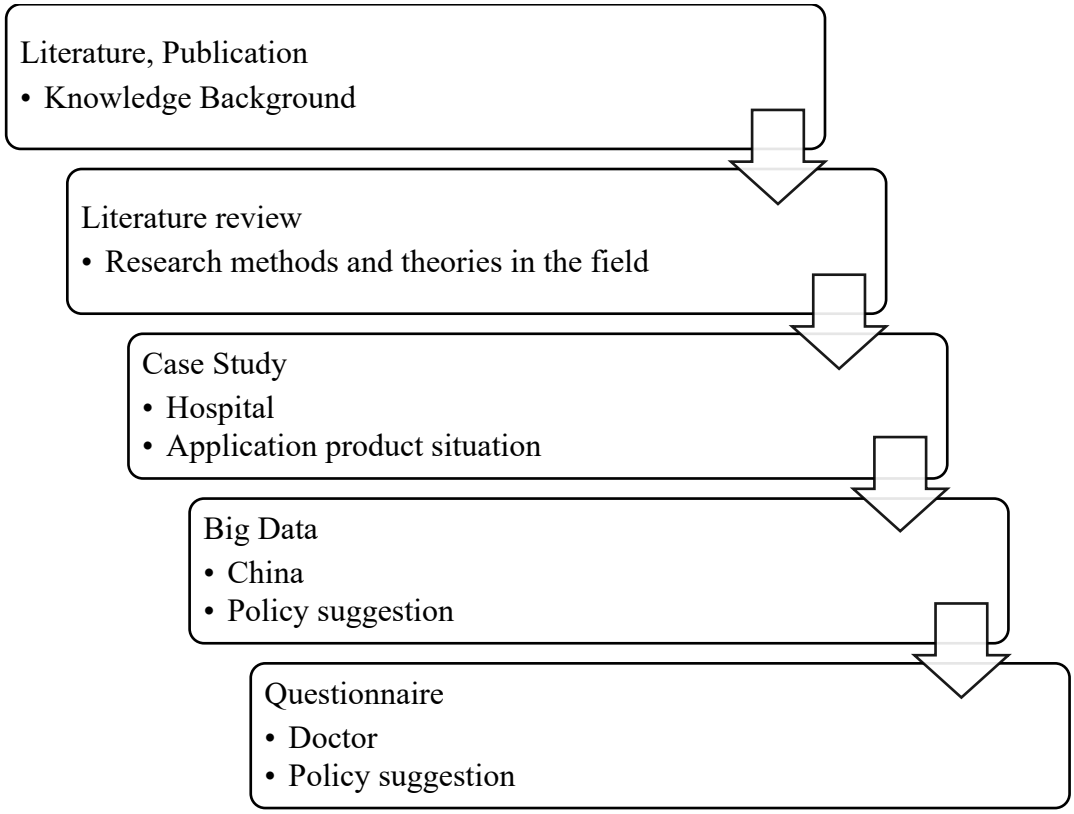

Figure 1.2 Conceptual framework

Therefore, this study conducts a comprehensive and systematic understanding of the types of special medical food products, key technologies for special medical food compliance research and development, regulations and standards, formula design and research and development processes. In the research process, it can be said that Witness the reform of Chinese companies facing the difficulty and challenge of registration approval in special medical foods; through key cluster sampling, using questionnaire interviews, big data analysis (deployed by 6 hospitals, provincial, university-affiliated) (sold at second and third levels) Medical institutions), mastered the application situation and influencing factors of special medical foods in hospitals, understood the hospital managers, doctors, and patients' cognitive attitudes and problems with special medical foods, to develop the special medical foods in the future, cultivate new formats, and explore The new growth momentum and development provide policy support and advice, which has positive significance for providing

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scientific management effectiveness.

1.4 Contribution of the study

According to the related laws and regulations of enteral nutrition, the research analyses the processes involved in the development and production of two types of products, the registration process and the clinical trial process. The research results of this dissertation provide meaningful help for pharmaceutical companies entering the business field of special medical formula foods, and companies concerned about the latest policy and regulatory trends of the special medical food industry to clarify compliance ideas.

This research was performed from the perspective of clinical utilization to make a depth analysis of the clinical characteristics, national utilization trend and the doctors' practice and opinions of enteral nutrition for the further development. Background and theoretical information were extracted through the literature and document review. The main framework of the field study was constructed. Descriptive analysis and statistical analysis were processed to investigate doctors' practice and opinions. Finally, reasonable conclusions and recommendations were provided based on the results of data analysis.

The inherent logic connection, strong literature foundation and credible data mining results proved the reliability of this research. This is the first study that provides systematic investigation about enteral nutrition utilization in China, which highlighted my contribution to clinical and academic research in this area.

1.5 Statement of originality

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This is to certify that the thesis is original and my own work, in which the content does not violate anyone's copyright, any idea, quotations and techniques except for methods made in standard references. Parts of this thesis have been published in the papers listed in publication sections. The thesis has not previously been submitted, in whole or in part, for any degree in any university or institution.

Journal articles in English

1. Suo, S., Lai, Y., Li, M., Song, Q., Cai, J., Zhao, J., ... & Hu, H. (2018). Phytochemicals, pharmacology, clinical application, patents, and products of Amomi fructus. *Food and chemical toxicology*, *119*, 31-36.

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Chapter 2 The Clinic Application of Enteral Nutrition in Guangzhou Tertiary Hospital: A Case Study

2.1 Introduction

Malnutrition is a critical condition for hospitalised patients. One is the cause of the disease, and the other is the consequence of the disease. The deterioration of malnutrition during hospitalisation will prolong the recovery time and increase medical expenses. Because the intestinal function and immune mechanism are related. Enteral nutrition (EN) is superior to parenteral nutrition, and enteral nutrition has lower risk and cost than parenteral nutrition. Providing enteral nutrition (EN) to patients to achieve targeted nutritional support in the hospital has been shown to benefit clinical outcomes, reduce hospital complications, and contain cost. Despite the importance of enteral nutrition in hospitalised patients, current data on the pattern of enteral nutrition use in China is limited. Thus, this study aimed to identify the trends of enteral nutrition used in Chinese hospitals and to identify aspects warranting further research for improving enteral nutrition practice.

With the development of clinical nutrition, in China, the medical staff of the top three hospitals undertake nutritional support and promote the development of nutritional support. As part of the development of health and wellness systems, enteral nutrition is developed primarily by national and international food and nutrition policies and is related to universal health. Improve health, reduce the social burden of caring for patients and reduce financial payments.

Malnutrition is a critical condition for hospitalised patients. One is the cause of the disease. One is the consequence of the disease. Malnutrition deteriorates during

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hospitalisation, which can prolong the recovery time and increase medical expenses. Previous studies have shown that enteral feeding is superior to parenteral nutrition because of the association between intestinal function and immune mechanisms, and intestinal feeding has lower risks and costs than parenteral nutrition.

The critical role of enteral nutrition support in various types of patients is a necessary intervention and influencing factors from nutritional status, the therapeutic effect on the quality of life. The study on enteral nutrition support classified according to the patient's disease, and the research mainly focused on cancer patients, critical patients, and burn patients. Organised according to the patient's critical condition, the study is primarily for critically ill patients in the ICU and advanced cancer. The research methods are mostly systematic evaluation related to clinical nutrition practice guidelines, comparative study of the clinical efficacy of enteral and parenteral, and meta-analysis of the clinical efficacy of nutritional support. In each study, enteral nutrition support overlaps with disease treatment and synergistically.

This study analyses the enteral nutrition prescription data of Guangzhou Sanjia Hospital to understand the clinical use of enteral nutrition in Chinese hospitals in actual situations, and to explore the factors affecting the development of enteral nutrition support. To make diet support a better part of the public health nutrition system.

The data analysis part of this paper combines econometric analysis and visualisation techniques to illustrate the demographic characteristics of patients using enteral nutrition in hospitals, and to analyse the relationship between the age and sex of patients and their length of hospital stay and consumption. Otherwise, This study analysis of the relationship between 11 kinds of enteral nutrition and patients from

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gender, age, department, medical insurance, payment, hospitalisation.

2.2 Method

2.2.1 Data source

This study is a retrospective study. Data were collected from four Grade 3 Class A hospitals in Guangzhou City, China. These four hospitals are the most leading medical institutions in Guangdong Province. The data was extracted from the health information systems of the four hospitals.

Two inclusion criteria were applied. First, all the patients who had been hospitalised for at least one day (≥24 hours). Second, the patient has been prescribed with EN. The data period was from January 1 to December 31 in 2015.

On January 1, 2015, the medical records used as enteral nutrition collected from four top three hospitals in Guangzhou (including their branches), and management data were retrospectively analysed. The study performed in patients who stayed in the inpatient department for at least one day (≥24H), including all age groups (0-103 years).

2.2.2 Measurements

Two parts of the information were measured: patient characteristics and medical information. The first part of patient characteristics includes gender, age and payment types. The second part of medical information consists of the length of hospital stay, medical departments hospitalised, disease diagnosis and enteral nutrition products prescribed.

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2.2.3 Data analysis

For data analysis, descriptive study was used to present the nature of patient characteristics and medical information. Number and percentage were analysed for continuous variables. All the data analysis was processed with SPSS 20.0 for Windows software.

The following information is extracted from the prescription data. The social demographic data includes the patient's age, gender, medical insurance mode, clinical variables including the primary diagnosis of the medical record, department, total amount, length of hospital stay, and usage of enteral nutrition.

Statistical analysis using Tableau and SPSS, descriptive results indicate patient characteristics and the use of enteral nutrition. The age of patients from 1 to 103 years old is divided into data groups of 10 years old, and the number of hospital days is grouped into "≤1", "1-2", "2-3", "3-4", and "4". -5" and ">5". The total amount is grouped by the same amount of 100 CNY, which is "<100", "100-199", "200-299", "300-399" and ">400". Qualitative and quantitative analysis of Pearson Chi-Square, Spearman's rho was performed using a chi-square test, and a two-sided test with $P < 0.05$ was evaluated statistically.

2.3 Results

2.3.1 Basic characteristics of patients and enteral nutrition prescriptions

The final dataset included 9,228 patients, as shown in Figure 1. The average age of patients was 64.34 years old. In terms of gender, there were 61.01% male patients and 38.99% female patients. The average hospitalisation stay was 40.43 days.

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As shown in Figure 1, there are four hospitals in the medical record data: Zhongshan First Hospital; Southern Medicine; Guangyi Yifu (plus a branch); and large overseas Chinese, during 2015, a total of 9,228 patients, 40,304 doctors. According to the chart ratio of enteral nutrition support in the four hospitals, there was a substantial difference between the number of prescriptions and the number of patients in the same year in 2015. To further understand the data of each hospital, the proportion of patients and medicines in the four hospitals showed a significant difference.

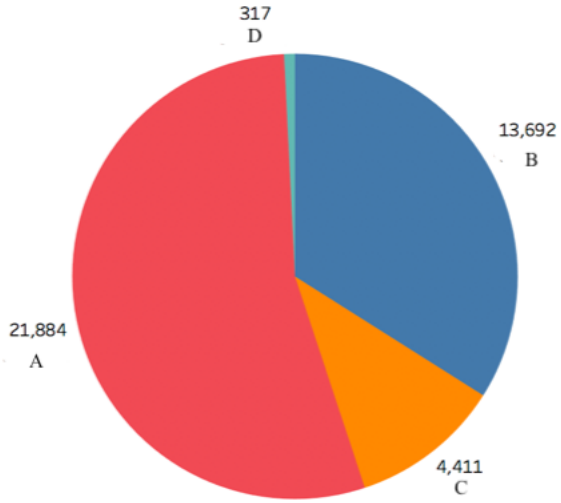

Figure 2.1 Patient number among the four sample hospitals

Overall, the analysis performed from 40,304 hospitalisation data. In 2015, the average age was 64.34 years, the minimum age was one year (including less than 1-year-old), and the maximum period was 103 years. The average number of hospital stays was 40.43, and the interval ranged from 1 to 630 days, of which 9 points were omitted. The unit price of enteral nutrition is from 40.40 to 99.45 CNY, and the average unit price of enteral feeding is 63.41, of which 7292 are insufficient information and are not in the count. In the total of 13,364 medical records, the total amount of each inpatient

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was from 41.40 CNY to 27,479.88 CNY, with an average cost of 259.64 CNY and a median of 71.26 CNY.

Table 2.1 Descriptive data collection age, length of hospital stay, unit price and charges

Title	Minimum	Maximum	Mean	Median	Percentiles	n		
					25	50	75	
Age(year)	1	103	64.34	67.00	14.00	24.82	43.82	40304
Number of days in hospital(day)	1	630	40.43	24.82	54.00	67.00	78.00	40295
Price(CNY)	40.40	99.45	63.41	67.36	50.34	67.36	71.26	33012
Expense (CNY)	41.40	27479.88	259.64	71.26	67.43	71.26	196.26	13634

2.3.2 Patient characteristics analysis

The total number of patients in this study was 9,228. As shown in Table 2, 5,630 male patients, accounting for 61.01%, and 3,598 female patients, accounting for 38.99%. The average age of male patients was 50.54 years, with a median of 50.5. The average age of female patients was 51.37 years, and the median age was 51.5. Respiratory medicine is the department with the most substantial number of male patients, and female patients are gastrointestinal surgery. After the age of 40, the number of patients increased rapidly and reached a peak at the age of 60 and then quickly fell back. The number of male patients in the interval between 40 and 60 is much higher than the number of female patients.

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Table 2.2 Characteristics of patients（ñ =9,228）

Characteristics	n (%)
Gender, n (%)	
Male	5,630 (61.01%)
Female	3,598 (38.99%)

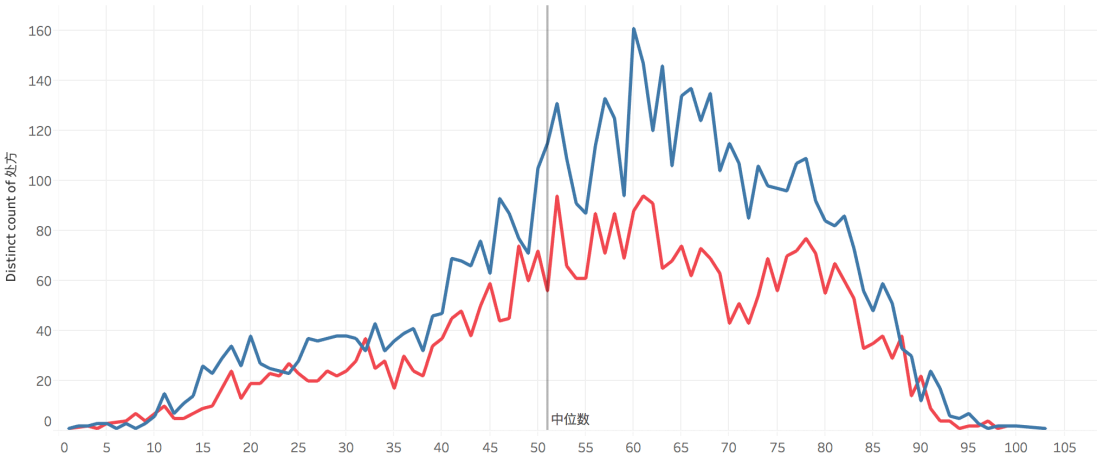

Figure 2.2 Characteristics of the patient's gender

2.3.3 Age analysis of patients

From the 40,304 hospitalisation data, the medical record of hospitalisation days was 37,985, accounting for 94.2%. The medical records with the total amount of expenditure per patient were 13,634, accounting for 33.8%. The age of 1 to 103 years old divided into ten groups of data at intervals of 10 years, and the number of hospitalisation days from 1 to 630 days was divided into six groups of data by week for analysis. As shown in the figure below, the data distribution showed a right-skewed distribution. The patients with a hospitalisation week of more than five weeks were mainly “60-69” and “70-79” years old.

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Table 2.3 Age Group and hospitalisation weeks

Age Group	hospitalisation weeks	Total					
	≤1	1-2	2-3	3-4	4-5	>5	
0-9	16	6	20	6	13	17	78
	20.50%	7.70%	25.60%	7.70%	16.70%	21.80%	100.00%
10-19	133	130	99	70	30	240	702
	18.90%	18.50%	14.10%	10.00%	4.30%	34.20%	100.00%
20-29	159	276	188	243	150	349	1365
	11.60%	20.20%	13.80%	17.80%	11.00%	25.60%	100.00%
30-39	219	376	299	196	179	754	2023
	10.80%	18.60%	14.80%	9.70%	8.80%	37.30%	100.00%
40-49	361	758	537	413	349	995	3413
	10.60%	22.20%	15.70%	12.10%	10.20%	29.20%	100.00%
50-59	641	962	848	811	544	1831	5637
	11.40%	17.10%	15.00%	14.40%	9.70%	32.50%	100.00%
60-69	849	1161	1409	818	655	3086	7978
	10.60%	14.60%	17.70%	10.30%	8.20%	38.70%	100.00%
70-79	708	1481	1291	1129	668	3364	8641
	8.20%	17.10%	14.90%	13.10%	7.70%	38.90%	100.00%
80-89	465	1208	1490	1160	724	2317	7364
	6.30%	16.40%	20.20%	15.80%	9.80%	31.50%	100.00%
90+	89	193	144	126	129	103	784
	11.40%	24.60%	18.40%	16.10%	16.50%	13.10%	100.00%
Total	3640	6551	6325	4972	3441	13056	37985
	9.6%	17.2%	16.7%	13.1%	9.1%	34.4%	100.0%

This study confirms the relationship between patient age and length of hospital stay and payment and uses Spearman's rho correlation coefficient analysis. Spearman's rho evaluated that any monotonic function can well describe the relationship between two variables, not the frequency of variables. Distribution is made for any assumptions. The P<=0.005 are shown as relevant.

Table 2.4 Case Processing Summary and Spearman's rho

	Cases	Correlation Coefficient			
	Valid	Missing			
	N	Per cent	N	Per cent	
Age * Hospitalization weeks	37985	94.2%	2319	5.8%	.038**
Age * Expenses	13692	34.0%	26612	66.0%	.054**

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In Figure 2.2, patients in different age groups are hospitalised for more than five weeks, and the number of patients in the interval between 60 and 90 years is significantly higher than that of other hospitalisations.

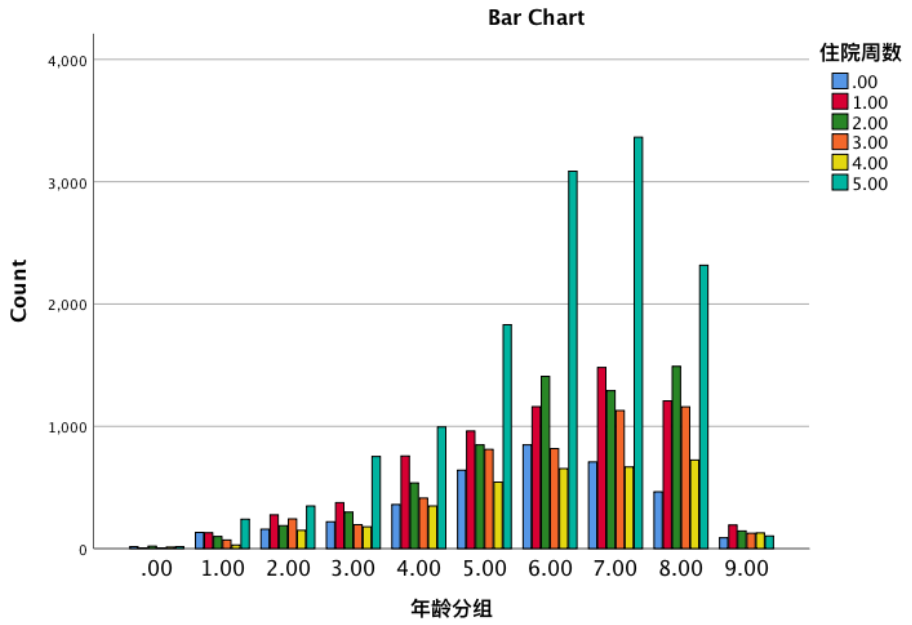

Figure 2.3 Age Group and hospitalisation weeks

Then, in the analysis of the relationship between patient age and payment, the total amount is grouped by the same amount of 100 CNY, and the proportion of records costing less than 100 CNY is 58.0%, which is significantly more than other data groups. The proportion distribution is in addition to "90+". Other age groups are more evenly distributed, with the “50-59” and “60-69” age groups spending the most. For the data group with the largest record of more than 400 CNY, the proportion of patients with "90+" was 27.2%. In fact, "80-89" accounted for 23.2%, and "10-19" accounted for 22.7%.

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Table 2.5 Age Group and Expenses Group

Age Group	Expenses Group	Total				
	<100	100-199	200-299	300-300	>400	
0-9	21	9	1	1	4	36
	58.3%	25.0%	2.8%	2.8%	11.1%	100.0%
10-19	244	70	32	21	108	475
	51.4%	14.7%	6.7%	4.4%	22.7%	100.0%
20-29	494	116	62	35	146	853
	57.9%	13.6%	7.3%	4.1%	17.1%	100.0%
30-39	639	193	79	14	116	1041
	61.4%	18.5%	7.6%	1.3%	11.1%	100.0%
40-49	1215	311	168	62	186	1942
	62.6%	16.0%	8.7%	3.2%	9.6%	100.0%
50-59	1633	449	229	81	276	2668
	61.2%	16.8%	8.6%	3.0%	10.3%	100.0%
60-69	1728	532	228	85	321	2894
	59.7%	18.4%	7.9%	2.9%	11.1%	100.0%
70-79	1222	368	164	85	283	2122
	57.6%	17.3%	7.7%	4.0%	13.3%	100.0%
80-89	641	282	104	49	325	1401
	45.8%	20.1%	7.4%	3.5%	23.2%	100.0%
90+	70	35	27	15	55	202
	34.7%	17.3%	13.4%	7.4%	27.2%	100.0%
Total	7907	2365	1094	448	1820	13634
	58.0%	17.3%	8.0%	3.3%	13.3%	100.0%

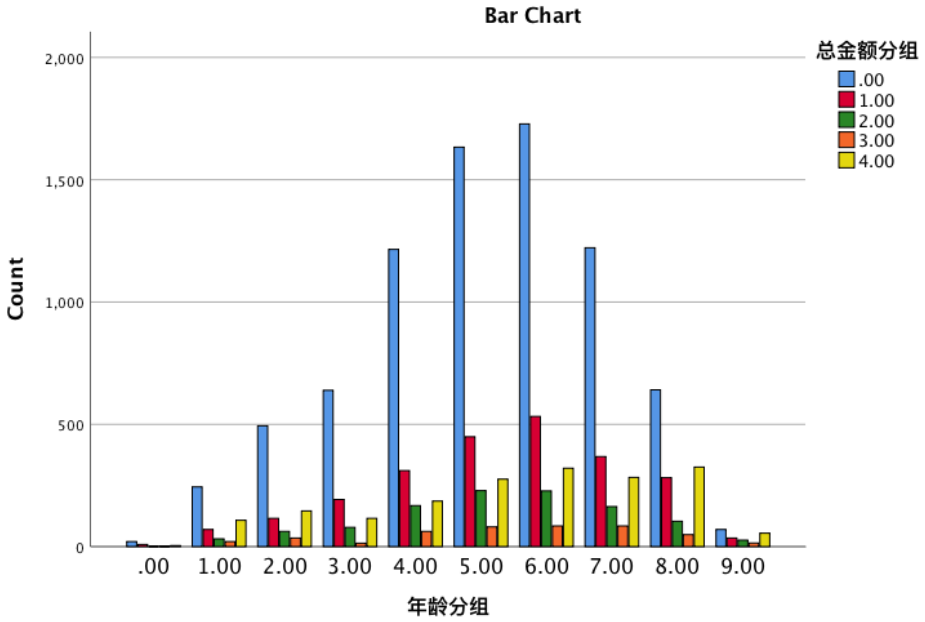

Figure 2.4 Age Group and the total amount of Group

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2.3.4 Patient gender analysis

In the data, 13,150 women were less than half of the 27,153 men, of which the number of women in the "0-9" age group was higher than that of the male case, while in the "60-69" "70-79" "80-89" age. The number of male cases in the group far exceeds the amount of female case.

Table 2.6 Gender and Age Group

	Age Group	Total										
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+		
Gender	Female	51	236	528	824	1261	2011	2683	2838	2448	270	13150
		0.4%	1.8%	4.0%	6.3%	9.6%	15.3%	20.4%	21.6%	18.6%	2.1%	100.0%
	Male	27	467	871	1218	2226	3874	5724	6535	5658	554	27153
		0.1%	1.7%	3.2%	4.5%	8.2%	14.3%	21.1%	24.1%	20.8%	2.0%	100.0%
Total	78	703	1399	2042	3487	5885	8407	9373	8106	824	40304	
	0.2%	1.7%	3.5%	5.1%	8.7%	14.6%	20.9%	23.3%	20.1%	2.0%	100.0%	

According to the gender and age grouping of the Chi-Square Tests patients, the number of hospitals stays and the total amount group was significantly correlated.

Table 2.7 Case Processing Summary and Chi-Square Tests

	Cases						Sig.
	Valid		Missing		Total		
	N	Per cent	N	Per cent	N	Per cent	
Gender * Age Group	40304	100.0%	0	0.0%	40304	100.0%	0.000
Gender * Hospitalization week	37985	94.2%	2319	5.8%	40304	100.0%	0.000
Gender * Expenses Group	13692	34.0%	26612	66.0%	40304	100.0%	0.000

In the figure below, it is shown that the number of male and female cases in the “0-39” age group is less than doubled, while the number of male cases in the “40-89” age

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group is much faster than the female case.

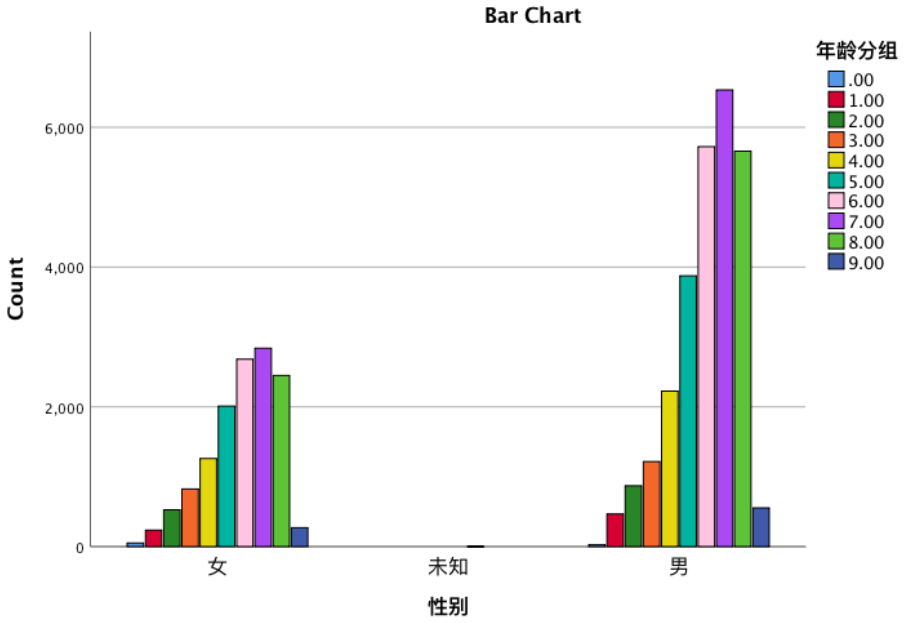

Figure 2.5 Gender and Age Group

The situation in the age group above can also be analysed in Table 2.8. The number of male cases over five weeks is up to three times the number of female cases.

Table 2.8 Gender and Hospitalization week

	Hospitalisation week	Total						
	<1	1-2	2-3	3-4	4-5	>5		
Gender	Female	1397	2482	2182	1855	1017	3535	12468
		11.2%	19.9%	17.5%	14.9%	8.2%	28.4%	100.0%
	Male	2243	4069	4143	3117	2424	9521	25517
		8.8%	15.9%	16.2%	12.2%	9.5%	37.3%	100.0%
Total	3640	6551	6325	4972	3441	13056	37985	
	9.6%	17.2%	16.7%	13.1%	9.1%	34.4%	100.0%	

As shown in the figure, the number of female cases showed a decreasing trend in the "1-5" week interval, and the male showed a decreasing trend in the "2-5" week interval.

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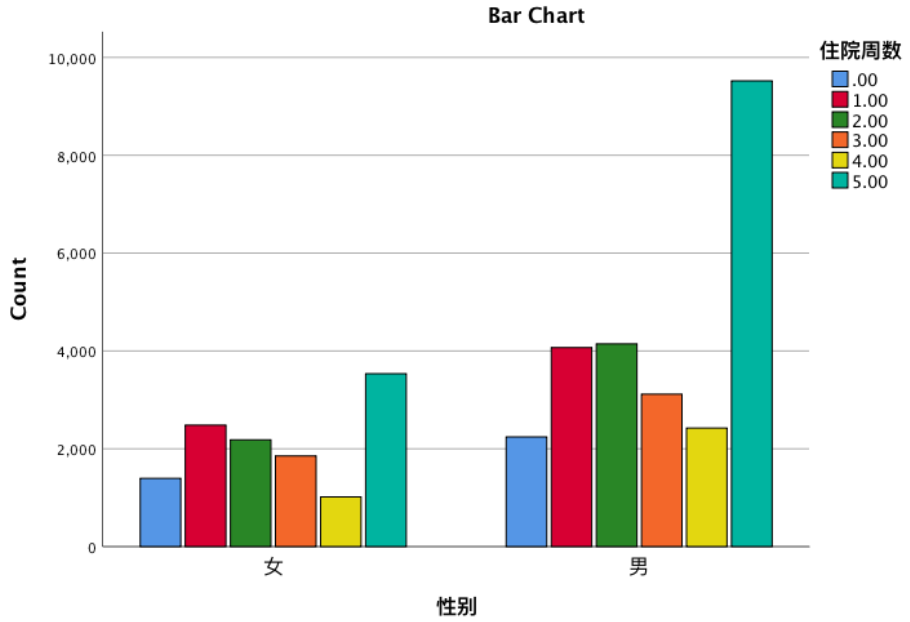

Figure 2.6 Gender and hospitalisation weeks

In the total amount group, the number of male and female cases is more than half of the expenditure of 100 CNY. Compared with the number of female cases, the proportion of male cases in the number of instances larger than one hundred CNY has gradually increased

Table 2.9 Gender and the total amount of Group

	Expenses Group （CNY）	Total					
	<100	100-199	200-299	300-300	>400		
Gender	Female	2902	851	370	138	564	4802
		60.1%	17.6%	7.7%	2.9%	11.7%	100.0%
	Male	5035	1534	732	310	1256	8832
		56.8%	17.3%	8.3%	3.5%	14.2%	100.0%
Total	7937	2385	1102	448	1820	13634	
	58.0%	17.4%	8.0%	3.3%	13.3%	100.0%	

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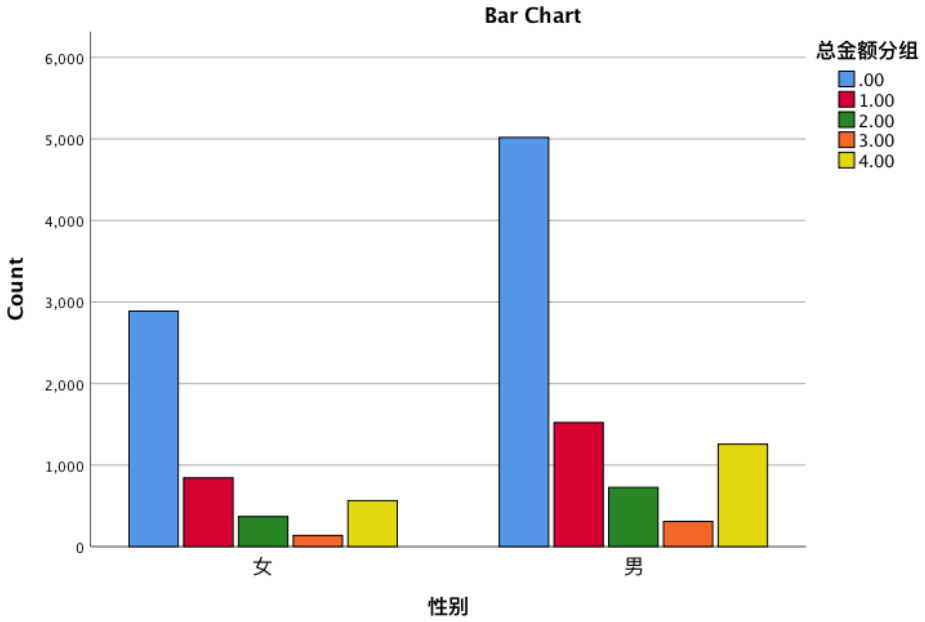

Figure 2.7 Gender and the total amount of Group

2.3.5 Analysis of enteral nutrition usage

A total of Ruigao emulsion, full-power suspension, Bapu Li suspension, Ansu powder, Ruining emulsion, Ruisu liquid, Ruidai emulsion, Yilijia, Ruixian, Jiawei body, Baipusu, 11 kinds of enteral nutrition preparation products, divided into liquid and powder, bottled and bagged, the specifications are mainly 500ml / bottle, the unit price is between 51 CNY and 108 CNY, the median is 67.36 CNY. Routes of administration include nasal feeding, oral administration, and others.

Table 2 uses a total of 11 kinds of enteral nutrition in four hospitals. Among them, Zhongshan No. 1 uses 7 types of enteral nutrition (SP Baipu Li, TP Ansu, TP Ruisu, TPF can entirely force, TPF-D Ruidai, TPF -T Ruineng, TP-HE Ruigao); Southern medicine has 4 kinds of enteral nutrition (TP Ansu, TPF can entirely force, TPF-D Rui, TPF-FOS Jiawei body); Enteral nutrition (TP Ansu, TP ruthenium, TPF Ruixian, TPF-D ruide, TPF-D Yilijia, TPF-T ruinen); JI Dahuaqiao has 6 kinds of enteral nutrition

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(TP Ansu, TPF can entirely force, TPF-D Ruidai, TPF-D Yilijia, TPF-T Ruineng, Baipusu). Ansu is the most commonly used enteral nutrition, but Yilijia and Jiawei are more than Ansu in two of the hospitals.

Table 2.10 enteral nutrition products prescribed

Product	Comment Name	Specification	Unit price	Dosage unit	Usage	Packing unit
Ruigao	TP-HE	500ml/per bottle	74.6430	ml	Nasal feeding / Oral administration	per bottle
Nengquanli	TPF	500ml/per bottle	51.8000 51.1470 81.05	ml	Nasal feeding / Oral administration	per bottle
Baipuli	SP	500ml/per bottle	108.0000 98.1280	ml	Oral administration	per bottle
Ansu	TP	400g/per bottle	67.4800 67.4270 67.36	g	Oral administration	per bottle
Ruineng	TPF-T	200ml/per bottle	49.8700 50.6520 49.82	ml	Nasal feeding / Oral administration	per bottle
Ruisu	TP	500ml	41.4000 41.3995	ml	Others / Nasal feeding / Oral administration	Per bag
Ruidai	TPF-D	500ml/bag	76.9000 71.2550 71.36	ml	Others / Nasal feeding / Oral administration	Per bag
Yilijia	TPF-D	500ml				
Ruixian	TPF	500ml				
Jiaweiti	TPF-FOS	500ml	59.49			
Baipusu		125g	79.09			

Representative companies include multinational companies such as Nestle, Abbott, Danone Nutricia, among which four companies, Abbott, Danone, Nestle, and Fresenius Kabi, occupy nearly 80% of the global market share, of which Abbott's global market share exceeds 30%. Ranked first in the industry. Such brands have formed strong brand advantages by virtue of their advanced technology and complete product range.

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Table 2.11 enteral nutrition products prescribed within each sampled hospital

Product	A Hospital		B Hospital		C Hospital		D Hospital	
	Number of prescriptions	%	Number of prescriptions	%	Number of prescriptions	%	Number of prescriptions	%
SP Baipuli	1692	12.36%						
TP Ansu	6613	48.30%	4758	21.74%	1351	30.63%	159	50.16%
TP Ruisu	610	4.46%	1449	6.62%				
TPF Nengquanli	2977	21.74%			518	11.74%	26	8.20%
TPF Ruixian			1738	7.94%				
TPF-D Ruidai	1022	7.46%	4198	19.18%	1125	25.50%	51	16.09%
TPF-D Yilijia			5554	25.38%				
TPF-FOS Jiaweiti					1417	32.12%	15	4.73%
TPF-T Ruineng	628	4.59%	4187	19.13%			57	17.98%
TP-HE Ruigao	150	1.10%						
Baipusu							9	2.84%

The results at Pearson Chi-Square showed that enteral nutrition was significantly associated with patient gender, age grouping, usage, department, health care style, total amount grouping, and the number of hospital stays.

Table 2.12 Case Processing Summary and Pearson Chi-Square

	Valid	Sig.	
	n	Percent	
Product * Gender	40304	100.0%	.000
Product*Age Group	40304	100.0%	.000
Product * Usage	40304	100.0%	.000
Product*Department	40304	100.0%	.000
Product*Medical insurance	40304	100.0%	.000
Product*Expenses Group	13692	34.0%	.000
Product*Hospitalization week	37985	94.2%	.000

2.3.6 enteral nutrition and patient gender

The following table shows that the proportion of male and female cases in each enteral

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nutrition is above and below the total percentage of 32.6% and 67.4%, except for Ruixian. Ruixian accounted for 15.5% of women's cases; male cases accounted for 84.5%, followed by Ruineng's gender ratio gap was slightly larger than the total proportion.

Table 2.13 enteral nutrition and Patient's Gender

Product	Gender	Total	
	Female	Male	
SP Baipuli	541 (32.0%)	1151(68.0%)	1692(100.0%)
TP Ansu	5142(39.9%)	7739(60.1%)	12881(100.0%)
TP Ruisu	786(38.2%)	1273(61.8%)	2059(100.0%)
TP-HE Ruigao	54(36.0%)	96(64.0%)	150(100.0%)
TPF Ruixian	269(15.5%)	1469(84.5%)	1738(100.0%)
TPF Nengquanli	1154(32.8%)	2367(67.2%	3521(100.0%)
TPF-D Yilijia	1825(32.9%)	3729(67.1%)	5554(100.0%)
TPF-D Ruidai	1747(27.3%)	4649(72.7%)	6396(100.0%)
TPF-FOS Jiaweiti	475(33.2%)	957(66.8%)	1432(100.0%)
TPF-T Ruineng	1151(23.6%)	3721(76.4%)	4872(100.0%)
Baipusu	6(66.7%)	3(33.3%)	9(100.0%)
Total	13150(32.6%)	27154(67.4%)	40304(100.0%)

2.3.7 enteral nutrition and Age group

Ansu is the most commonly used enteral nutrition, age-grouped as "0-9" "10-19" "20-29" "30-39" "40-49" "50-59" "60-69" "70-79" "80-89" "90+", including those with special nutritional needs under normal physiological conditions, such as pregnant women, elderly people, and people with special nutritional needs under pathological conditions, such as patients with severe diseases, patients with various diet-related chronic diseases, and surgery.

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Table 2.14 enteral nutrition and Age group

	Age group										
	0-9	Oct-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+	
SP Baipuli	0 0.00%	58 3.40%	122 7.20%	116 6.90%	324 19.10%	287 17.00%	372 22.00%	200 11.80%	194 11.50%	19 1.10%	1692 100.00%
TP Ansu	18 0.10%	381 3.00%	693 5.40%	1003 7.80%	1638 12.70%	2428 18.80%	2654 20.60%	2034 15.80%	1842 14.30%	190 1.50%	12881 100.00%
TP Ruisu	12 0.60%	34 1.70%	45 2.20%	98 4.80%	157 7.60%	346 16.80%	481 23.40%	546 26.50%	330 16.00%	10 0.50%	2059 100.00%
TP-HE Ruigao	0 0.00%	2 1.30%	18 12.00%	15 10.00%	25 16.70%	12 8.00%	32 21.30%	24 16.00%	18 12.00%	4 2.70%	150 100.00%
TPF Ruixian	0	0	13 0.70%	80 4.60%	23 1.30%	143 8.20%	219 12.60%	406 23.40%	834 48.00%	20 1.20%	1738 100.00%
TPF Nengquanli	11 0.30%	109 3.10%	253 7.20%	247 7.00%	463 13.10%	700 19.90%	769 21.80%	547 15.50%	363 10.30%	59 1.70%	3521 100.00%
TPF-D Yilijia	0	0	0	166 3.00%	98 1.80%	393 7.10%	1260 22.70%	1891 34.00%	1529 27.50%	217 3.90%	5554 100.00%
TPF-D Ruidai	5 0.10%	37 0.60%	101 1.60%	128 2.00%	378 5.90%	840 13.10%	1638 25.60%	1868 29.20%	1309 20.50%	92 1.40%	6396 100.00%
TPF-FOS Jiaweiti	26 1.80%	48 3.40%	97 6.80%	129 9.00%	178 12.40%	288 20.10%	296 20.70%	228 15.90%	106 7.40%	36 2.50%	1432 100.00%
TPF-T Ruineng	6 0.10%	33 0.70%	57 1.20%	59 1.20%	202 4.10%	446 9.20%	685 14.10%	1628 33.40%	1579 32.40%	177 3.60%	4872 100.00%
Baipusu	0 0.00%	1 11.10%	0 0.00%	1 11.10%	1 11.10%	2 22.20%	1 11.10%	1 11.10%	2 22.20%	0 0.00%	9 100.00%
Total	78 0.20%	703 1.70%	1399 3.50%	2042 5.10%	3487 8.70%	5885 14.60%	8407 20.90%	9373 23.30%	8106 20.10%	824 2.00%	40304 100.00%

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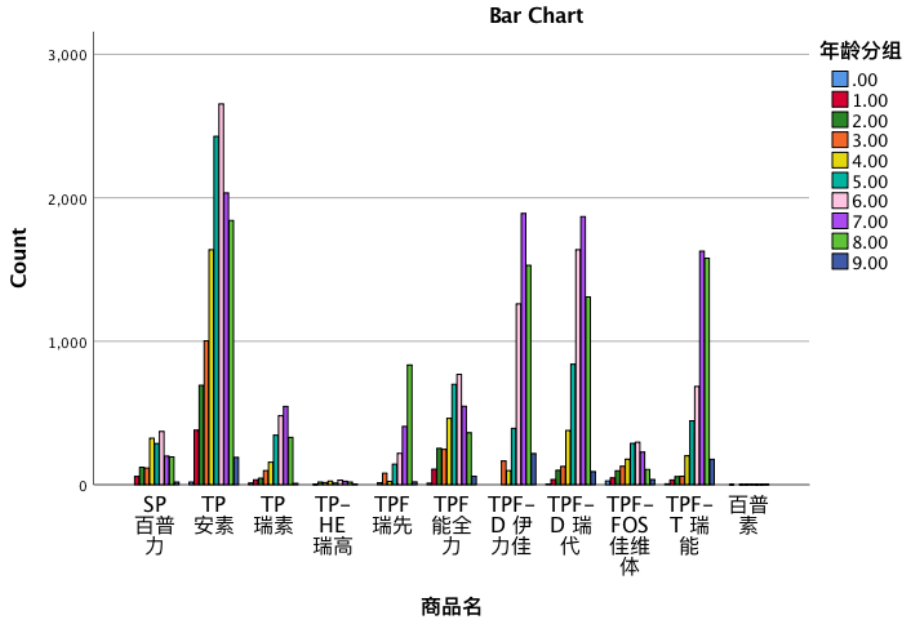

Figure 2.8 enteral nutrition and Age Group

2.3.8 Analysis of the route of administration of EN

Oral administration in the nutritional support route, tube feeding through the gastrointestinal tube (TF); and intravenous parenteral nutrition (PN), oral including oral nutritional supplements (ONS), mainly for nutrition Poor, in addition to dietary management products for specific diseases. In the prescription data, a total of 1298 kinds of diagnosis were diagnosed. The chief route of Ansu was oral, and other products were partial tube feeding.

Table 2.15 The route of administration of EN

Hospital	Oral administration	Nasal feeding	Gastric Tube Injection	Intestinal feeding
A Hospital	10,753	11,029		
B Hospital	6,913	4,746		1,728
C Hospital	1,429	769	2,096	
D Hospital	196	121		
Total	19,291	16,665		

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2.3.9 The relationship between the use of hospital enteral nutrition and the department (disease)

The original data has a total of 73 departments, first merged into 58, such as respiratory medicine 1-5 replaced by respiratory medicine

1) 14.42% in internal medicine department; 12.53% in severe medicine; 12.40% in respiratory medicine; 8.07% in neurology; 6.45% in thoracic surgery; 6.09% in gastrointestinal surgery; 5.02% in gastroenterology; Surgery 3.97%; general external severe disease 3.96%; nerve 2.63%; senile disease internal medicine 2.40%; colorectal surgery 2.37%; hepatobiliary surgery 2.00%; rectal anal fistula surgery 1.97%; emergency clinic 1.25%; biliary pancreatic surgery 1.24%; comprehensive 1.12 %; cardiovascular medicine 1.00%

2) Percentage of diagnosis using EN, pulmonary infection 10.20%; pneumonia 5.74%; chronic obstructive pulmonary disease 5.39%; interstitial pneumonia 2.58%; cerebral infarction 1.80%; aspiration pneumonia 1.21%; cerebral hemorrhage 1.13%; Cerebral infarction 1.12%; respiratory failure NOS1.08%; thoracic malignant tumor 1.01%; pneumonia, 0.95% due to inhalation oil; heart and lung transplantation status 0.93%; Parkinson's disease 0.93%; gastric cancer 0.88%; Crohn's disease 0.86%; Cerebral infarction sequelae 0.84%; coronary heart disease 0.81%; severe pneumonia 0.75%; rectal cancer 0.57%; hemorrhoids 0.56%

3) The five products except Ansuo are used in 29 departments. Yilijia is the most used, mainly for respiratory medicine and severe diseases. Secondly, Ruidai is also mainly used for respiratory medicine. Ruixian is mainly used in neurology, and a resin is mainly used in respiratory medicine and neurology. Ruineng is mainly used for

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internal medicine synthesis.

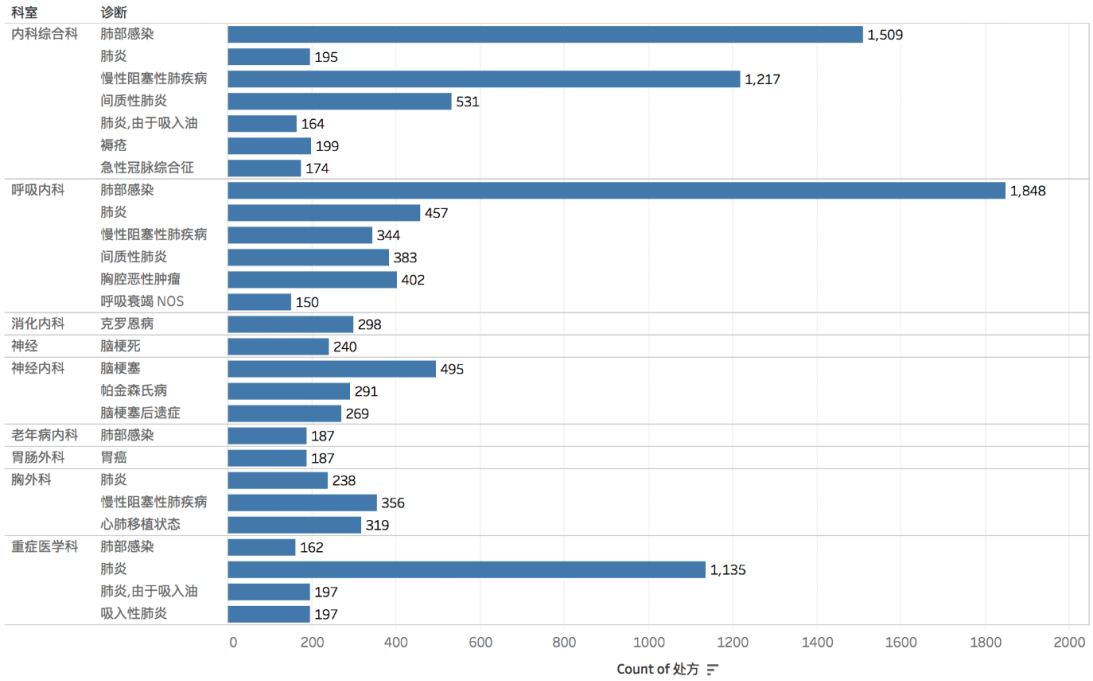

Figure 2.9 Diagnostic proportion of department

The screening method was to select a diagnosis result of more than 150 prescriptions, a total of 27. According to the top five departments, the largest to the smallest is the Department of Internal Medicine, Severe, Respiratory Medicine, Neurology and Thoracic Surgery.

1) The internal medicine mainly uses Ruineng and Ruidai. The severe cases mostly use Ruidai, Yilijia and Quanquan. The respiratory medicine mainly uses Yilijia, Ruidai and Ansu. The neurology department mainly uses Ruixian, Ruisu and An. Prime, thoracic surgery primarily uses Yilijia, Ruixian and Ruidai.

2) Ansu is used more in other departments, especially gastrointestinal surgery and gastroenterology.

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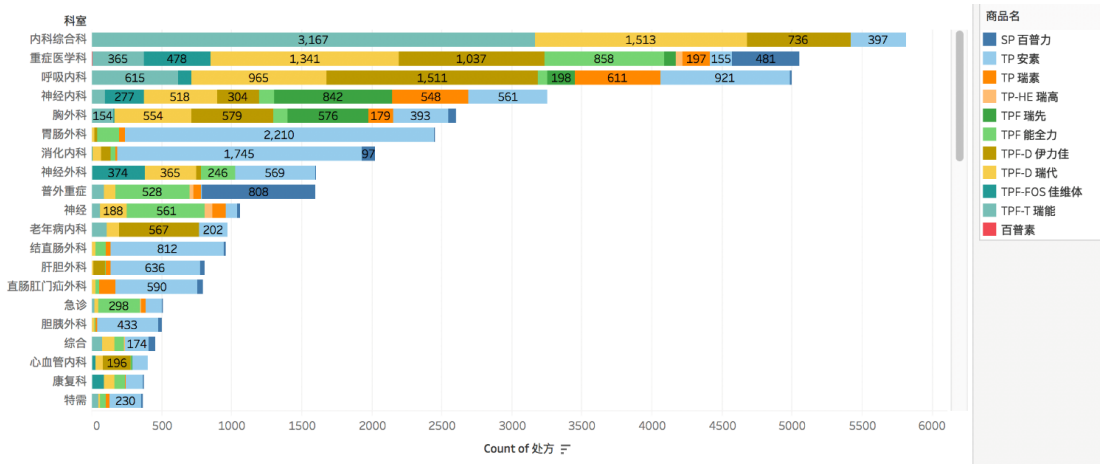

Figure 2.10 Use of enteral nutrition products in departments with prescriptions (≥ 150)

2.3.10 Payment cost analysis of EN

Ansu mainly uses the records with a total amount of less than 100 CNY, and the files with a total amount of more than 400 CNY are primarily utilized for full force and Ruidai.

Table 2.17 enteral nutrition and Expenses Group

	Expenses Group	Total				
	<100	100-199	200-299	300-300	>400	
SP Baipuli	664	467	233	101	227	1692
	39.2%	27.6%	13.8%	6.0%	13.4%	100.0%
TP Ansu	5300	506	391	87	329	6613
	80.1%	7.7%	5.9%	1.3%	5.0%	100.0%
TP Ruisu	348	105	42	24	91	610
	57.0%	17.2%	6.9%	3.9%	14.9%	100.0%
TP-HE Ruigao	39	33	29	9	40	150
	26.0%	22.0%	19.3%	6.0%	26.7%	100.0%
TPF Nengquanli	1109	928	208	132	600	2977
	37.3%	31.2%	7.0%	4.4%	20.2%	100.0%
TPF-D Ruidai	313	195	120	49	345	1022
	30.6%	19.1%	11.7%	4.8%	33.8%	100.0%
TPF-T Ruineng	164	151	79	46	188	628
	23.5%	23.0%	12.5%	8.1%	33.0%	100.0%
Total	7937	2385	1102	448	1820	13692
	58.0%	17.4%	8.0%	3.3%	13.3%	100.0%

As shown in the figure below, Ansu has used many leaders in the case of less than 100

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CNY, and the other ones are more powerful.

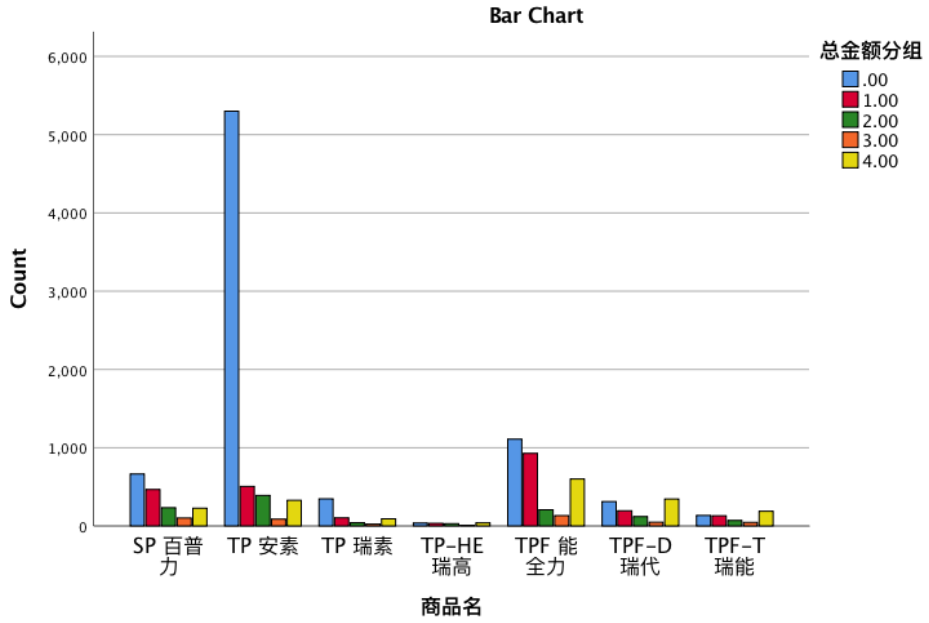

Figure 2.11enteral nutrition and Expenses Group

2.3.11 Medical insurance analysis of EN

Only four hospitals have data on health care.

1) Types of medical insurance include medical insurance, self-pay, public fees, etc.

2) "Other" items involve employees in various districts, Gaogan (5%-20%), and multiple types of insurance including medical insurance, commercial insurance, maternity insurance, new rural cooperative medical insurance, agricultural, medical insurance, migrant workers' insurance, specialised medical care, etc.

Table 2.18 Counting statistics for medical insurance choices

Medical Insurance Methods	Number of prescriptions	%	Number of patients	%
Medical Insurance	27,559	68.92%	5,745	64.47%
Self-pay	7,117	17.80%	1,654	18.56%

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Others	3,673	9.19%	1,393	15.63%
Public fee	1,638	4.10%	161	1.81%

2.3.2.7 enteral nutrition and length of hospital stay

Patients who were hospitalised within two weeks mainly used ANSUL, and patients who were hospitalised for more than five weeks primarily used Yilijia, Ruidai and Ansu.

Table 2.19 enteral nutrition and Hospitalization week

	Hospitalization week	Total					
	<1	1-2	2-3	3-4	4-5	>5	
SP Baipuli	69	116	249	245	214	799	1692
	4.1%	6.9%	14.7%	14.5%	12.6%	47.2%	100.0%
TP Ansu	1912	3015	2501	1750	1027	2100	12305
	15.5%	24.5%	20.3%	14.2%	8.3%	17.1%	100.0%
TP Ruisu	231	347	379	276	180	528	1941
	11.9%	17.9%	19.5%	14.2%	9.3%	27.2%	100.0%
TP-HE Ruigao	8	33	23	29	20	37	150
	5.3%	22.0%	15.3%	19.3%	13.3%	24.7%	100.0%
TPF Ruixian	36	160	192	104	68	1021	1581
	2.3%	10.1%	12.1%	6.6%	4.3%	64.6%	100.0%
TPF Nengquanli	389	558	527	488	382	1171	3515
	11.1%	15.9%	15.0%	13.9%	10.9%	33.3%	100.0%
TPF-D Yilijia	207	672	832	471	319	2624	5125
	4.0%	13.1%	16.2%	9.2%	6.2%	51.2%	100.0%
TPF-D Ruidai	375	788	686	756	708	2623	5936
	6.3%	13.3%	11.6%	12.7%	11.9%	44.2%	100.0%
TPF-FOS Jiaweiti	88	194	230	226	176	518	1432
	6.1%	13.5%	16.1%	15.8%	12.3%	36.2%	100.0%
TPF-T Ruineng	325	668	703	624	347	1632	4299
	7.6%	15.5%	16.4%	14.5%	8.1%	38.0%	100.0%
Baipusu	0	0	3	3	0	3	9
	0.0%	0.0%	33.3%	33.3%	0.0%	33.3%	100.0%
Total	3640	6551	6325	4972	3441	13056	37985
	9.6%	17.2%	16.7%	13.1%	9.1%	34.4%	100.0%

As shown in the figure below, in the shorter period of hospital stay, the number of prescriptions for ANSUL is significantly higher than that of other enteral nutrition. Among the number of orders for more than five weeks of hospitalisation, Yilijia and Ruidai were the most, followed by Ansu and Ruineng.

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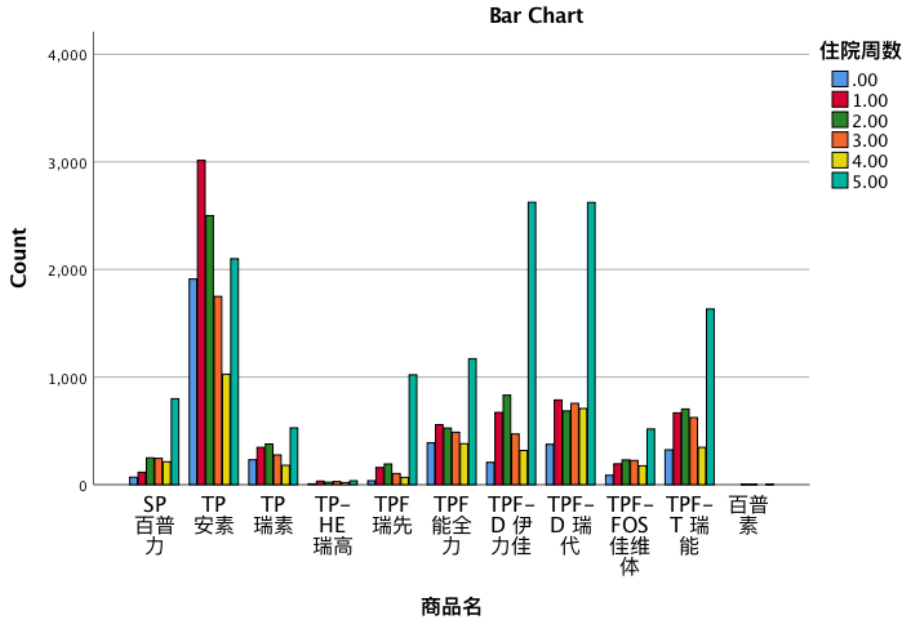

Figure 2.12 Enteral nutrition and Hospitalization week

2.4 Chapter summary

The majority of enteral nutrition prescriptions in the four Grade 3 Class A hospital studied has been shown to confine to a small number of products, departments and disease diagnosis, suggesting important areas for future investigations about improving enteral nutrition practice in the hospital settings.

Among 9,228 patients, 61.01% were male and 64.47% had health insurance. The patients aged from 0 to 103 with a mean (SD) of 63.34 (14) years. The hospitalization duration ranged from 1 to 630 days with a mean (SD) of 40.43 (54) days. The total number of enteral nutrition prescriptions was 40,304. The ratio of patient number and enteral nutrition prescription among these 4 hospitals ranged from 1:1 to 1:10.24. A total of 11 enteral nutrition products were identified, 2 of which were used by all 4 hospitals representing 31.96% and 15.87% of the overall enteral nutrition usage respectively. The departments responsible for the greatest enteral nutrition use were

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Internal Medicine (14.42%), Critical Care (12.53%) and Respiratory (12.40%). Among the patients prescribed with EN, 10.20%, 5.74% and 5.39% were diagnosed with lung infection, pneumonia and COPD respectively. enteral nutrition was mostly administered orally (48.49%) and via nasal feeding (41.89%).

According to the proportion of the four hospitals supported by enteral nutrition, the number of prescriptions and the number of patients were significantly different in 2015. Four hospitals use a total of 11 kinds of enteral nutrition, including A hospital using seven kinds of enteral nutrition; B hospital has six kinds of enteral nutrition; C hospital has four kinds of enteral nutrition; D hospital has six kinds of Enteral Nutrition. Enteral nutrition usage classified "oral and nasal feeding", from the overall view, the proportion of oral use of oral nutrition is higher than nasal feeding. Which A hospital and C hospital use nasal feeding ratio slightly higher than oral.

It is worth noting that the findings from this research was based on the data from 4 Grade 3 Class A hospitals in Guangzhou City. It does not reflect the enteral nutrition prescriptions in lower level hospitals and primacy health cares. In addition, it cannot represent the enteral nutrition practice in other provinces in China, especially considering the vast economic deviations among regions. Future study should further investigate enteral nutrition utilization at different medical institutions in different regions in China.

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Chapter 3 National utilization trend of enteral nutrition in Chinese hospitals: 2013-2017

3.1 Introduction

Clinical nutrition support is generally considered to provide energy and nutrients through oral, enteral or parenteral routes for patients who cannot obtain adequate nourishment by eating or drinking. Nutrition support is divided into parenteral nutrition (PN) and enteral nutrition (EN), containing protein, glucose, lipids, vitamins, minerals.PN is a liquid mixture which is delivered intravenously. enteral nutrition is oral nutrient supplementation or tube feeding, which is given various nutrients into stomach or small bowel. A retrospective review showed that the benefits of choosing enteral nutrition over PN in different patient populations, and nutrition clinicians believe that enteral nutrition is preferable to PN. A study about an assessment of nutritional prescriptions from 59 hospitals in China showed that there were marked differences, such as regional, departmental and disease-based differences between PN and enteral nutrition.

In China, a nation-wide nutrition screening survey in 2012 was conducted on elderly patients in hospital using the Mini Nutrition Assessment - Short Form (MNA-SF) by the Chinese Medical Association Nutrition Support Group for Geriatric Patients, showing that the risk of malnutrition elderly patients in hospital was high at 50.1%, and the actual malnutrition rate was 15.1%. Therefore, the Chinese Medical Association's Group of Geriatric Nutrition Support suggests applying enteral nutrition support to improve the clinical status of elderly patients and result in reduced mortality, shorter hospital stays and lower medical costs. Also, a study based on a standard nutrition screening and enteral nutrition protocol in a tertiary children's center in China

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in 2012 showed that early implementation of the standard enteral nutrition protocol led to shortening the length of hospital stay and reducing overall care costs for hospitalized children with common gastrointestinal diseases.

However, enteral nutrition use also faces some challenges. In particular, many people who need enteral nutrition are suffering from neurological conditions, such as stroke and dementia which may impact on swallowing reflexes. In order to improve the safe and effective of patient care of EN, the American Society for Parenteral and Enteral Nutrition (ASPEN) published the *Guidelines for the Use of Parenteral and Enteral Nutrition in Adult and Pediatric Patients* in 2002. To guide appropriate use of enteral nutrition in China, in 2011, two guidelines, the *Indications Consensus of Enteral Nutrition in Patients with Neurological Diseases* and the *Practices Consensus of Enteral Nutrition in Patients with Neurological Diseases* were published. Some guidelines were introduced in the sequent years.

But the real-world use of enteral nutrition is varied from the guidelines. A study conducted by the Chinese Society for Parenteral and Enteral Nutrition showed that only seven of the ten guidelines for enteral nutrition practices were in good compliance in China's tertiary hospitals. Other studies have also found that enteral nutrition is not standardized, and there may be differences in hospital grades. However, existing literature data is concentrated in a single or limited number of hospitals, and there is no report on the use of enteral nutrition throughout China.

Thus, this study aimed to characterize national utilization trend of enteral nutrition in Chinese hospitals during 2013 to 2017. It is expected the research findings could generate evidence to optimize utilization of enteral nutrition in China.

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3.2 Methods

3.2.1 Data source

Table 3.1 Distribution of enteral nutrition sample hospitals

	Number of secondary hospitals	Number of tertiary hospitals
Eastern region	694	602
Central region	141	182
Western region	80	101
Total	915	885

3.2.2 Measurement

As of June 28, 2018, a total of 15 domestic and 43 imported enteral nutrition approvals were approved by the State Food and Drug Administration. According to the monitoring data of the national sample hospitals, a total of 54 sample enteral nutrition products include 14 domestic and 40 imported enteral nutrition products. The sample product coverage rate reached 93% (see Appendix 1).

3.3 Results

3.3.1 Yearly trend

From 2013 to September 2017, the sales volume and sales value of enteral nutrition at tertiary and secondary hospitals in China showed ascendant trend, and there were fluctuations in sales volume and sales value of EN. By September 2017, the sales volume of enteral nutrition reached 13.95 million units, and the sales value of enteral nutrition was 950 million CNY.

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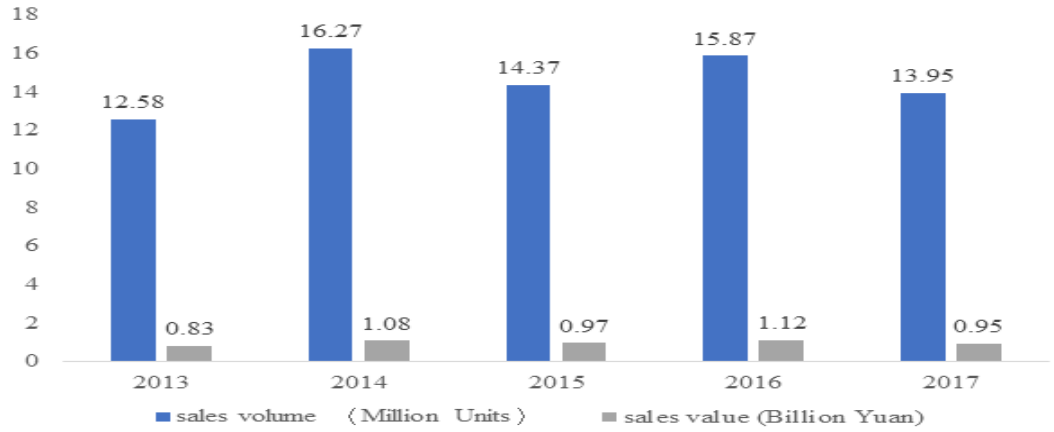
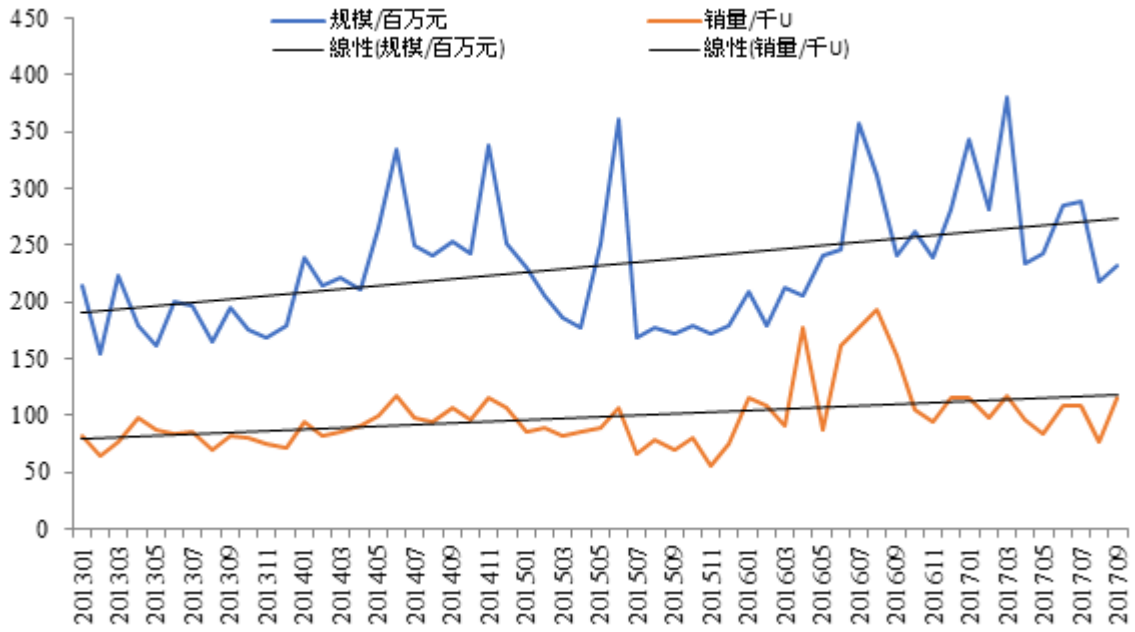


Figure 3.1 Total sales and sales of enteral nutrition hospitals (level Two and level three hospitals)

January-September 2017

3.3.2 Monthly trend

The monthly sales volume and sales of enteral nutrition in tertiary and secondary hospitals showed upward trend. In May 2014, the sales value of enteral nutrition increased significantly. In March 2016, the sales volume of enteral nutrition increased markedly. Subsequently, the sales volume of enteral nutrition decreased in November



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2016.

Figure 3.1 Monthly sales of enteral nutrition

3.3.3 Distribution of individual varieties

Among various ENs, enteral nutrition suspension (TPF) played a leading role, its market share was 22.0% and market size reached 207 million CNY, followed by enteral nutrition emulsion (TPF-D) and enteral nutrition suspension liquid (SP), with market share of 16.7% and 15.1%, and market size of 157 million CNY and 143 million CNY respectively. These three types of enteral nutrition accounted for more than 50% market share of the enteral nutrition market. The compound growth rate of TPF was the highest, which was 24.1%. The compound growth rates of enteral nutrition suspension (TPF-DM) and enteral nutrition suspension (MCT) were 21.6% and 20.2%, respectively.

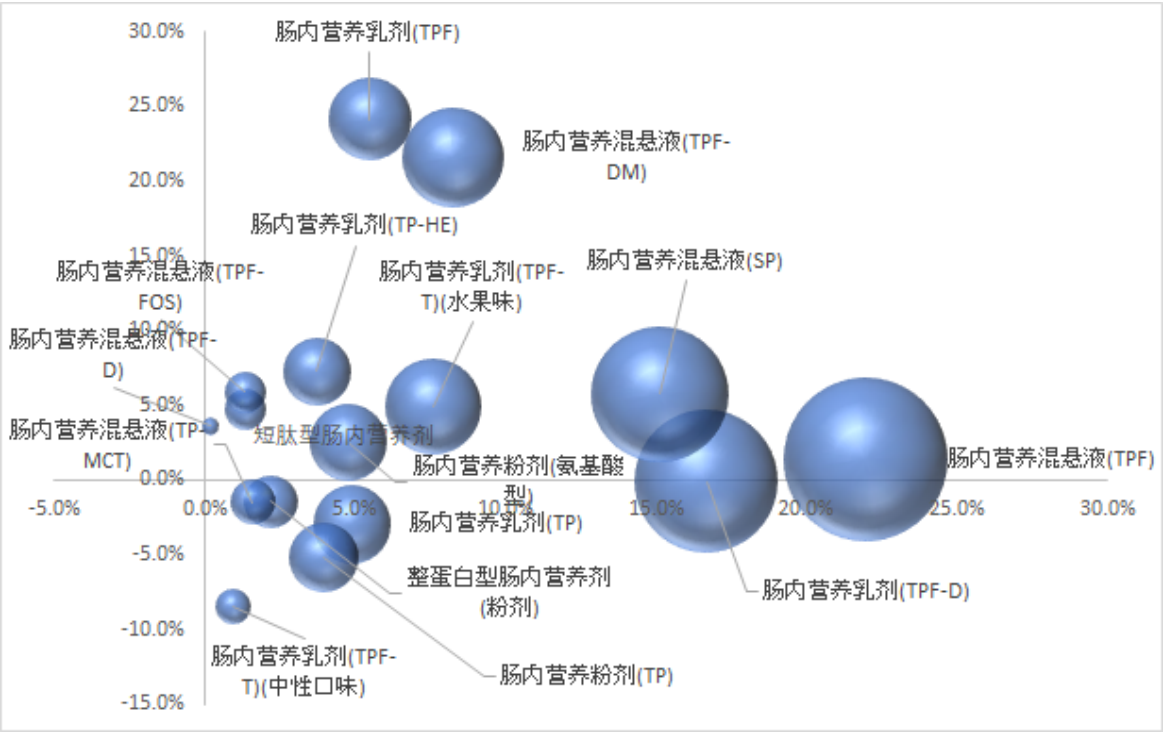

Figure 3.3Enteral nutrition market share accounted bubble chart

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3.3.4 Statistical comparison of the average sales of individual tertiary and secondary hospitals

From 2013 to September 2017, the proportion of sales value of enteral nutrition in secondary and tertiary hospitals remained stable. The proportion of sales value of enteral nutrition in tertiary hospitals was about 87%, and the proportion of sales value of enteral nutrition in secondary hospitals was about 10% and decreased year by year. The proportion of sales volume of enteral nutrition in secondary and tertiary hospitals was the same as the proportion of sales value of EN. The proportion of sales volume of enteral nutrition in tertiary hospitals account for approximately 86%, and the proportion of sales volume of enteral nutrition in secondary hospitals account for approximately 10% and also decreased year by year. As of September 2017, the proportion of sales value and sales volume of enteral nutrition in tertiary hospitals accounted for 89.60% and 89.28%, the proportion of sales value and sales volume of enteral nutrition in secondary hospitals accounted for 10.4% and 10.72%, respectively.

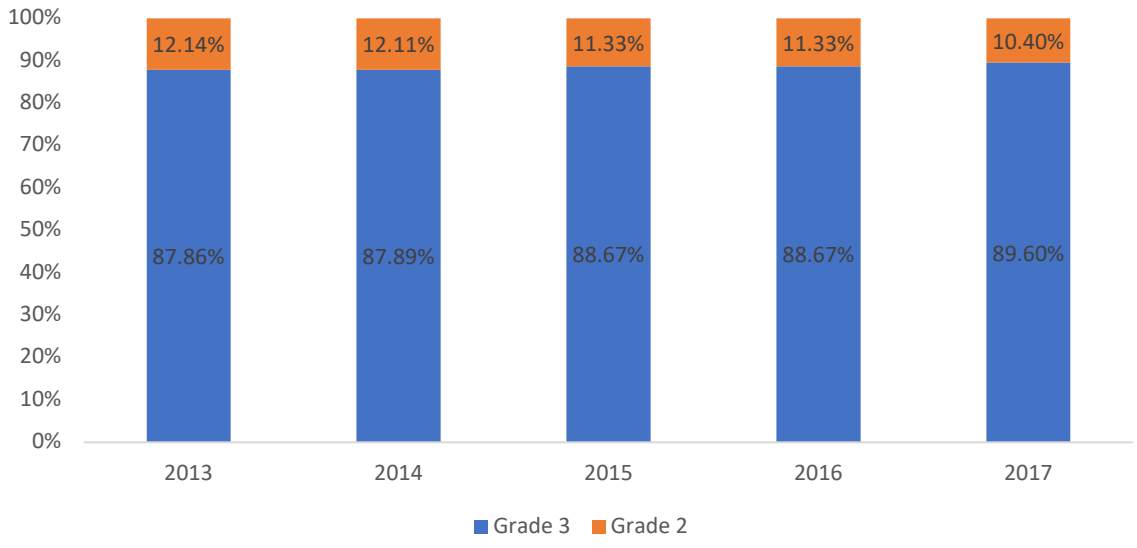

Figure 3.4 Market structure (sales) of enteral nutrition hospital grade

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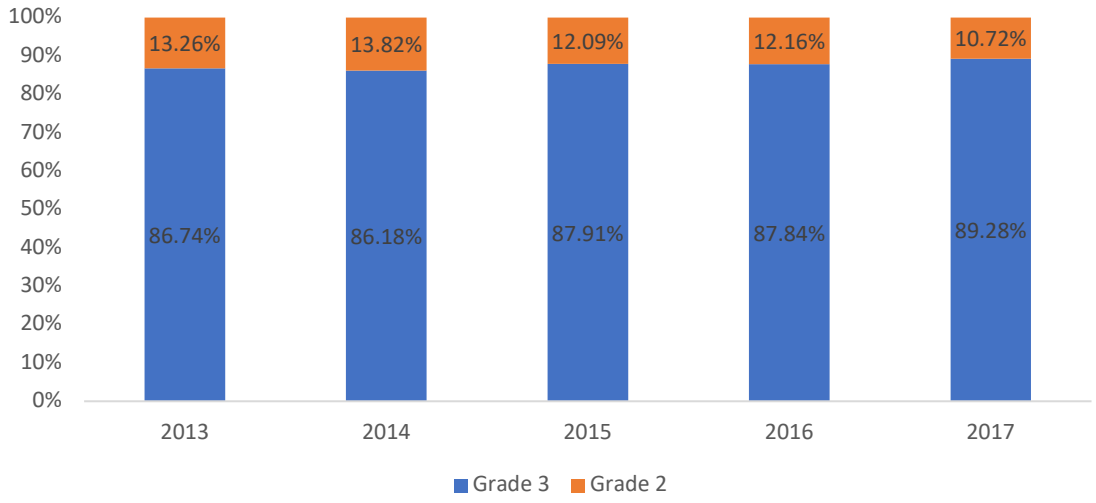

Figure 3.5 Market structure (sales quantity) of enteral nutrition hospital grade

The average sales value of individual tertiary and secondary hospitals in all sample hospitals showed upward trend. The average sales value of a single tertiary hospital is higher than a single secondary hospital. In 2016, the average sales value of individual secondary and tertiary hospital reached the maximum, which was 1.3 million CNY and 210,000 CNY respectively.

Table 3.2 Average comparison of sales of individual tertiary and secondary hospitals in all sample hospitals (2013-2017) (RMB million)

	Average sales (SD) for a single tertiary hospital	Average sales (SD) for a single secondary hospital	*P* Value
2013	0.93 (SD)	0.14 (SD)	0.0000
2014	1.25 (SD)	0.19 (SD)	0.0000
2015	1.13 (SD)	0.18 (SD)	0.0000
2016	1.30 (SD)	0.21 (SD)	0.0000
2017	1.15 (SD)	0.18 (SD)	0.0000

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3.3.5 Statistical comparison of the average sales of individual tertiary hospitals in different regions

According to Chinese national policy, Chinese economic region is divided into four regions: the eastern, central, western, and northeast regions. This study divided geographic regions accordingly. Among the three regions, the average sales value of individual tertiary hospitals in the eastern region was the largest, and the central region was similar to the western region. The sales value of individual tertiary hospitals in the three regions showed increase. The average sales of individual tertiary hospitals in the eastern region was more than 1.1 million CNY, and the average sales of individual tertiary hospitals in the central and western regions was more than 300,000 CNY.

Table 3.3 Comparison of average sales of individual tertiary hospitals in different regions (2013-2017) (RMB million)

	Average sales (SD) for a single tertiary hospital in the east	Average sales (SD) of a single tertiary hospital in the central region	Average sales (SD) of a single tertiary hospital in the west	*P* Value
2013	1.17(SD)	0.37(SD)	0.37	0.0000
2014	1.55(SD)	0.56(SD)	0.64	0.0000
2015	1.44(SD)	0.50(SD)	0.43	0.0000
2016	1.66(SD)	0.60(SD)	0.51	0.0000
2017	1.44(SD)	0.57(SD)	0.48	0.0000

3.3.6 Statistical comparison of the average sales of individual secondary hospitals in different regions

The average sales value of individual secondary hospitals in three regions is the same as the individual tertiary hospitals. The average sales value of individual secondary hospitals in the eastern region was the largest, and the central region was similar to the western region. The average sales value of individual secondary hospitals in all three

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regions showed upward trend. The average sales value of individual secondary hospitals in the eastern region exceeded 100,000 CNY, and the average sales value of individual secondary hospital in central and western regions exceeded 40,000 CNY.

Table 3.4 Comparison of average sales of individual secondary hospitals in different regions (2013-2017)

	Average sales (SD) for a single secondary hospital in the east	Average sales (SD) of a single secondary hospital in the central region	Average sales (SD) of a single secondary hospital in the west	*P* Value
2013	0.16	0.05	0.06	0.0000
2014	0.20	0.14	0.12	0.2059
2015	0.22	0.04	0.06	0.0000
2016	0.26	0.04	0.10	0.0009
2017	0.21	0.05	0.09	0.0283

3.4 Chapter summary

To characterize utilization of enteral nutrition (EN) in Chinese hospitals during 2013 to 2017 from a national perspective. A descriptive analysis was conducted. Data was collected from 915 secondary hospitals and 885 tertiary hospitals from 3 regions (eastern, central and western region). A total of 54 sample enteral nutrition products include 14 domestic and 40 imported enteral nutrition products. From 2013 to September 2017, the sales volume and sales value of enteral nutrition at tertiary and secondary hospitals in China showed ascendant trend. Among various ENs, enteral nutrition suspension (TPF) played a leading role, its market share was 22.0% and market size reached 207 million CNY. The proportion of sales value and sales volume of enteral nutrition in secondary and tertiary hospitals remained stable. The proportion of sales value of enteral nutrition in tertiary hospitals was about 87%, and the proportion of sales value of enteral nutrition in secondary hospitals was about 10% and decreased year by year. The average sales value of a single tertiary hospital was

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higher than a single secondary hospital. The average sales value of individual tertiary hospitals in the eastern region was the largest which was more than 1.1 million CNY, and the central region was similar to the western region which was more than 300,000 CNY.

Through the retrospective analysis of the development of China's foods for special medial purposes, we can find that there are three challenges in the development of foods for special medial purposes in China: First, the lack of scientific research support and evidence-based evidence of the status of insufficient evidence restricts the development of the industry. Second, foreign-funded enterprises to dominate the market, local enterprises are facing barriers to entry. At present, foreign brands dominate the market, while the domestic brand products accounted for only about 10% of the market. Third, the current state-related policies, regulations and standards are inadequate, product approval, production and market regulation is deficient.

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Chapter 4 An elicitation study using the questionnaire

4.1 Introduction

Since September 2017, the General Administration of Food and Drugs issued a Foods for special medical purposes (FSMP) registration of two essential amendments to the document, deleted the original document is not applicable and too strict part of the reduction of unnecessary approval procedures, research and development of production agencies BST food products expectations again high. While the policy is becoming more evident, corresponding to the expectations of production enterprises, in the clinical application of the timely catch and continue the development of the porter, and ultimately to benefit patients, it is necessary to take into account nutrition screening and assessment, for patients to choose the nutrition formula, the implementation of enteral nutrition treatment and follow-up feedback, and a series of actions.

Research in many areas of health care has shown that there is a gap between what should be done and what is actually in clinical practice. The study of the causes of this "knowledge practice gap" has helped improve the quality of clinical practice. The more and more literature support such research needs to identify barriers, select available interventions to address these barriers and improve the quality of medical services. In the innovation system, this is a continuous process, in which system, learning and network play a central role in promoting innovation and technology Reform (Freeman, 1987; Lundvall, 1992; Metcalfe, 1988; Nelson and Winter, 1982). Lundvall a distinction between learning, search and exploration. Learning is associated with daily activities, and activities provide the experience and insights that bring new knowledge and creativity. Besides, the company also includes research and development (search)

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academic research (exploration) and so on. The research of the national innovation system considers that the concept of the innovation system includes diffusion and application in the whole economy (Metcalfe, 1995).

National factors not only affect technical policy, but also makes the innovation system a whole in terms of linguistic and cultural factors, and broadly understand the determinants of the Innovation System (Edquist, 1997), including the state's policies, laws and regulations, as well as other innovative development, dissemination and application factors. Based on the research of David and Foray (1995), The knowledge creation pattern is more the function of system utilisation influence, which originates from the new combination and application of different elements in the existing knowledge base. At the same time, user-driven innovation is becoming increasingly important (Von Hippel, 2010). Moreover, innovation may face dysfunction and become the obstacle of system operation.

This study provides an analysis of the obstacles to the provision of enteral nutrition support services, further evaluates and proposes interventions, and designs a "physician's questionnaire for Enteral nutrition support practices and perceptions" to investigate. The results suggest that the additional costs associated with disease-related malnutrition are considerable (Freijer, 2013), while up to one-third per cent of hospitalised patients are malnourished, resulting in poorer hospitalisation and reduced survival rates, as well as increased costs of care (Lim, 2012). This survey is for enteral nutrition support, not parenteral nutrition support or other nutritional support methods. The objective of this study was to obtain the obstacle factors in the clinical practice of enteral nutrition support through questionnaires and to select the appropriate intervention measures.

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4.2 Method

4.2.1 Data Collection

In the form of the first visit, 15 pre-investigations conducted. The pre-surveys were the chief physician and deputy chief physician of a top three hospital in Guangzhou. According to the patient's enteral nutrition support prescription data, six departments with more nutritional support were selected. After the revision of the opinions, from January to February 2017, 31 questionnaires were distributed to all hospitals in Guangzhou and above, and ten questionnaires used in each hospital. The answer was self-filling.

This questionnaire about doctors' practice and awareness of enteral nutrition support is chosen by the hospital to select the departments and doctors with nutritional support experience in different ways and to inform the doctor to complete the questionnaire. Respondents were asked to take time (10 minutes) to answer questions, and the hospital side returned to the anonymous questionnaire. The valid questionnaire was 310.

4.2.2 Questionnaire Measurement

Searched for the keywords "Intestinal Nutrition", "Nutrition Support", "Doctor", and "Questionnaire" in the "abstract". The journal source based on the journal included in Web of Science and the deadline was December 2016. A total of X articles is searched, and after screening according to the topic, the questionnaire design in the X articles classify according to the research questions and research contents, and the questions and answers revise concerning the domestic situation. The questionnaire included the ESPEN Guidelines for Nutrition Support Standards, the Food Guide for Special

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Medical Uses (Formulations) and related research results. The doctor's prescription for nutritional support is the only way. The purpose of the questionnaire is to understand the doctor's implementation of nutritional support and to identify obstacles that intervened in this process. The pre-survey questionnaire tested the effectiveness of the content and methods and a reliable way of conducting an internal investigation of the doctor. There is a total of X questions, including ten single choice questions, twelve multiple choice questions, two scale questions, and an open question.

4.2.3 Data Analysis

Descriptive statistics to calculate the frequency of responses. For the nominal date nominal data, use the Pearson ($\chi 2$) statistical test and Monte Carlo method to determine the confidence interval size of 99 in the Confidence Level parameter box. The sample size of the default data in the "Number of samples" parameter box is 10000. The data was analysed using SPSS.

The analysis was performed using descriptive statistical populations such as age, gender, employment status and work experience. The doctor's qualifications for physicians are “residents”, “attending physicians”, “deputy chief physicians”, “direct physicians” and “others”, and “others” include departmental interns and trainees. According to the pre-survey and consultation doctors, the clinical experience options divide into “<5”, “5-10”, and “>10”. The number of new diseases treated each year divide into “<50” and “50-100”. 101-300", ">300". According to the previous data on the use of enteral nutrition in hospitals, more departments selected and classified into “internal medicine”, “gastrointestinal”, “surgical”, “breathing”, “severe” and “other”. The hospital's hospital attributes classified as “high school affiliates”, “provincial level”, “city level” and “county level and others”. The hospital grades classified as

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"three-a", "three-four", "di-dimethyl" and "Specialist hospital". Demographic data usage frequency present as a percentage median and interquartile range (IQR) aggregate form. Closed questions have coded categorical variables and then use non-parametric statistics. The questionnaire was submitted anonymously, and all data was presented in aggregate form only. The analysis was performed using SPSS software.

4.3 Results

4.3.1 General distribution of the "Nutrition Screening and Assessment" section

A total of 310 doctors responded to questionnaires (Table 1) by selecting doctors with the knowledge background and practical experience of enteral nutrition support. The gender distribution of the respondents was more average, with the majority of the 40-year-old and the following physicians and residents. Clinical experience distribution average, more than ten years. The number of new patients treated each year was 101 to 300. The majority of the hospital is in the city level above the general three-armour hospital. Department of Surgery 15.81%, internal medicine 25.81%, gastrointestinal 19.35% respiration 5.48%; severe 5.81%; other 27.74%.

Table 4.1 (Q1-8) Demographic information

Descriptive statistics of the responders		n (%)
1.1 Age		
	<31	108(34.84)
	31-40	137(44.19)
	41-50	47(15.16)
	51-60	17(5.48)
	>60	1(0.32)
1.2 Gender		
	female	135(43.55)
	malemale	175(56.45)
1.3 Hospital properties		
	University hospital	119(38.39)
	Provincial hospital	42(13.55)
	Municipal hospital	139(44.84)
	County hospital	1(0.32)
	other_____	9(2.90)

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1.4 Hospital grade		
	First-class Hospital at Grade 3	237(76.45)
	Triple-B	12(3.87)
	Dimethyl	4(1.29)
	other	57(18.39)
1.5 Hospital Departments		
	Surgical	49(15.81)
	Internal medicine	80(25.81)
	Gastroenterology	60(19.35)
	Respiratory	17(5.48)
	Emergency and critical care medicine	18(5.81)
	other	86(27.74)
1.6 Doctor title		
	Resident	82(26.45)
	Attending physician	131(42.26)
	Associate senior doctor	54(17.42)
	Chief physician	18(5.81)
	other	25(8.06)
1.7 Clinical experience (years since full medical registration)		
	<5	105(33.87)
	5-10	73(23.55)
	>10	132(42.58)
1.8 Number of new patients treated per year		
	<50	41(13.23)
	50-100	71(22.90)
	101-300	137(44.19)
	>300	61(19.68)

4.3.2 Analysis of Part Two the “Nutrition Screening and Assessment” section

Overall, (Q2.1) 64.52% considered that nutrition assessment and nutritional support were part of the diagnosis and treatment plan; secondly, 18.06% was helpful in understanding the condition; and 15.81% thought it played a significant role, but not the part of the regular foundation. (Q2.2) More than 60% of the surveyed doctors believe that nutrition screening and assessment are part of the diagnosis and treatment plan. They need to play the role of nutrition assessment and nutritional support in the daily care of patients and indicate that they are in the respondents. In the department where the nutrition screening is performed, it is a standard procedure to evaluate the nutritional status of the patient at the time of admission and during hospitalisation. However, less than half of the respondents indicated that the procedure included

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measuring the patient's weight at admission and calculating energy intake during hospitalisation. There was no significant difference in nutritional assessment between "on admission" and "hospitalisation"; 26.45% only performed nutritional assessments at "when admitted", and 11.61% only performed nutritional assessments during "hospitalisation". (Q2.3) Nutritional assessment methods mainly based on body weight or body mass index, and 25.16% of the total respondents used multidimensional screening tools.

Table 4.2 Proportion of the "Nutrition Screening and Assessment" section

Nutrition screening and assessment		n (%)
2.1 Do you need to play a nutritional assessment and nutritional support role in routine care for patients?		
	Yes, because it is part of the diagnosis, treatment program	200(64.52)
	Play an important role, but not the regular basis of the part	49(15.81)
	Better understand the condition and treatment of the auxiliary role	56(18.06)
2.2 What is the role of nutrition screening in your department? [multiple choice]		
	Evaluation of the nutritional status of patients at admission is the standard procedure.	188(60.65)
	Evaluation of the nutritional status of patients during hospitalisation is a standard procedure.	190(61.29)
	Energy intake during hospitalisation is routine.	147(47.42)
	Measurement of patient weight at admission is a fixed procedure.	148(47.74)
	other_____	22(7.10)
2.3 How does nutrition assessment work? [Multiple choices]		
	Using the multidimensional screening tool (MUST, NRS2002, MNA, NRI, SGA)	78(25.16)
	By assessing body mass index, based on food intake and instrument evaluation	186(60.00)
	BMI By assessing BMI by assessing body mass index, according to food intake and instrument evaluation	214(69.03)
	By assessing whether or not to reduce weight shortly	149(48.06)
	other_____	8(2.58)

4.3.2.2 Do you need to play a nutritional assessment and nutritional support role in routine care for patients?

A total of 96.67% of respondents from the Department of Gastroenterology chose the "composition of diagnosis and treatment plan", while 70.59% of the patients in the

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Department of Respiratory chose “to better understand the condition and assist the treatment”. Relevant factors are significantly related to hospital attributes, hospital grades, departments and doctor title.

4.3.2.3 What is the role of nutrition screening in your department?

A more substantial proportion of university hospitals will have a nutritional screening program at the time of admission. Compared with the “assessment of nutritional status during hospitalisation”, a larger proportion of surgical and respiratory departments are performed at “admission”. There is no significant difference in the individual doctor. Relevant factors include age, hospital attributes, hospital grade, department, physician title, and clinical experience (year)

Table 4.3 The role of nutrition screening in the department

	X\Y	Yes, because it is part of the diagnosis, treatment programn (%)	Play an important role, but not the regular basis of the part	Better understand the condition and treatment of the auxiliary role	other	P
1.Age	<31	67(62.04)	19(17.59)	20(18.52)	2(1.85)	.251
	31-40	95(69.34)	21(15.33)	20(14.6)	1(0.73)	
	41-50	30(63.83)	4(8.51)	12(25.53)	1(2.13)	
	51-60	8(47.06)	5(29.41)	3(17.65)	1(5.88)	
	>60	0(0)	0(0)	1(100)	0(0)	
2.Gender	female	78(57.78)	25(18.52)	28(20.74)	4(2.96)	.092
	male	122(69.71)	24(13.71)	28(16)	1(0.57)	
3.Hospital properties	University hospital	78(65.55)	18(15.13)	21(17.65)	2(1.68)	.000
	Provincial hospital	13(30.95)	13(30.95)	13(30.95)	3(7.14)	
	Municipal hospital	104(74.82)	15(10.79)	20(14.39)	0(0)	
	County hospital	1(100)	0(0)	0(0)	0(0)	
	other	4(44.44)	3(33.33)	2(22.22)	0(0)	

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4.Hospital grade	Triple-A	173(73)	31(13.08)	30(12.66)	3(1.27)	.000
	Triple-B	11(91.67)	1(8.33)	0(0)	0(0)	
	Dimethyl	1(25)	2(50)	1(25)	0(0)	
	Other	15(26.32)	15(26.32)	25(43.86)	2(3.51)	
5.Hospital departments	Surgical	29(59.18)	7(14.29)	12(24.49)	1(2.04)	.000
	Internal medicine	52(65)	21(26.25)	7(8.75)	0(0)	
	Gastroenterology	58(96.67)	2(3.33)	0(0)	0(0)	
	Respiratory	3(17.65)	2(11.76)	12(70.59)	0(0)	
	Emergency and critical care medicine	14(77.78)	1(5.56)	2(11.11)	1(5.56)	
	other	44(51.16)	16(18.6)	23(26.74)	3(3.49)	
6.Doctor title	Resident	48(58.54)	18(21.95)	16(19.51)	0(0)	.025
	Attending physician	96(73.28)	19(14.5)	15(11.45)	1(0.76)	
	Associate senior doctor	29(53.7)	6(11.11)	16(29.63)	3(5.56)	
	Chief physician	11(61.11)	4(22.22)	3(16.67)	0(0)	
	Other	16(64)	2(8)	6(24)	1(4)	
7.Clinical experience(year)	<5	64(60.95)	18(17.14)	21(20)	2(1.9)	.948
	5-10	46(63.01)	13(17.81)	13(17.81)	1(1.37)	
	>10	90(68.18)	18(13.64)	22(16.67)	2(1.52)	
8.Number of new patients treated per year	<50	25(60.98)	7(17.07)	7(17.07)	2(4.88)	.037
	50-100	50(70.42)	10(14.08)	11(15.49)	0(0)	
	101-300	83(60.58)	21(15.33)	33(24.09)	0(0)	
	>300	42(68.85)	11(18.03)	5(8.2)	3(4.92)	

< .1; **<.05; *<.001*

Table 4.4 Proportion of responses to each answer about the nutrition screening process

	n(%)					
	X\Y	Evaluation of the nutritional status of patients at admission is the standard procedure.	Evaluation of the nutritional status of patients during hospitalisation is a standard procedure.	Energy intake during hospitalisation is routine.	Measurement of patient weight at admission is a fixed procedure.	other
1.Age	<31	61(56.48)	59(54.63)	45(41.67)	59(54.63)	10(9.26)
	31-40	87(63.5)	97(70.8)	80(58.39)	63(45.99)	4(2.92)
	41-50	30(63.83)	26(55.32)	18(38.3)	15(31.91)	6(12.77)
	51-60	9(52.94)	8(47.06)	4(23.53)	11(64.71)	2(11.76)
	>60	1(100)	0(0)	0(0)	0(0)	0(0)

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2.Gender	female	78(57.78)	74(54.81)	65(48.15)	66(48.89)	16(11.85)
	male	110(62.86)	116(66.29)	82(46.86)	82(46.86)	6(3.43)
3.Hospital properties	University hospital	65(54.62)	60(50.42)	34(28.57)	72(60.5)	13(10.92)
	Provincial hospital	19(45.24)	24(57.14)	15(35.71)	21(50)	9(21.43)
	Municipal hospital	95(68.35)	102(73.38)	95(68.35)	52(37.41)	0(0)
	County hospital	1(100)	1(100)	1(100)	1(100)	0(0)
	Other	8(88.89)	3(33.33)	2(22.22)	2(22.22)	0(0)
4.Hospital grade	Triple-A	159(67.09)	162(68.35)	123(51.9)	108(45.57)	15(6.33)
	Triple-B	9(75)	11(91.67)	11(91.67)	5(41.67)	0(0)
	Dimethyl	3(75)	3(75)	4(100)	1(25)	0(0)
	Other	17(29.82)	14(24.56)	9(15.79)	34(59.65)	7(12.28)
5.Hospital departments	Surgical	28(57.14)	29(59.18)	21(42.86)	31(63.27)	1(2.04)
	Internal medicine	46(57.5)	51(63.75)	36(45)	46(57.5)	3(3.75)
	Gastroenterology	55(91.67)	56(93.33)	56(93.33)	3(5)	0(0)
	Respiratory	3(17.65)	3(17.65)	4(23.53)	13(76.47)	0(0)
	Emergency and critical care medicine	12(66.67)	14(77.78)	11(61.11)	7(38.89)	1(5.56)
	Other	44(51.16)	37(43.02)	19(22.09)	48(55.81)	17(19.77)
6.Doctor title	Resident	46(56.1)	45(54.88)	36(43.9)	50(60.98)	6(7.32)
	Attending physician	89(67.94)	94(71.76)	75(57.25)	55(41.98)	4(3.05)
	Associate senior doctor	24(44.44)	29(53.7)	24(44.44)	18(33.33)	10(18.52)
	Chief physician	12(66.67)	10(55.56)	4(22.22)	11(61.11)	0(0)
	Other	17(68)	12(48)	8(32)	14(56)	2(8)
7.Clinical experience(year)	<5	59(56.19)	55(52.38)	42(40)	61(58.1)	10(9.52)
	5-10	40(54.79)	44(60.27)	33(45.21)	44(60.27)	2(2.74)
	>10	89(67.42)	91(68.94)	72(54.55)	43(32.58)	10(7.58)
8.Number of new patients treated per year	<50	25(60.98)	25(60.98)	18(43.9)	21(51.22)	4(9.76)
	50-100	49(69.01)	47(66.2)	35(49.3)	31(43.66)	1(1.41)
	101-300	75(54.74)	85(62.04)	69(50.36)	63(45.99)	10(7.3)
	>300	39(63.93)	33(54.1)	25(40.98)	33(54.1)	7(11.48)

< .1; **<.05; *<.001*

Table 4.5 Significance of each answer to the nutrition screening process

	P			
X\Y	Evaluation of the nutritional status of patients at admission is the standard procedure.	Evaluation of the nutritional status of patients during hospitalisation is a standard procedure.	Energy intake during hospitalisation is routine.	Measurement of patient weight at admission is a fixed procedure.
1.Age	0.640	0.027**	0.006**	0.044*
2.Gender	0.364	0.040**	0.821	0.723
3.Hospital properties	0.011**	0.001**	0.000***	0.002**

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4.Hospital grade	0.000***	0.000***	0.000***	0.196
5.Hospital departments	0.000***	0.000***	0.000***	0.000***
6.Doctor title	0.034	0.028	0.013	0.007**
7.Clinical experience(year)	0.107	0.033	0.076	0.000***
8.Number of new patients treated per year	0.225	0.555	0.616	0.608

< .1; **<.05; *<.001*

4.3.2.4 How to conduct a nutritional assessment?

Among the significant factors in the use of multidimensional screening tools are age, hospital attributes, hospital grades, departments, physician titles, and the number of new patients treated each year. Among the doctors surveyed, “residents” and “chief physicians” chose to use multi-dimensional screening tools at a higher rate. The number of newly treated patients per year is significantly higher at the "<50" and ">300" choices using multi-dimensional screening tools. In departments, surgery accounts for a more significant proportion of multi-dimensional screening tools.Relevant factors include age, hospital attributes, hospital grade, department, and the number of new patients treated each year.

Table 4.6 Use of multidimensional screening tools

	P			
X\Y	Using the multidimensional screening tool (MUST, NRS2002, MNA, NRI, SGA)	By evaluating the body mass index, based on food intake and instrument evaluation.	By assessing BMI	By assessing whether or not to reduce weight shortly
1.Age	0.004**	0.489	0.171	0.002**
2.Gender	0.115	0.102	0.053	0.161
3.Hospital properties	0.000***	0.000***	0.003**	0.001**
4.Hospital grade	0.018**	0.000***	0.000***	0.156
5.Hospital departments	0.000***	0.000***	0.000***	0.000***
6.Doctor title	0.000***	0.015**	0.213	0.004**
7.Clinical experience(year)	0.100	0.071	0.352	0.000***
8.Number of new patients treated per year	0.000***	0.369	0.523	0.146

< .1; **<.05; *<.001*

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4.3.3 Part Three (Q3.1-Q3.9) Knowledge and practice about identify patients at risk of malnutrition

Overall, (Q3.2) the vast majority of interviewed physicians indicated that they had prescribed nutritional support for patients when their nutritional status had been impaired, or when there was a risk of impaired nutritional status or malnutrition during treatment. (Q3.3) To investigate the source of knowledge of enteral nutrition, 75.48% of the respondents' doctors indicated that they were from clinical experience, 64.19% said that they were from the same hospital's dietitian and 48.06% from other doctors, and 54.84% said they were from journal articles. (Q3.1) Respondents provided more than 50% of all nutritional support, accounting for 76.45% of “nutrition counseling” and “68.06% of “intestinal nutrition (tube feeding)” from large to small, “parenteral nutrition” "66.45%, "food mix" 64.52%, "oral nutritional supplement" 56.45%.

(Q3.7) 82.26% of respondents believe that the choice of enteral nutrition support for patients depends on “patient's condition”, and 80.65% of people think that it depends on “patient's criticality level”, and another 58.06% think it depends on The "doctor's clinical experience" and 43.55% of people think that it depends on "the doctor's subject knowledge." (Q3.4) Respondents indicated the most important considerations for selecting enteral nutrition support (oral and tube feeding) product varieties, nutrition, safety and patient status, and 58.06% of people considered price and 55.48% of people Consider the convenience of the product. (Q3.5) 70.00% of the respondents indicated that they often prescribed nutritional support for “a tumour” patients, 69.03% were “wound, infection, surgery and other stress states”, and 46.77% were “gastrointestinal absorption”. In patients with “dangerous and pancreatitis”, 41.29% were “liver disease” patients and 37.10% were “diabetes” patients. The survey doctors evaluated the current

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use of enteral nutrition support and the prediction of future development. (Q3.8) 59.68% of the respondents believe that the proportion of enteral nutrition and parenteral nutrition at this stage is “suitable”, 29.03% Think "relatively unreasonable." (Q3.9) At the same time, more than 70% of respondents agreed that the proportion of enteral nutrition support would increase significantly in the next three years, and 18.06% expressed reservations.

The invalidation question, the multiple-choice question (Q3.6), investigates the management style of the respondent's nutritional support. The option is “directly operated by the doctor in charge of the patient in the department” 27.10%, “through the nutrition department within the unit” 17.42%, “Through the doctors of the clinical nutrition department to work in the department" 34.84% and "according to patient requirements" 1.94%. Among them, respondents who have two or more management methods at the same time classified as “others” with 18.39%.

Table 4.7 Types of nutritional support

3.1 What types of nutritional support do you currently offer? [Multiple choices]		
	Nutritional counseling	237(76.45)
	Diet	200(64.52)
	Oral nutritional supplements	175(56.45)
	Enteral nutrition (tube feeding)	211(68.06)
	Parenteral nutrition	206(66.45)
3.2 What are the prescriptions for which patients will be given supportive nutrition? [Multiple choices]		
	During treatment with impaired nutrition or nutritional risk	286(92.26)
	Nutritional status has been impaired	261(84.19)
	Has reported spontaneous feeding difficulties	178(57.42)
	Has been diagnosed at the end of the disease	199(64.19)
	other_____	15(4.84)
3.3 Will your knowledge of enteral nutrition be? [Multiple choices]		
	Unit of nutritionist	199(64.19)
	Policy / guidelines / agreements	109(35.16)
	Journal article	170(54.84)
	Graduate courses	60(19.35)
	In-service education	63(20.32)

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	the Internet	85(27.42)
	Undergraduate Education	75(24.19)
	Graduate course or doctoral program	55(17.74)
	In-service graduate course or doctoral program	25(8.06)
	Other doctors	149(48.06)
	Clinical Experience	234(75.48)
	other_____	7(2.26)
3.4 What are your considerations for choosing enteral nutrition support (oral and tube feeding)? [Multiple choice]		
	Price	180(58.06)
	Brand	105(33.87)
	Nutrient content	270(87.10)
	Taste	87(28.06)
	Convenience	172(55.48)
	Safety	249(80.32)
	The patient's disease	234(75.48)
	The age of the patient	140(45.16)
	The patient's medical insurance	115(37.10)
	other_____	8(2.58)
3.5 Which of the following diseases do you often support for enteral nutrition? [Multiple choices]		
	Diabetes	115(37.10)
	Respiratory system	69(22.26)
	Kidney disease	68(21.94)
	Liver disease	128(41.29)
	Tumor	217(70.00)
	Muscle attenuation	40(12.90)
	Trauma, infection, surgery, and other stress conditions	214(69.03)
	Inflammatory bowel disease	60(19.35)
	Food protein allergy	39(12.58)
	Refractory epilepsy	19(6.13)
	Gastrointestinal disorders, pancreatitis	145(46.77)
	Fatty acid metabolism abnormalities	38(12.26)
	Obesity, fat reduction surgery	32(10.32)
	other_____	20(6.45)
3.6 How does your organisation manage nutrition support?		
	Directly by the doctor in charge of the work in the department	84(27.10)
	Through the Department of Nutrition	54(17.42)
	Through the clinical nutrition department doctors to work in the department	108(34.84)
	According to patient requirements	6(1.94)
	other_____	57(18.39)
3.7 Do you think doctors choose enteral nutrition support for patients depends on? [Multiple choice]		
	Patient's request	87(28.06)
	Patient’s illness	255(82.26)
	The severity of the patient	250(80.65)

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	Doctor's department	70(22.58)
	Doctor's subject knowledge	135(43.55)
	Doctor's clinical experience	180(58.06)
	other_____	10(3.23)
3.8 Regarding the current use of enteral nutrition and parenteral nutrition? [Scale]		
	Very unreasonable	9(2.90)
	Relatively unreasonable	90(29.03)
	More reasonable	185(59.68)
	reasonable	25(8.06)
	Very reasonable	1(0.32)
3.9 Do you believe that the proportion of enteral nutrition support will increase significantly in the next three years? [Scale]		
	Very dissenting	2(0.65)
	Dissenting	24(7.74)
	Consent	218(70.32)
	Very consent	10(3.23)
	Reservations	56(18.06)

4.3.3.2 What types of nutritional support do you currently offer?

According to the statistics of the survey, 20.65% of the five types of nutritional support methods for nutrition counselling, diet matching, oral nutritional supplements, enteral nutrition (tube feeding), and parenteral nutrition were provided among the doctors interviewed.

The highest ratio of respondents from colleges and universities to provide nutritional support is diet matching, which is 70.59%. Compared with college affiliated hospitals and provincial hospitals, respondents from municipal hospitals were more likely to provide nutritional counselling, enteral nutrition for tube feeding and parenteral nutrition.

Surgical and internal medicine can provide a more balanced type of nutritional support, major nutritional counselling for gastroenterology and intensive care, enteral nutrition for tube feeding and parenteral nutrition. The Department of Respiratory Medicine

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mainly provides nutritional counselling, diet matching and oral enteral nutrition. Compared with clinical experience (years), respondents in “<5” and “5-10” indicated that the ratio of nutritional support available was more average, and respondents at ">10" provided a larger ratio of nutritional counselling, tube feeding for enteral nutrition and parenteral nutrition.

Results were considered significant if p</=0.005. There was no statistical difference between gender and the type of nutritional support. Relevant factors include age, hospital attributes, hospital grade, department, physician title, clinical experience (years), and the number of new patients treated each year.

Table 4.8 Respondent information analysis of type of nutritional support

		n(%)				
	X\Y	Nutritional counseling	Diet	Oral nutritional supplements	Enteral nutrition (tube feeding)	Parenteral nutrition
1.Age	<31	70(64.81)	69(63.89)	66(61.11)	67(62.04)	67(62.04)
	31-40	113(82.48)	81(59.12)	74(54.01)	104(75.91)	103(75.18)
	41-50	38(80.85)	34(72.34)	25(53.19)	33(70.21)	28(59.57)
	51-60	15(88.24)	16(94.12)	9(52.94)	7(41.18)	8(47.06)
	>60	1(100)	0(0)	1(100)	0(0)	0(0)
2.Gender	female	101(74.81)	89(65.93)	78(57.78)	93(68.89)	87(64.44)
	male	136(77.71)	111(63.43)	97(55.43)	118(67.43)	119(68)
3.Hospital properties	University hospital	76(63.87)	84(70.59)	78(65.55)	74(62.18)	70(58.82)
	Provincial hospital	31(73.81)	29(69.05)	26(61.9)	23(54.76)	28(66.67)
	Municipal hospital	120(86.33)	81(58.27)	67(48.2)	112(80.58)	106(76.26)
	County hospital	1(100)	1(100)	1(100)	0(0)	1(100)
	Other	9(100)	5(55.56)	3(33.33)	2(22.22)	1(11.11)
4.Hospital grade	Triple-A	181(76.37)	153(64.56)	126(53.16)	176(74.26)	164(69.2)
	Triple-B	8(66.67)	3(25)	5(41.67)	11(91.67)	12(100)
	Dimethyl	4(100)	2(50)	4(100)	1(25)	4(100)
	Other	44(77.19)	42(73.68)	40(70.18)	23(40.35)	26(45.61)

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5.Hospital departments	Surgical	35(71.43)	35(71.43)	32(65.31)	32(65.31)	37(75.51)
	Internal medicine	55(68.75)	56(70)	57(71.25)	55(68.75)	54(67.5)
	Gastroenterology	57(95)	23(38.33)	13(21.67)	56(93.33)	54(90)
	Respiratory	16(94.12)	14(82.35)	13(76.47)	6(35.29)	7(41.18)
	Emergency and critical care medicine	15(83.33)	9(50)	10(55.56)	18(100)	18(100)
	Other	59(68.6)	63(73.26)	50(58.14)	44(51.16)	36(41.86)
6.Doctor title	Resident	52(63.41)	55(67.07)	53(64.63)	48(58.54)	50(60.98)
	Attending physician	113(86.26)	77(58.78)	62(47.33)	106(80.92)	101(77.1)
	Associate senior doctor	35(64.81)	34(62.96)	34(62.96)	35(64.81)	40(74.07)
	Chief physician	18(100)	14(77.78)	11(61.11)	10(55.56)	7(38.89)
	Other	19(76)	20(80)	15(60)	12(48)	8(32)
7.Clinical experience(year)	<5	69(65.71)	72(68.57)	67(63.81)	60(57.14)	63(60)
	5-10	54(73.97)	50(68.49)	47(64.38)	51(69.86)	49(67.12)
	>10	114(86.36)	78(59.09)	61(46.21)	100(75.76)	94(71.21)
8.Number of new patients treated per year	<50	28(68.29)	31(75.61)	19(46.34)	14(34.15)	23(56.1)
	50-100	56(78.87)	35(49.3)	35(49.3)	54(76.06)	46(64.79)
	101-300	97(70.8)	84(61.31)	77(56.2)	98(71.53)	97(70.8)
	>300	56(91.8)	50(81.97)	44(72.13)	45(73.77)	40(65.57)

	P				
X\Y	Nutritional counseling	Diet	Oral nutritional supplements	Enteral nutrition (tube feeding)	Parenteral nutrition
1.Age	0.011**	0.023	0.673	0.009**	0.022**
2.Gender	0.551	0.649	0.679	0.785	0.511
3.Hospital properties	0.000***	0.238	0.026**	0.000***	0.000***
4.Hospital grade	0.596	0.014	0.023**	0.000***	0.000***
5.Hospital departments	0.001**	0.000***	0.000***	0.000***	0.000***
6.Doctor title	0.000***	0.186	0.096	0.001**	0.000***
7.Clinical experience(year)	0.001**	0.228	0.007**	0.009**	0.190
8.Number of new patients treated per year	0.007**	0.000***	0.026	0.000***	0.355

< .1; **<.05; *<.00*

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4.3.3.3 What are the prescriptions for which patients will be given supportive nutrition?

According to Table 3-5, the vast majority of respondents prescribed nutritional support for patients with impaired nutritional status or malnutrition during treatment, followed by “nutrition status has been impaired” but “reported spontaneously” Feeding difficulties" and "has been diagnosed at the end of the disease" are relatively few.

Results were considered significant if p</=0.005. Relevant factors include age, hospital attributes, department, physician title, clinical experience (years), and the number of new patients treated each year.

4.3.3.4 Will your knowledge of enteral nutrition be?

Table 3-7 below shows that the maximum rate of knowledge for respondents aged 50 and under is clinical experience, and a more significant percentage of respondents over the age of 50 are from journal articles. The maximum rate of knowledge of respondents who are referred to as residents, attending physicians, or deputy chief physicians is clinical experience, and the chief physician's respondents indicated that a more significant percentage is from journal articles.

Results were considered significant if p</=0.005. Relevant factors include age, hospital attributes, hospital grade, department, physician title, clinical experience (years), and the number of new patients treated each year.

Table 4.9 Respondent information analysis of supportive nutrition

		n(%)				
	X\Y	During treatment with impaired nutrition or nutritional risk	Nutritional status has been impaired	Has reported spontaneous feeding difficulties	Has been diagnosed at the end of the disease	Other

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1.Age	<31	99(91.67)	89(82.41)	75(69.44)	63(58.33)	5(4.63)
	31-40	130(94.89)	125(91.24)	69(50.36)	101(73.72)	3(2.19)
	41-50	41(87.23)	35(74.47)	23(48.94)	28(59.57)	5(10.64)
	51-60	15(88.24)	11(64.71)	11(64.71)	7(41.18)	2(11.76)
	>60	1(100)	1(100)	0(0)	0(0)	0(0)
2.Gender	female	119(88.15)	112(82.96)	68(50.37)	83(61.48)	11(8.15)
	male	167(95.43)	149(85.14)	110(62.86)	116(66.29)	4(2.29)
3.Hospital properties	University hospital	103(86.55)	92(77.31)	89(74.79)	54(45.38)	10(8.4)
	Provincial hospital	38(90.48)	34(80.95)	25(59.52)	24(57.14)	3(7.14)
	Municipal hospital	135(97.12)	128(92.09)	62(44.6)	119(85.61)	2(1.44)
	County hospital	1(100)	1(100)	1(100)	1(100)	0(0)
	Other	9(100)	6(66.67)	1(11.11)	1(11.11)	0(0)
4.Hospital grade	Triple-A	219(92.41)	201(84.81)	137(57.81)	148(62.45)	12(5.06)
	Triple-B	11(91.67)	9(75)	4(33.33)	9(75)	0(0)
	Dimethyl	3(75)	3(75)	3(75)	3(75)	1(25)
	Other	53(92.98)	48(84.21)	34(59.65)	39(68.42)	2(3.51)
5.Hospital departments	Surgical	46(93.88)	41(83.67)	40(81.63)	31(63.27)	1(2.04)
	Internal medicine	72(90)	70(87.5)	57(71.25)	46(57.5)	3(3.75)
	Gastroenterology	58(96.67)	54(90)	6(10)	55(91.67)	1(1.67)
	Respiratory	16(94.12)	16(94.12)	13(76.47)	16(94.12)	1(5.88)
	Emergency and critical care medicine	16(88.89)	16(88.89)	7(38.89)	15(83.33)	1(5.56)
	Other	78(90.7)	64(74.42)	55(63.95)	36(41.86)	8(9.3)
6.Doctor title	Resident	74(90.24)	68(82.93)	61(74.39)	45(54.88)	3(3.66)
	Attending physician	124(94.66)	122(93.13)	64(48.85)	100(76.34)	3(2.29)
	Associate senior doctor	46(85.19)	39(72.22)	26(48.15)	32(59.26)	8(14.81)
	Chief physician	18(100)	12(66.67)	11(61.11)	8(44.44)	0(0)
	Other	24(96)	20(80)	16(64)	14(56)	1(4)
7.Clinical experience(year)	<5	94(89.52)	84(80)	75(71.43)	60(57.14)	6(5.71)
	5-10	68(93.15)	67(91.78)	46(63.01)	46(63.01)	3(4.11)
	>10	124(93.94)	110(83.33)	57(43.18)	93(70.45)	6(4.55)
8.Number of new patients treated per year	<50	36(87.8)	33(80.49)	25(60.98)	22(53.66)	3(7.32)
	50-100	64(90.14)	57(80.28)	38(53.52)	48(67.61)	2(2.82)
	101-300	127(92.7)	121(88.32)	70(51.09)	92(67.15)	5(3.65)
	>300	59(96.72)	50(81.97)	45(73.77)	37(60.66)	5(8.2)

	P			
X\Y	During treatment with impaired nutrition or nutritional risk	Nutritional status has been impaired	Has reported spontaneous feeding difficulties	Has been diagnosed at the end of the disease
1.Age	0.476	0.008**	0.015**	0.010**
2.Gender	0.017**	0.602	0.027**	0.382
3.Hospital properties	0.026**	0.010**	0.000***	0.000***

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4.Hospital grade	0.632	0.781	0.323	0.666
5.Hospital departments	0.693	0.078	0.000***	0.000***
6.Doctor title	0.121	0.001**	0.003**	0.003**
7.Clinical experience(year)	0.427	0.099	0.000***	0.102
8.Number of new patients treated per year	0.344	0.359	0.023**	0.363

*< .1;
**<.05;
***<.001

Table 4.10 Respondent information analysis of knowledge of enteral nutrition

		n(%)			
	X\Y	Unit of clinical dietician	Journal article	Other doctors	Clinical experience
1.Age	<31	57(52.78)	49(45.37)	59(54.63)	74(68.52)
	31-40	105(76.64)	83(60.58)	66(48.18)	116(84.67)
	41-50	31(65.96)	24(51.06)	18(38.3)	35(74.47)
	51-60	6(35.29)	13(76.47)	6(35.29)	9(52.94)
	>60	0(0)	1(100)	0(0)	0(0)
2.Gender	female	79(58.52)	71(52.59)	65(48.15)	99(73.33)
	male	120(68.57)	99(56.57)	84(48)	135(77.14)
3.Hospital properties	University hospital	60(50.42)	53(44.54)	59(49.58)	76(63.87)
	Provincial hospital	20(47.62)	22(52.38)	20(47.62)	29(69.05)
	Municipal hospital	117(84.17)	86(61.87)	69(49.64)	127(91.37)
	County hospital	0(0)	1(100)	0(0)	1(100)
	Other	2(22.22)	8(88.89)	1(11.11)	1(11.11)
4.Hospital grade	Triple-A	161(67.93)	118(49.79)	124(52.32)	177(74.68)
	Triple-B	8(66.67)	5(41.67)	7(58.33)	11(91.67)
	Dimethyl	0(0)	3(75)	0(0)	3(75)
	Other	30(52.63)	44(77.19)	18(31.58)	43(75.44)
5.Hospital departments	Surgical	32(65.31)	31(63.27)	28(57.14)	34(69.39)
	Internal medicine	50(62.5)	46(57.5)	33(41.25)	60(75)
	Gastroenterology	58(96.67)	30(50)	35(58.33)	58(96.67)
	Respiratory	16(94.12)	15(88.24)	3(17.65)	16(94.12)
	Emergency and critical care medicine	14(77.78)	11(61.11)	9(50)	16(88.89)
	Other	29(33.72)	37(43.02)	41(47.67)	50(58.14)
6.Doctor title	Resident	42(51.22)	38(46.34)	44(53.66)	54(65.85)
	Attending physician	106(80.92)	76(58.02)	58(44.27)	114(87.02)
	Associate senior doctor	28(51.85)	27(50)	24(44.44)	43(79.63)
	Chief physician	9(50)	16(88.89)	6(33.33)	10(55.56)
	Other	14(56)	13(52)	17(68)	13(52)
7.Clinical experience(year)	<5	55(52.38)	48(45.71)	56(53.33)	65(61.9)
	5-10	52(71.23)	44(60.27)	29(39.73)	61(83.56)
	>10	92(69.7)	78(59.09)	64(48.48)	108(81.82)
8.Number of new patients treated	<50	21(51.22)	22(53.66)	24(58.54)	24(58.54)
	50-100	50(70.42)	39(54.93)	31(43.66)	54(76.06)

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per year	101-300	97(70.8)	68(49.64)	67(48.91)	113(82.48)
	>300	31(50.82)	41(67.21)	27(44.26)	43(70.49)

	P			
X\Y	Unit of clinical dietician	Journal article	Other doctors	Clinical experience
1.Age	0.000***	0.040**	0.223	0.002**
2.Gender	0.067	0.485	0.979	0.439
3.Hospital properties	0.000***	0.011**	0.192	0.000***
4.Hospital grade	0.008**	0.001**	0.007**	0.619
5.Hospital departments	0.000***	0.010**	0.035**	0.000***
6.Doctor title	0.000***	0.018	0.107	0.000***
7.Clinical experience(year)	0.008**	0.068	0.201	0.000***
8.Number of new patients treated per year	0.009**	0.152	0.433	0.013**

< .1; **<.05; *<.001*

4.3.3.5 What are your considerations for choosing enteral nutrition support (oral and tube feeding)?

Respondents who are older are gradually reducing the ratio of “nutrition” considerations and increasing patient considerations. In departments where product convenience is considered, the gastroenterology department is higher than in other departments, and the respiratory department is less concerned with this factor, and a larger ratio considers the price. The most significant consideration in surgery, internal medicine, and critical illness is the nutritional content of the product.

Relevant factors include age, hospital attributes, hospital grade, department, physician title, clinical experience (years), and the number of new patients treated each year. Results were considered significant if p</=0.005.

4.3.3.6 Which of the following diseases do you often support for enteral nutrition?

According to Table 3-11, the nature of the respondent's department affected the respondent's response. The disease selected for enteral nutrition support was

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influenced by the department, mainly focusing on tumours and “trauma, infection, surgery and other stresses”. Status, the data shows that the second is mostly liver disease, diabetes and others.

Relevant factors include age, hospital attributes, hospital grade, department, physician title, and clinical experience (year). Results were considered significant if p</=0.005.

Table 4.11 Respond analysis of the choosing enteral nutrition support

		n(%)				
	X\Y	Price	Nutrison	Easy	Safety	diagnose
1.Age	<31	72(66.67)	97(89.81)	48(44.44)	81(75)	79(73.15)
	31-40	69(50.36)	122(89.05)	89(64.96)	117(85.4)	107(78.1)
	41-50	26(55.32)	38(80.85)	29(61.7)	38(80.85)	39(82.98)
	51-60	12(70.59)	13(76.47)	6(35.29)	13(76.47)	9(52.94)
	>60	1(100)	0(0)	0(0)	0(0)	0(0)
2.Gender	female	75(55.56)	121(89.63)	80(59.26)	106(78.52)	112(82.96)
	male	105(60)	149(85.14)	92(52.57)	143(81.71)	122(69.71)
3.Hospital properties	University hospital	72(60.5)	97(81.51)	48(40.34)	85(71.43)	88(73.95)
	Provincial hospital	27(64.29)	37(88.1)	23(54.76)	31(73.81)	30(71.43)
	Municipal hospital	71(51.08)	133(95.68)	98(70.5)	126(90.65)	114(82.01)
	County hospital	1(100)	1(100)	1(100)	1(100)	1(100)
	Other	9(100)	2(22.22)	2(22.22)	6(66.67)	1(11.11)
4.Hospital grade	Triple-A	126(53.16)	209(88.19)	137(57.81)	188(79.32)	181(76.37)
	Triple-B	2(16.67)	11(91.67)	9(75)	9(75)	10(83.33)
	Dimethyl	3(75)	3(75)	1(25)	2(50)	3(75)
	Other	49(85.96)	47(82.46)	25(43.86)	50(87.72)	40(70.18)
5.Hospital departments	Surgical	32(65.31)	44(89.8)	22(44.9)	37(75.51)	34(69.39)
	Internal medicine	54(67.5)	71(88.75)	50(62.5)	63(78.75)	61(76.25)
	Gastroenterology	16(26.67)	56(93.33)	55(91.67)	54(90)	50(83.33)
	Respiratory	14(82.35)	16(94.12)	7(41.18)	16(94.12)	15(88.24)
	Emergency and critical care	8(44.44)	16(88.89)	9(50)	15(83.33)	16(88.89)

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	medicine					
	Other	56(65.12)	67(77.91)	29(33.72)	64(74.42)	58(67.44)
6.Doctor title	Resident	49(59.76)	72(87.8)	39(47.56)	63(76.83)	59(71.95)
	Attending physician	65(49.62)	118(90.08)	87(66.41)	113(86.26)	104(79.39)
	Associate senior doctor	32(59.26)	42(77.78)	30(55.56)	39(72.22)	40(74.07)
	Chief physician	16(88.89)	15(83.33)	10(55.56)	15(83.33)	11(61.11)
	Other	18(72)	23(92)	6(24)	19(76)	20(80)
7.Clinical experience(year)	<5	67(63.81)	93(88.57)	41(39.05)	80(76.19)	77(73.33)
	5-10	43(58.9)	63(86.3)	44(60.27)	56(76.71)	56(76.71)
	>10	70(53.03)	114(86.36)	87(65.91)	113(85.61)	101(76.52)
8.Number of new patients treated per year	<50	26(63.41)	36(87.8)	13(31.71)	30(73.17)	29(70.73)
	50-100	40(56.34)	65(91.55)	44(61.97)	60(84.51)	58(81.69)
	101-300	71(51.82)	119(86.86)	84(61.31)	113(82.48)	103(75.18)
	>300	43(70.49)	50(81.97)	31(50.82)	46(75.41)	44(72.13)

	P				
X\Y	Price	Nurition	Convenient	Safe	The patient's disease species
1.Age	0.072	0.024**	0.004**	0.077	0.040**
2.Gender	0.432	0.243	0.240	0.483	0.007**
3.Hospital properties	0.027**	0.000***	0.000***	0.001**	0.000***
4.Hospital grade	0.000***	0.555	0.072	0.198	0.713
5.Hospital departments	0.000***	0.080	0.000***	0.133	0.099
6.Doctor title	0.011**	0.199	0.001**	0.185	0.409
7.Clinical experience(year)	0.244	0.858	0.000***	0.131	0.820
8.Number of new patients treated per year	0.085	0.439	0.005**	0.327	0.502

< .1; **<.05; *<.001*

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Table 4.12 Respond analysis of the following diseases

	X\Y	n (%)				
		Diabetes	Liver disease	Tumor	Trauma, infection, surgery and other stress states	Gastrointestinal tract malabsorption, pancreatitis
1.Age	<31	35(32.41)	37(34.26)	71(65.74)	72(66.67)	58(53.7)
	31-40	48(35.04)	65(47.45)	104(75.91)	98(71.53)	59(43.07)
	41-50	25(53.19)	22(46.81)	33(70.21)	32(68.09)	23(48.94)
	51-60	7(41.18)	4(23.53)	9(52.94)	11(64.71)	5(29.41)
	>60	0(0)	0(0)	0(0)	1(100)	0(0)
2.Gender	female	64(47.41)	58(42.96)	88(65.19)	89(65.93)	62(45.93)
	male	51(29.14)	70(40)	129(73.71)	125(71.43)	83(47.43)
3.Hospital properties	University hospital	46(38.66)	33(27.73)	78(65.55)	69(57.98)	65(54.62)
	Provincial hospital	16(38.1)	9(21.43)	20(47.62)	30(71.43)	20(47.62)
	Municipal hospital	52(37.41)	85(61.15)	118(84.89)	105(75.54)	60(43.17)
	County hospital	1(100)	1(100)	1(100)	1(100)	0(0)
	Other	0(0)	0(0)	0(0)	9(100)	0(0)
4.Hospital grade	Triple-A	98(41.35)	100(42.19)	173(73)	167(70.46)	126(53.16)
	Triple-B	6(50)	9(75)	8(66.67)	12(100)	5(41.67)
	Dimethyl	2(50)	3(75)	4(100)	3(75)	2(50)
	Other	9(15.79)	16(28.07)	32(56.14)	32(56.14)	12(21.05)
5.Hospital departments	Surgical	15(30.61)	16(32.65)	37(75.51)	34(69.39)	32(65.31)
	Internal medicine	46(57.5)	33(41.25)	49(61.25)	57(71.25)	40(50)
	Gastroenterology	21(35)	46(76.67)	58(96.67)	55(91.67)	24(40)
	Respiratory	2(11.76)	5(29.41)	17(100)	3(17.65)	1(5.88)
	Emergency and critical care medicine	6(33.33)	11(61.11)	14(77.78)	14(77.78)	9(50)
	Other	25(29.07)	17(19.77)	42(48.84)	51(59.3)	39(45.35)
6.Doctor title	Resident	27(32.93)	31(37.8)	58(70.73)	58(70.73)	44(53.66)
	Attending physician	46(35.11)	66(50.38)	102(77.86)	95(72.52)	60(45.8)
	Associate senior doctor	23(42.59)	19(35.19)	31(57.41)	36(66.67)	22(40.74)
	Chief physician	8(44.44)	6(33.33)	12(66.67)	12(66.67)	6(33.33)
	Other	11(44)	6(24)	14(56)	13(52)	13(52)
7.Clinical experience(year)	<5	36(34.29)	34(32.38)	71(67.62)	68(64.76)	57(54.29)
	5-10	20(27.4)	25(34.25)	49(67.12)	46(63.01)	35(47.95)
	>10	59(44.7)	69(52.27)	97(73.48)	100(75.76)	53(40.15)
8.Number of new patients treated per	<50	13(31.71)	15(36.59)	26(63.41)	22(53.66)	19(46.34)
	50-100	29(40.8	34(47.89)	51(71.83)	52(73.24)	37(52.11)

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year		5)				
	101-300	49(35.77)	55(40.15)	102(74.45)	97(70.8)	56(40.88)
	>300	24(39.34)	24(39.34)	38(62.3)	43(70.49)	33(54.1)

	P				
X\Y	Diabetes	Liver disease	Tumor	Trauma, infection, surgery and other stress states	Gastrointestinal tract malabsorption, pancreatitis
1.Age	0.126	0.097**	0.095	0.861	0.209
2.Gender	0.001**	0.599	0.104	0.299	0.793
3.Hospital properties	0.128	0.000***	0.000***	0.007**	0.014**
4.Hospital grade	0.003**	0.009**	0.046**	0.018**	0.000***
5.Hospital departments	0.000***	0.000***	0.000***	0.000***	0.001**
6.Doctor title	0.652	0.055	0.034**	0.350	0.409
7.Clinical experience(year)	0.038**	0.003**	0.513	0.085	0.093
8.Number of new patients treated per year	0.759	0.611	0.264	0.146	0.257

< .1; **<.05; *<.001*

4.3.3.7 How does your organisation manage nutrition support?

Results were considered significant if p</=0.005.

4.3.3.8 Do you think doctors choose enteral nutrition support for patients depends on?

Respondents' choice of enteral nutrition support for patients depends on a variety of factors, as shown in Table 3-13, the most considered of which is the patient's condition and the criticality of the patient. The “patient’s requirement” in each option is the respondent's choice. Minimal. Relevant factors include age, hospital attributes, hospital grade, and department. Results were considered significant if p</=0.005.

4.3.3.9 Regarding the current use of enteral nutrition and parenteral nutrition?

The responses in Table 3-15 indicate that respondents are reasonable about the current use of enteral nutrition and parenteral nutrition and that “reasonable” is the majority.

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Related factors are hospital grades and departments. Results were considered significant if p</=0.005. In addition to the respiratory department, the proportion of the use of enteral nutrition and parenteral nutrition in other departments from the large to the small is "reasonable", "relatively unreasonable", "reasonable", "very unreasonable", "very reasonable." The ratio of gastroenterology is significantly more concentrated than other departments, "more reasonable", and the respiratory department is more focused on "relatively unreasonable."

Table 4.13 Respond analysis of organisation manage nutrition support

		n(%)						
	X\Y	Patient's requirement	Patient's disease	The severity of the patient	Doctor's department	Doctor's subject knowledge	Clinical experience	Other
1.Age	<31	32(29.63)	88(81.48)	87(80.56)	17(15.74)	38(35.19)	59(54.63)	3(2.78)
	31-40	38(27.74)	114(83.21)	119(86.86)	34(24.82)	62(45.26)	83(60.58)	4(2.92)
	41-50	11(23.4)	40(85.11)	33(70.21)	15(31.91)	25(53.19)	30(63.83)	2(4.26)
	51-60	5(29.41)	13(76.47)	11(64.71)	4(23.53)	9(52.94)	7(41.18)	1(5.88)
	>60	1(100)	0(0)	0(0)	0(0)	1(100)	1(100)	0(0)
2.Gender	female	39(28.89)	117(86.67)	106(78.52)	24(17.78)	59(43.7)	70(51.85)	5(3.7)
	male	48(27.43)	138(78.86)	144(82.29)	46(26.29)	76(43.43)	110(62.86)	5(2.86)
3.Hospital properties	University hospital	34(28.57)	100(84.03)	83(69.75)	19(15.97)	52(43.7)	61(51.26)	6(5.04)
	Provincial hospital	15(35.71)	34(80.95)	36(85.71)	5(11.9)	19(45.24)	25(59.52)	4(9.52)
	Municipal hospital	32(23.02)	115(82.73)	127(91.37)	44(31.65)	59(42.45)	90(64.75)	0(0)
	County hospital	0(0)	1(100)	1(100)	0(0)	1(100)	1(100)	0(0)
	Other	6(66.67)	5(55.56)	3(33.33)	2(22.22)	4(44.44)	3(33.33)	0(0)
4.Hospital grade	Triple-A	66(27.85)	191(80.59)	189(79.75)	55(23.21)	99(41.77)	128(54.01)	8(3.38)
	Triple-B	2(16.67)	11(91.67)	11(91.67)	1(8.33)	6(50)	10(83.33)	0(0)
	Dimethyl	0(0)	3(75)	3(75)	0(0)	2(50)	2(50)	0(0)
	Other	19(33.33)	50(87.72)	47(82.46)	14(24.56)	28(49.12)	40(70.18)	2(3.51)
5.Hospital	Surgica	14(28.57)	40(81.63)	38(77.55	12(24.4	22(44.9)	34(69.39)	2(4.0

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departments	l			)	9)			8)
	Internal medicine	27(33.75)	69(86.25)	65(81.25)	8(10)	40(50)	46(57.5)	4(5)
	Gastroenterology	17(28.33)	44(73.33)	56(93.33)	23(38.33)	25(41.67)	31(51.67)	0(0)
	Respiratory	0(0)	16(94.12)	16(94.12)	5(29.41)	3(17.65)	15(88.24)	0(0)
	Emergency and critical care medicine	3(16.67)	15(83.33)	15(83.33)	7(38.89)	6(33.33)	13(72.22)	1(5.56)
	Other	26(30.23)	71(82.56)	60(69.77)	15(17.44)	39(45.35)	41(47.67)	3(3.49)
6.Doctor title	Resident	19(23.17)	70(85.37)	66(80.49)	14(17.07)	29(35.37)	45(54.88)	4(4.88)
	Attending physician	38(29.01)	108(82.44)	111(84.73)	38(29.01)	57(43.51)	77(58.78)	2(1.53)
	Associate senior doctor	15(27.78)	43(79.63)	40(74.07)	10(18.52)	26(48.15)	32(59.26)	4(7.41)
	Chief physician	5(27.78)	15(83.33)	11(61.11)	6(33.33)	10(55.56)	11(61.11)	0(0)
	Other	10(40)	19(76)	22(88)	2(8)	13(52)	15(60)	0(0)
7.Clinical experience (year)	<5	29(27.62)	86(81.9)	86(81.9)	14(13.33)	37(35.24)	58(55.24)	5(4.76)
	5-10	23(31.51)	58(79.45)	58(79.45)	21(28.77)	32(43.84)	39(53.42)	1(1.37)
	>10	35(26.52)	111(84.09)	106(80.3)	35(26.52)	66(50)	83(62.88)	4(3.03)
8.Number of new patients treated per year	<50	11(26.83)	34(82.93)	37(90.24)	6(14.63)	19(46.34)	28(68.29)	1(2.44)
	50-100	20(28.17)	57(80.28)	61(85.92)	21(29.58)	28(39.44)	33(46.48)	0(0)
	101-300	35(25.55)	118(86.13)	111(81.02)	35(25.55)	59(43.07)	85(62.04)	4(2.92)
	>300	21(34.43)	46(75.41)	41(67.21)	8(13.11)	29(47.54)	34(55.74)	5(8.2)

	P			
X\Y	Patient's disease	The severity of the patient	Doctor's subject knowledge	Clinical experience
1.Age	0.247	0.009**	0.140	0.375
2.Gender	0.074	0.405	0.961	0.052
3.Hospital properties	0.293	0.000***	0.841	0.098
4.Hospital grade	0.477	0.739	0.730	0.040**
5.Hospital departments	0.324	0.010**	0.221	0.009**
6.Doctor title	0.829	0.086	0.345	0.973
7.Clinical experience(year)	0.702	0.912	0.075	0.325
8.Number of new patients treated per year	0.312	0.013	0.795	0.082

<.1; **<.05; *<.001*

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Table 4.14 Respond analysis of regarding the current use of enteral nutrition and parenteral nutrition

X\Y		n(%)					P
		Very unreasonable	Relatively unreasonable	Comparatively rational	Reasonable	Very reasonable	
1.Age	<31	3(2.78)	28(25.93)	66(61.11)	11(10.19)	0(0)	0.846
	31-40	3(2.19)	42(30.66)	83(60.58)	8(5.84)	1(0.73)	
	41-50	1(2.13)	14(29.79)	28(59.57)	4(8.51)	0(0)	
	51-60	2(11.76)	6(35.29)	7(41.18)	2(11.76)	0(0)	
	>60	0(0)	0(0)	1(100)	0(0)	0(0)	
2.Gender	female	1(0.74)	37(27.41)	79(58.52)	18(13.33)	0(0)	0.011**
	male	8(4.57)	53(30.29)	106(60.57)	7(4)	1(0.57)	
3.Hospital properties	University hospital	4(3.36)	39(32.77)	63(52.94)	12(10.08)	1(0.84)	0.697
	Provincial hospital	2(4.76)	15(35.71)	20(47.62)	5(11.9)	0(0)	
	Municipal hospital	3(2.16)	34(24.46)	94(67.63)	8(5.76)	0(0)	
	County hospital	0(0)	0(0)	1(100)	0(0)	0(0)	
	Other	0(0)	2(22.22)	7(77.78)	0(0)	0(0)	
4.Hospital grade	Triple-A	7(2.95)	55(23.21)	151(63.71)	23(9.7)	1(0.42)	0.002***
	Triple-B	0(0)	2(16.67)	10(83.33)	0(0)	0(0)	
	Dimethyl	0(0)	1(25)	2(50)	1(25)	0(0)	
	Other	2(3.51)	32(56.14)	22(38.6)	1(1.75)	0(0)	
5.Hospital departments	Surgical	3(6.12)	14(28.57)	26(53.06)	5(10.2)	1(2.04)	0.000***
	Internal medicine	3(3.75)	27(33.75)	40(50)	10(12.5)	0(0)	
	Gastroenterology	1(1.67)	4(6.67)	54(90)	1(1.67)	0(0)	
	Respiratory	0(0)	12(70.59)	4(23.53)	1(5.88)	0(0)	
	Emergency and critical care medicine	0(0)	4(22.22)	14(77.78)	0(0)	0(0)	
	Other	2(2.33)	29(33.72)	47(54.65)	8(9.3)	0(0)	
6.Doctor title	Resident	2(2.44)	23(28.05)	46(56.1)	11(13.41)	0(0)	0.105
	Attending physician	4(3.05)	39(29.77)	80(61.07)	7(5.34)	1(0.76)	
	Associate senior doctor	0(0)	15(27.78)	34(62.96)	5(9.26)	0(0)	
	Chief physician	3(16.67)	7(38.89)	8(44.44)	0(0)	0(0)	

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	Other	0(0)	6(24)	17(68)	2(8)	0(0)	
7.Clinical experience(year)	<5	2(1.9)	32(30.48)	62(59.05)	9(8.57)	0(0)	0.126
	5-10	3(4.11)	24(32.88)	35(47.95)	10(13.7)	1(1.37)	
	>10	4(3.03)	34(25.76)	88(66.67)	6(4.55)	0(0)	
8.Number of new patients treated per year	<50	0(0)	14(34.15)	23(56.1)	4(9.76)	0(0)	0.392
	50-100	3(4.23)	14(19.72)	48(67.61)	6(8.45)	0(0)	
	101-300	3(2.19)	40(29.2)	82(59.85)	12(8.76)	0(0)	
	>300	3(4.92)	22(36.07)	32(52.46)	3(4.92)	1(1.64)	

< .1; **<.05; *<.001*

4.3.3.10 Do you believe that the proportion of enteral nutrition support will increase significantly in the next three years?

Respondents in the gastrointestinal and respiratory departments have a higher concentration of choices and agree that the proportion of enteral nutrition support will increase significantly in the next three years, concerning internal medicine, surgery and others, with some reservations compared to the gastrointestinal and respiratory departments.

Results were considered significant if p</=0.005. Relevant factors include hospital attributes, departments, physician titles, and the number of new patients treated each year.

Table 4.15 Respond analysis of the forecast of enteral nutrition support

		n(%)					
	X\Y	Very dissenting	Dissenting	Consent	Very consent	Reservations	P
1.Age	<31	1(0.93)	9(8.33)	68(62.96)	6(5.56)	24(22.22)	0.883
	31-40	1(0.73)	12(8.76)	103(75.18)	2(1.46)	19(13.87)	
	41-50	0(0)	2(4.26)	34(72.34)	1(2.13)	10(21.28)	
	51-60	0(0)	1(5.88)	12(70.59)	1(5.88)	3(17.65)	
	>60	0(0)	0(0)	1(100)	0(0)	0(0)	
2.Gender	female	0(0)	7(5.19)	94(69.63)	4(2.96)	30(22.22)	0.205
	male	2(1.14)	17(9.71)	124(70.86)	6(3.43)	26(14.86)	
3.Hospital	University hospital	1(0.84)	16(13.45)	69(57.98)	6(5.04)	27(22.69)	0.001***

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properties	Provincial hospital	1(2.38)	1(2.38)	27(64.29)	0(0)	13(30.95)	
	Municipal hospital	0(0)	5(3.6)	115(82.73)	4(2.88)	15(10.79)	
	County hospital	0(0)	0(0)	0(0)	0(0)	1(100)	
	Other	0(0)	2(22.22)	7(77.78)	0(0)	0(0)	
4.Hospital grade	Triple-A	1(0.42)	20(8.44)	164(69.2)	8(3.38)	44(18.57)	0.822
	Triple-B	0(0)	0(0)	11(91.67)	0(0)	1(8.33)	
	Dimethyl	0(0)	0(0)	2(50)	0(0)	2(50)	
	Other	1(1.75)	4(7.02)	41(71.93)	2(3.51)	9(15.79)	
5.Hospital departments	Surgical	0(0)	5(10.2)	30(61.22)	2(4.08)	12(24.49)	0.002***
	Internal medicine	0(0)	9(11.25)	50(62.5)	6(7.5)	15(18.75)	
	Gastroenterology	1(1.67)	1(1.67)	56(93.33)	1(1.67)	1(1.67)	
	Respiratory	0(0)	0(0)	16(94.12)	0(0)	1(5.88)	
	Emergency and critical care medicine	0(0)	0(0)	15(83.33)	0(0)	3(16.67)	
	Other	1(1.16)	9(10.47)	51(59.3)	1(1.16)	24(27.91)	
6.Doctor title	Resident	1(1.22)	4(4.88)	53(64.63)	5(6.1)	19(23.17)	0.002***
	Attending physician	1(0.76)	10(7.63)	103(78.63)	1(0.76)	16(12.21)	
	Associate senior doctor	0(0)	2(3.7)	37(68.52)	2(3.7)	13(24.07)	
	Chief physician	0(0)	1(5.56)	14(77.78)	2(11.11)	1(5.56)	
	Other	0(0)	7(28)	11(44)	0(0)	7(28)	
7.Clinical experience(year)	<5	1(0.95)	10(9.52)	63(60)	6(5.71)	25(23.81)	0.085
	5-10	1(1.37)	8(10.96)	51(69.86)	1(1.37)	12(16.44)	
	>10	0(0)	6(4.55)	104(78.79)	3(2.27)	19(14.39)	
8.Number of new patients treated per year	<50	0(0)	6(14.63)	19(46.34)	1(2.44)	15(36.59)	0.000 ***
	50-100	0(0)	4(5.63)	58(81.69)	0(0)	9(12.68)	
	101-300	2(1.46)	8(5.84)	105(76.64)	2(1.46)	20(14.6)	
	>300	0(0)	6(9.84)	36(59.02)	7(11.48)	12(19.67)	

< .1; **<.05; *<.001*

4.3.4 Improvement suggestions for enteral nutrition care

4.3.4.1 General description of improvement suggestions

As shown in Table 4-1 below, with regard to improvement needs for enteral nutrition products, 74.8% respondents chose “few product of varieties”, 50% chose “price is too high”, 40% chose “not easy to store”, 36.1% considered “poor taste”, 28.7%

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considered “unreasonable formula proportion”, and 24.2% considered “inconvenient to use”.

Regarding barriers to provide enteral nutrition care, 80.0% respondents doctors chose “lack of relevant knowledge”, 76.8% indicate “no clear guidelines”, 54.8% believe that “lack of attention”, 43.9% believe that “unclear division of tasks”, and 28.7% “lack of time”

For the actions that can contribute to the actual improvement of enteral nutrition care, the respondents’ choice included: “establish industry norms” 85.2%, “education programs” (71.0%), “amend regulation policy” (66.5%), and “increase related inputs” (62.3%).

For how physicians would like to know information (resources) of enteral nutrition, the respondents reported: “medical website” (76.77%), “academic journal” (69.03%), “WEBCHAT subscription number” (65.81%)，“Hospital or department internal information” (64.19%), and “short-term training courses” (62.90%).

Table 4.16 Suggestions for improvement of enteral nutrition care

Which of the following do you think existing enteral nutrition products need to improve? (multiple choices)		n (%)
	Unreasonable formula proportion	89 (28.7)
	Little variety of products	232 (74.8)
	Price is too high	155 (50.0)
	Not easy to store	124 (40.0)
	Inconvenient to use	75 (24.2%)
	Poor taste	112 (36.1)
Which of the following do you think is a barrier to provide enteral nutrition care to patients? (multiple choices)		
	Lack of clear guides	238 (76.8%)
	Lack of relevant knowledge	248 (80.0%)
	Lack of time	89 (28.7%)
	Unclear division of tasks	136 (43.9%)
	Lack of attention	170 (54.8%)

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Which of the following measures do you think may help to improve the patient's enteral nutrition support? (multiple choices)		
	Amend regulation policy	206 (66.5%)
	Establish industry norms	264 (85.2%)
	Education program	220 (71.0%
	Increase relevant input	193 (62.3%)
How would you like to know the information? (multiple choices)		
	WEBCHAT subscription number	204(65.81)
	Medical website	238(76.77)
	Academic journal	214(69.03)
	Short-term training courses	195(62.90)
	Hospital or department internal information	199(64.19)

4.3.4.2 Improvement needs for enteral nutrition products

The results of Chi-test of improvement needs for enteral nutrition products among respondent characteristics were summarized in Table 4-2 And Table4-3. It showed that respondents' opinions about enteral nutrition products were mostly significantly associated with age, hospital ownership, hospital level, hospital departments, physician title, and clinical experience.

Table 4.17 Chi-test of improvement needs for enteral nutrition products

		Unreasonable formula ratio	Few varieties	Expensive	Not easy to store	Inconvenient to use	Poor taste
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
1.Age	<31	22(20.37)	71(65.74)	63(58.33)	39(36.11)	25(23.15)	44(40.74)
	31-40	38(27.74)	112(81.75)	59(43.07)	68(49.64)	34(24.82)	46(33.58)
	41-50	21(44.68)	34(72.34)	21(44.68)	15(31.91)	12(25.53)	15(31.91)
	51-60	8(47.06)	14(82.35)	11(64.71)	2(11.76)	4(23.53)	7(41.18)
	>60	0(0)	1(100)	1(100)	0(0)	0(0)	0(0)
2.Gender	female	33(24.44)	100(74.07)	68(50.37)	52(38.52)	29(21.48)	52(38.52)
	male	56(32)	132(75.43)	87(49.71)	72(41.14)	46(26.29)	60(34.29)
3.Hospital properties	University hospital	32(26.89)	76(63.87)	58(48.74)	23(19.33)	31(26.05)	59(49.58)
	Provincial hospital	11(26.19)	32(76.19)	25(59.52)	18(42.86)	13(30.95)	22(52.38)
	Municipal	39(28.06)	115(82.73)	62(44.6)	82(58.99)	30(21.58)	29(20.

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	hospital						86)
	County hospital	0(0)	1(100)	1(100)	0(0)	0(0)	1(100)
	other	7(77.78)	8(88.89)	9(100)	1(11.11)	1(11.11)	1(11.11)
4.Hospital grade	First-class Hospital at Grade 3	55(23.21)	169(71.31)	106(44.73)	104(43.88)	57(24.05)	88(37.13)
	Triple-B	1(8.33)	9(75)	3(25)	7(58.33)	2(16.67)	4(33.33)
	Dimethyl	0(0)	2(50)	3(75)	2(50)	2(50)	3(75)
	other	33(57.89)	52(91.23)	43(75.44)	11(19.3)	14(24.56)	17(29.82)
5.Hospital departments	Surgical	13(26.53)	32(65.31)	26(53.06)	18(36.73)	21(42.86)	23(46.94)
	Internal medicine	21(26.25)	62(77.5)	47(58.75)	20(25)	22(27.5)	42(52.5)
	Gastroenterology	9(15)	53(88.33)	15(25)	54(90)	7(11.67)	5(8.33)
	Respiratory	12(70.59)	17(100)	13(76.47)	5(29.41)	3(17.65)	3(17.65)
	Emergency and critical care medicine	8(44.44)	12(66.67)	7(38.89)	10(55.56)	4(22.22)	3(16.67)
	other	26(30.23)	56(65.12)	47(54.65)	17(19.77)	18(20.93)	36(41.86)
6.Doctor title	Resident	16(19.51)	58(70.73)	47(57.32)	25(30.49)	18(21.95)	37(45.12)
	Attending physician	33(25.19)	107(81.68)	64(48.85)	71(54.2)	27(20.61)	40(30.53)
	Associate senior doctor	20(37.04)	38(70.37)	18(33.33)	17(31.48)	14(25.93)	21(38.89)
	Chief physician	11(61.11)	16(88.89)	13(72.22)	3(16.67)	5(27.78)	8(44.44)
	other	9(36)	13(52)	13(52)	8(32)	11(44)	6(24)
7. Clinical experience(year)	<5	24(22.86)	68(64.76)	59(56.19)	31(29.52)	26(24.76)	43(40.95)
	5-10	18(24.66)	59(80.82)	40(54.79)	26(35.62)	19(26.03)	30(41.1)
	>10	47(35.61)	105(79.55)	56(42.42)	67(50.76)	30(22.73)	39(29.55)

Table 4.18 Significance value of Chi-test of improvement needs for enteral nutrition products

	P					
	Unreasonable formula ratio	Few varieties	Expensive	Not easy to store	Inconvenient to use	Poor taste
1.Age	0.012**	0.056	0.071	0.009**	0.977	0.645
2.Gender	0.145	0.785	0.909	0.640	0.327	0.442
3.Hospital properties	0.023**	0.009***	0.010**	0.000***	0.567	0.000***
4.Hospital grade	0.000***	0.012**	0.000***	0.004**	0.608	0.290

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5.Hospital departments	0.000***	0.002	0.000***	0.000***	0.007**	0.000***
6.Doctor title	0.003**	0.010**	0.022	0.000***	0.152	0.138
7. Clinical experience(year)	0.067	0.014**	0.070	0.003**	0.858	0.115

< .1; **<.05; *<.001*

4.3.4.3 Barriers to provide enteral nutrition care

The results of Chi-test of barriers to provide enteral nutrition care among respondent characteristics were summarized in Table 4-4 And Table4-5. It showed that respondents' opinions about barriers were mostly significantly associated with hospital ownership, hospital level, hospital departments, physician title, and clinical experience.

Table 4.19 Respond analysis of barriers to provide enteral nutrition care

X\Y		No clear guidelines	Lack of relevant knowledge	Lack of time	Unclear task assignment	Lack of attention
		79(73.15)	85(78.7)	22(20.37)	47(43.52)	62(57.41)
1.Age	<31	109(79.56)	112(81.75)	49(35.77)	59(43.07)	72(52.55)
	31-40	38(80.85)	37(78.72)	14(29.79)	23(48.94)	27(57.45)
	41-50	11(64.71)	14(82.35)	4(23.53)	7(41.18)	9(52.94)
	51-60	1(100)	0(0)	0(0)	0(0)	0(0)
	>60	110(81.48)	111(82.22)	39(28.89)	58(42.96)	80(59.26)
2.Gender	female	128(73.14)	137(78.29)	50(28.57)	78(44.57)	90(51.43)
	male	82(68.91)	85(71.43)	28(23.53)	54(45.38)	66(55.46)
3.Hospital properties	University hospital	29(69.05)	34(80.95)	12(28.57)	19(45.24)	29(69.05)
	Provincial hospital	117(84.17)	120(86.33)	47(33.81)	62(44.6)	74(53.24)
	Municipal hospital	1(100)	1(100)	0(0)	0(0)	0(0)
	County hospital	9(100)	8(88.89)	2(22.22)	1(11.11)	1(11.11)
	other	175(73.84)	185(78.06)	67(28.27)	98(41.35)	120(50.63)
4.Hospital grade	First-class Hospital at Grade 3	10(83.33)	10(83.33)	6(50)	4(33.33)	6(50)
	Triple-B	2(50)	3(75)	0(0)	0(0)	2(50)
	Dimethyl	51(89.47)	50(87.72)	16(28.07)	34(59.65)	42(73.68)
	other	30(61.22)	39(79.59)	8(16.33)	21(42.86)	30(61.22)
5.Hospital departments	Surgical	53(66.25)	61(76.25)	21(26.25)	40(50)	56(70)
	Internal medicine	56(93.33)	56(93.33)	26(43.33)	17(28.33)	10(16.67)
	Gastroenterology	17(100)	15(88.24)	5(29.41)	16(94.12)	15(88.24)
	Respiratory	14(77.78)	16(88.89)	8(44.44)	7(38.89)	10(55.56)

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	Emergency and critical care medicine	68(79.07)	61(70.93)	21(24.42)	35(40.7)	49(56.98)
	other	56(68.29)	64(78.05)	15(18.29)	36(43.9)	54(65.85)
6.Doctor title	Resident	108(82.44)	109(83.21)	42(32.06)	56(42.75)	64(48.85)
	Attending physician	43(79.63)	42(77.78)	25(46.3)	27(50)	33(61.11)
	Associate senior doctor	11(61.11)	16(88.89)	3(16.67)	8(44.44)	9(50)
	Chief physician	20(80)	17(68)	4(16)	9(36)	10(40)
	other	74(70.48)	80(76.19)	20(19.05)	43(40.95)	61(58.1)
7.Clinical experience(year)	<5	56(76.71)	55(75.34)	20(27.4)	33(45.21)	42(57.53)
	5-10	108(81.82)	113(85.61)	49(37.12)	60(45.45)	67(50.76)
	>10	30(73.17)	27(65.85)	7(17.07)	18(43.9)	24(58.54)

	P				
X\Y	No clear guidelines	Lack of relevant knowledge	Lack of time	Unclear task assignment	Lack of attention
1.Age	0.474	0.345	0.105	0.851	0.746
2.Gender	0.085	0.390	0.951	0.777	0.170
3.Hospital properties	0.012**	0.046**	0.417	0.300	0.019**
4.Hospital grade	0.042	0.419	0.231	0.018**	0.018**
5.Hospital departments	0.000***	0.020**	0.022	0.000***	0.000***
6.Doctor title	0.074	0.362	0.002**	0.823	0.057
7. Clinical experience(year)	0.121	0.104	0.009**	0.759	0.460

< .1; **<.05; *<.001*

4.3.4.4 Improvements actions for enteral nutrition care

The results of Chi-test of improvement actions for enteral nutrition care among respondent characteristics were summarized in Table 4-6 And Table4-7. It showed that respondents' opinions about improvement actions were mostly significantly associated with hospital ownership, hospital departments, physician title, and clinical experience.

Table 4.20 Respond analysis of improvements actions for enteral nutrition care

X\Y		Advice on administrative policies and amended regulations	Create industry standard	Educational programs	Increase investment
1.Age	<31	67(62.04%)	91(84.26%)	76(70.37%)	59(54.63%)
	31-40	98(71.53%)	121(88.32%)	94(68.61%)	88(64.23%)
	41-50	30(63.83%)	37(78.72%)	36(76.6%)	34(72.34%)
	51-60	10(58.82%)	14(82.35%)	14(82.35%)	12(70.59%)
	>60	1(100%)	1(100%)	0(0%)	0(0%)

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2.Gender	female	89(65.93%)	122(90.37%)	99(73.33%)	85(62.96%)
	male	117(66.86%)	142(81.14%)	121(69.14%)	108(61.71%)
3.Hospital properties	University hospital	52(43.7%)	91(76.47%)	79(66.39%)	68(57.14%)
	Provincial hospital	24(57.14%)	34(80.95%)	35(83.33%)	22(52.38%)
	Municipal hospital	121(87.05%)	131(94.24%)	102(73.38%)	101(72.66%)
	County hospital	1(100%)	1(100%)	0(0%)	1(100%)
	other	8(88.89%)	7(77.78%)	4(44.44%)	1(11.11%)
4.Hospital grade	First-class Hospital at Grade 3	155(65.4%)	197(83.12%)	163(68.78%)	150(63.29%)
	Triple-B	8(66.67%)	12(100%)	9(75%)	4(33.33%)
	Dimethyl	2(50%)	3(75%)	2(50%)	1(25%)
	other	41(71.93%)	52(91.23%)	46(80.7%)	38(66.67%)
5.Hospital departments	Surgical	25(51.02%)	38(77.55%)	34(69.39%)	25(51.02%)
	Internal medicine	45(56.25%)	65(81.25%)	60(75%)	53(66.25%)
	Gastroenterology	57(95%)	59(98.33%)	41(68.33%)	44(73.33%)
	Respiratory	17(100%)	16(94.12%)	15(88.24%)	15(88.24%)
	Emergency and critical care medicine	14(77.78%)	17(94.44%)	11(61.11%)	7(38.89%)
	other	48(55.81%)	69(80.23%)	59(68.6%)	49(56.98%)
6.Doctor title	Resident	51(62.2%)	69(84.15%)	58(70.73%)	40(48.78%)
	Attending physician	92(70.23%)	113(86.26%)	92(70.23%)	92(70.23%)
	Associate senior doctor	34(62.96%)	46(85.19%)	38(70.37%)	40(74.07%)
	Chief physician	13(72.22%)	14(77.78%)	14(77.78%)	11(61.11%)
	other	16(64%)	22(88%)	18(72%)	10(40%)
7. Clinical experience(year)	<5	62(59.05%)	90(85.71%)	73(69.52%)	51(48.57%)
	5-10	46(63.01%)	57(78.08%)	48(65.75%)	53(72.6%)
	>10	98(74.24%)	117(88.64%)	99(75%)	89(67.42%)

	P			
X\Y	Advice on administrative policies and amended regulations	Create industry standard	Educational programs	Increase investment
1.Age	0.459	0.562	0.328	0.131
2.Gender	0.863	0.023**	0.420	0.822
3.Hospital properties	0.000***	0.002**	0.037**	0.000***
4.Hospital grade	0.712	0.183	0.249	0.065
5.Hospital departments	0.000***	0.009**	0.489	0.006**

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6.Doctor title	0.711	0.890	0.977	0.001**
7. Clinical experience(year)	0.038**	0.124	0.348	0.001**

< .1; **<.05; *<.001*

4.3.4.5 Information sources for enteral nutrition

The results of Chi-test of information sources for enteral nutrition among respondent characteristics were summarized in Table 4-8 And Table4-9. It showed that respondents' opinions about information sources of enteral nutrition were mostly significantly associated with hospital ownership, hospital level, hospital departments, physician title, and clinical experience.

4.4 Chapter summary

Enteral nutrition provides patients with an economic and scientific nutritional support that has a significant impact on the patient's treatment and recovery, and quality of life. Enteral nutrition support as part of a holistic approach needs to address a variety of problems in the clinical application process.

Table 4.21 Respond analysis of information sources for enteral nutrition

		WeChat subscription	Medical website	Academic papers	Training course	Hospital or department internal information
1.Age	<31	74(68.52)	74(68.52)	66(61.11)	71(65.74)	69(63.89)
	31-40	94(68.61)	112(81.75)	103(75.18)	82(59.85)	87(63.5)
	41-50	24(51.06)	37(78.72)	33(70.21)	31(65.96)	32(68.09)
	51-60	12(70.59)	14(82.35)	11(64.71)	10(58.82)	11(64.71)

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	>60	0(0)	1(100)	1(100)	1(100)	0(0)
2.Gender	female	86(63.7)	100(74.07)	83(61.48)	88(65.19)	89(65.93)
	male	118(67.43)	138(78.86)	131(74.86)	107(61.14)	110(62.86)
3.Hospital properties	University hospital	86(72.27)	72(60.5)	70(58.82)	71(59.66)	74(62.18)
	Provincial hospital	29(69.05)	36(85.71)	23(54.76)	30(71.43)	25(59.52)
	Municipal hospital	85(61.15)	120(86.33)	112(80.58)	88(63.31)	98(70.5)
	County hospital	1(100)	1(100)	0(0)	0(0)	0(0)
	other	3(33.33)	9(100)	9(100)	6(66.67)	2(22.22)
4.Hospital grade	First-class Hospital at Grade 3	153(64.56)	173(73)	155(65.4)	141(59.49)	146(61.6)
	Triple-B	7(58.33)	10(83.33)	10(83.33)	9(75)	9(75)
	Dimethyl	2(50)	3(75)	0(0)	2(50)	2(50)
	other	42(73.68)	52(91.23)	49(85.96)	43(75.44)	42(73.68)
5.Hospital departments	Surgical	33(67.35)	38(77.55)	27(55.1)	32(65.31)	33(67.35)
	Internal medicine	62(77.5)	57(71.25)	53(66.25)	56(70)	54(67.5)
	Gastroenterology	21(35)	58(96.67)	54(90)	26(43.33)	34(56.67)
	Respiratory	17(100)	16(94.12)	16(94.12)	16(94.12)	16(94.12)
	Emergency and critical care medicine	10(55.56)	15(83.33)	14(77.78)	12(66.67)	12(66.67)
	other	61(70.93)	54(62.79)	50(58.14)	53(61.63)	50(58.14)
6.Doctor title	Resident	57(69.51)	58(70.73)	51(62.2)	55(67.07)	50(60.98)
	Attending physician	82(62.6)	108(82.44)	95(72.52)	80(61.07)	86(65.65)
	Associate senior doctor	32(59.26)	39(72.22)	35(64.81)	35(64.81)	35(64.81)
	Chief physician	13(72.22)	17(94.44)	15(83.33)	12(66.67)	14(77.78)
	other	20(80)	16(64)	18(72)	13(52)	14(56)
7. Clinical experience(year)	<5	76(72.38)	71(67.62)	66(62.86)	67(63.81)	66(62.86)
	5-10	50(68.49)	55(75.34)	45(61.64)	42(57.53)	47(64.38)
	>10	78(59.09)	112(84.85)	103(78.03)	86(65.15)	86(65.15)

	P				
X\Y	WeChat subscription	Medical website	Academic papers	Training course	Hospital or department internal information

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1.Age	0.113	0.151	0.183	0.769	0.711
2.Gender	0.493	0.323	0.012**	0.465	0.576
3. Hospital properties	0.075	0.000***	0.000***	0.462	0.020**
4. Hospital grade	0.479	0.031**	0.000***	0.109	0.274
5. Department / Section	0.000***	0.000***	0.000***	0.002**	0.072
6. Doctor title	0.320	0.039**	0.307	0.687	0.614
7. Clinical experience	0.086	0.007**	0.013**	0.542	0.935

< .1; **<.05; *<.0*

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Chapter 5 Discussion and conclusion

5.1 Summary of research findings

Through the above retrospective analysis of the development of China's FSMP industry, we can find that the FSMP industry in China is facing the following three challenges now:

First, there are only limited scientific research support and insufficient results from evidence-based medicine, which are hindering the development of the industry to some extent. FSMP, different from health care products, require great investments in scientific research and technologies and long-term accumulation [12]. China's R&D technology in this industry is still in its infancy, and there is still a large gap in the knowledge and technological reserve. We have a long way to go to develop FSMP suitable for Chinese population. For example, the foreign brand products in the market, which are compounded by monomeric nutrients, have a high osmotic pressure not suitable for the gastrointestinal tolerance of Chinese people, often leading to diarrhea in patients. On the other hand, the domestic brand products are non-pre-digestible, dispersed and not so flowable for nasal feeding. How to solve these technical problems troubles the development of FSMP in China. Moreover, as FSMP do not provide a single physiological function that is clearly identified, it is difficult to evaluate them in the clinical trial stage. So clinical research have to be accelerated with the development of FSMP.

Second, foreign companies are dominating the market, raising the entry barriers for local companies. At present, foreign brand products occupy a dominant position in the market, while domestic brand products only account for about a 10% share [13]. Local

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companies hope to enter the FSMP industry, but the difficulties they face make most of them stay at the wait-and-see stage. In particular, new entrants need to re-establish a production line that meets relevant food production regulations, which requires more investments in experiments and tests. All these are huge challenges for domestic companies.

Third, the current national policies, regulations and standards are not complete, and the product approval, production and market supervision are not standardized. Though the recent new standards have made the public's understanding of FSMP undergo a major change, and distinguished FSMP from functional foods and health products, some companies still include sports foods, health care products or functional foods in the FSMP category, which indicates that more efforts are needed in the implementation of the new standards [14]. In addition, there are some drawbacks in the Chinese medical system: if the sales of drugs is linked to the interests of doctors, doctors may be reluctant to accept the products registered and approved as "foods"; patient's understanding of treatment is easily influenced by doctors, likely to pay too much attention to drug treatment while ignoring the role of nutrition and FSMP in treatment and rehabilitation; and FSMP are not on the National Reimbursement Drug List as drugs, which make consumers unable to be reimbursed for FSMP expenses.

It is precisely because of the above problems that the FSMP industry in China is far behind that in the developed countries in Europe and America. Considering China's huge population and its rising nutritional health needs, FSMP definitely have great potential in China. FSMP is still at the very beginning of its industrial development in China. So, to actively promote the development of China's FSMP industry, it is necessary to make concerted efforts from the perspective of industrial innovation

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system in knowledge and technology development, enterprise and its network construction and policy formulation.

5.2 Discussion of Guangzhou hospital

Each of the four hospitals uses four to six enteral nutrition products, and these enteral nutrition products need to provide various nutrients during the treatment process, affecting the therapeutic effect and affecting the nutritional status and quality of life of the patients.

In the first-tier cities, which are the main players and promoters of clinical nutrition support in the policy, the proportion of the use of enteral nutrition is not balanced. At present, the existing product types in China are not balanced with the needs of patients. To meet clinical needs, the National Health and Family Planning Commission have successively formulated and published GB 25596-2010 National Food Safety Standards for Special Medical Uses. General Principles, GB 29922-2013 "Food Safety National Standards for General Medical Use Formulas" and GB 29923-2013 "Food Safety National Standards for Good Medical Use Formulas Good Manufacturing Practices", provide management policies for the development and production of enteral nutrition And standards to support enteral nutrition in the future to better serve health and wellness systems.

Whether to meet the existing needs of patients and doctors and future needs is what the next step needs to know. The incidence of nutritional risk and malnutrition is significantly correlated with age and the different stages of certain diseases. Nutrition screening is an essential first step in nutritional support. It is also essential to study the actual situation of nutrition screening, as well as the doctor's knowledge background.

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The relationship between nutritional support and development.

This study only used the data of four top three hospitals in Guangzhou and did not apply to the nutritional support of enteral nutrition in other provinces and cities, nor the use of enteral nutrition preparations in hospitals other than the top three hospitals.

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5.3 Discussion of enteral nutrition in Chinese hospitals

The majority of enteral nutrition prescriptions in the four Grade 3 Class A hospital studied has been shown to confine to a small number of products, departments and disease diagnosis, suggesting important areas for future investigations about improving enteral nutrition practice in the hospital settings.

It is worth noting that the findings from this research was based on the data from 4 Grade 3 Class A hospitals in Guangzhou City. It does not reflect the enteral nutrition prescriptions in lower level hospitals and primacy health cares. In addition, it can not represent the enteral nutrition practice in other provinces in China, especially

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considering the vast economic deviations among regions. Future study should further investigate enteral nutrition utilization at different medical institutions in different regions in China.

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5.4 Discussion of the questionnaire

This study provided utilization of enteral nutrition in Chinese secondary and tertiary hospitals between 2013 and September 2017. The data showed that sales volume and sales value of enteral nutrition at tertiary and secondary hospitals have continued to rise since 2013. By September 2017, the sales volume of enteral nutrition reached 13.95 million units, and sales value of enteral nutrition was 950 million CNY. The reason may be that the views on PN and enteral nutrition have been changed. In the past few decades, the view of using enteral nutrition and PN has been changed markedly. In the 1970s, the proportion of patients receiving PN to enteral nutrition was 9:1. In the 1990s, the proportion of patients receiving PN and enteral nutrition was reversed to 1:9 globally. It was showed that nutrition clinicians believe that enteral nutrition is better than PN. Among various patient populations, more patients chose EN.

EN as a nutritional support can be applied in different fields such as long-term care and management of diabetes, cancer, inflammatory bowel disease. enteral nutrition nutritional support in elderly patients is particularly important, especially in critically ill patients, the mortality and morbidity of elderly patients is much higher than young patients. This may be due to the lower reserve capacity of organs and systems, and the lower ability to respond to physiological pressure. enteral nutrition support can improve the clinical status of elderly patients, and result in reduced mortality, shortened hospital stays and reduced medical costs. When selecting nutritional support,

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various factors should be considered, such as the patient's condition, nutritional status and age. With the development of nutrition support in China, various guidelines have been published, such as *Guidelines for parenteral and enteral nutrition support in geriatric* and *Patients in China and Practices consensus of enteral nutrition in patients with neurological diseases*. A study about the practice of enteral nutrition in Chinese tertiary hospitals shows that the configuration and staffing of enteral nutrition devices in Chinese tertiary hospitals is sufficient. However, some related practices have not yet reached the desired level, indicating that improvements and personnel training are needed.

There were significant differences in the choice of nutritional support between hospitals in different regions in China. According to Chinese national policy, Chinese economic regions are divided into four regions: eastern, central, western and northeast. In terms of economic development, the eastern region is the most developed region, followed by the central region and western region, and northeastern region. This study provided data from secondary and tertiary hospitals in eastern, central and western region in China. The average sales value of individual secondary hospitals and individual tertiary hospitals in all three regions showed upward trend. The average sales value of individual secondary hospitals in the three regions was different from the individual tertiary hospitals, and the regional different was similar to the level of economic development. The average sales value of the individual secondary hospitals and individual tertiary hospitals in the eastern region were the largest, much higher than that in the central and western regions, and the average sales value of the individual secondary hospitals and individual tertiary hospitals in the central and western regions was similar. There were inequalities in the distribution of health

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resources and services between regions, with more manpower and capital investment in the eastern region than in the central and western regions.

There were large differences in the choice of nutritional support among different hospitals and different diseases in Chinese hospitals. These differences may not only be attributed to differences in the epidemic but also to different doctors. Nursing personnel play a key role in using enteral nutrition continuous care. In this study, from the period of 2013 to September 2017, the proportion of enteral nutrition sales in secondary and tertiary hospitals were stable. The proportion of sales value of enteral nutrition in tertiary hospitals was about 87%, far more than the proportion of sales value of enteral nutrition in secondary hospitals. The proportion of sales volume of enteral nutrition in secondary and tertiary hospitals were the same as the proportion of sales value. The proportion of sales volume of enteral nutrition in tertiary hospitals was about 86% and the proportion of sales volume of enteral nutrition in secondary hospitals was about 10%. As of September 2017, the proportion of sales value and sales volume in tertiary hospitals were 89.60% and 89.28%, respectively. The proportion of sales value and sales volume in secondary hospitals were 10.4% and 10.72% respectively. It may be due to the distribution of medical resources and the level of medical staff. The medical resources of tertiary hospitals are more adequate than those of secondary hospitals. The level of medical personnel in tertiary hospitals is higher than medical personnel in secondary hospitals, and they have the opportunities to participate in advanced training to understand the current research and clinical guidelines of EN.

With the development of enteral nutrition in China, the sales volume and sales value of enteral nutrition in tertiary and secondary hospitals have been increasing and

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showed upward trend during 2013 to 2017. There were obvious differences of average sales value of enteral nutrition between hospitals and regions. There are total of 15 domestic and 43 imported enteral nutrition approvals approved by the State Food and Drug Administration in China. However, TPF, TPF-D and SP which accounted for more than half of market share of the enteral nutrition market, played a dominant role in enteral nutrition market.

5.5 Conclusion

In the innovation system, the government as a significant player plays a vital role in coordinating the operation of the system. Freeman pointed out that "the institutional network of the public and private sectors, the activities of the two types of sectors and their interactions generate, cite, improve and disseminate new technologies." In continuous incremental innovation, feedback from different participants is an important part. Part of each innovation involves responding to the previous innovation process.

Under the guidance of the new policy, producers have continuous feedback and mutual influence. The medical sector, as a user, has detailed information exchange and feedback with producers during the domestic production diffusion phase, which can encourage producers to innovate further products (Lundvall, 1988), which will produce a virtuous circle (Nelson, 1993). The lack of coordination in all parts of the innovation system will lead to innovation performance (Steinmuller, 2010).

This study found that formal education about enteral nutrition, and nutrition education opportunities are scarce, and some respondents showed limitations in understanding and application of relevant knowledge. Hospital and school education programs

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provide limited education on the source of knowledge related to enteral nutrition, and respondents indicated that most of the knowledge of enteral nutrition comes from clinical experience and hospital colleagues (dictators and other doctors). At the same time, it also expressed its willingness to accept more knowledge of nutritional support, and a variety of ways to access knowledge, such as clinical journals, seminars or formal education, undergraduate or postgraduate courses.

Besides, informal sources such as the Internet and the WeChat public account have also been proposed. At the same time as the enteral nutrition support work, there is a lack of relevant authoritative information on the guidelines for enteral nutrition use, which may be related to the breadth and intensity of knowledge dissemination, and only limited to the registration management policy for the producer.

Providing policies that promote cognitive and related information diffusion can speed up the application of enteral nutrition, or as a new product for special medical foods, and expand the scope of application. In the analysis of the innovation system, the dysfunctional or missing part that appears in the system can be identified. Among them, the assignment of new tasks to the public sector is a usual response to dysfunctionality.

Throughout the development of special medical food in China, there are also some challenges. On the one hand, the cognition of special medical foods from medical personnel to consumers in China is still relatively vague, and it is not even possible to distinguish between them and health products. On the other hand, in the context of the limited proportion of medicines and the separation of pharmaceuticals, it is a worthwhile direction for pharmaceutical companies to enter the special medical food industry. How to use the advantages of current policy dividends and market expansion to succeed in the future, is the challenge before the eager. As the country gradually

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clarifies the development direction of special medical food and issues corresponding implementation standards and regulations, it is believed that the blue ocean of special medical food will usher in explosive growth. Up to now, a total of 12 special medical foods have been approved. As Hengrui, Abbott, Nestle, and Yili have successively obtained adult FSMP registration certificates, it also shows the beginning of the adult FSMP market. It is expected that the end of 2019 to 2020 will accelerate the promotion of adult FSMP Registration and listing.

With the deployment and implementation of the national nutrition and health industry development strategy, as people's attention and demand for nutrition and health increases, special medical foods have received more and more attention. Take a slice of food in the blue ocean.

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Appendices

Annex I-Classification of Foods for Special Medical Purpose (FSMP) Registration in China

Classification	Specific Categories	
FSMP for 0-12 months old infant	Lactose free formula or low lactose formula food	
	Partially hydrolyzed milk protein formula food	
	Extensively hydrolyzed milk protein formula or amino acid-based formula food	
	Premature or low birth weight infant formula food	
	Breast milk nutrition food	
	Amino acid metabolism disorder formula food	
FSMP for 1 year old and above	Full nutritional formula food	
	Specific full nutritional formula food	1*. For diabetics; 2*. For respiratory system disease patients; 3*. For kidney disease patients; 4*. For cancer patients; 5. For hepatopaths; 6. For muscle attenuation syndrome patients; 7. For patients with trauma, infection, surgery or other stress condition; 8*. For patients with inflammatory bowel disease; 9*. For food protein allergy sufferers; 10*. For patients with intractable epilepsy; 11. For patients with gastrointestinal disorders, pancreatitis; 12. For patients with fatty acid metabolism; 13*. For patients with obesity, fat reducing surgery.
	Incomplete nutritional formula food	

27 March 2018 original article from Chemical Inspection and Regulation Service (CIRS)

*Currently, for specific full nutritional formula food, the adjustable nutrients indexes of 8 specific categories (No.1, 2(COPD), 3, 4, 8, 9, 10, 13) are available according to Q&A of GB 29922-2013.

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Annex II-Questionnaire

Part 1 Background / Respondent characteristics / Descriptive statistics of the responders

1. Age

<31

31-40

41-50

51-60

> 60

2. gender

female

male

3. Hospital properties

Affiliated Hospital of Colleges and Universities

Provincial hospital

Municipal hospital

County hospital

Private hospital

other_____

4. Hospital grade

Triple-A grade hospital

Triple-B grade hospital

Dimethyl Grade Hospital

Diethyl level hospital

other_____

5. Department / Section

Nutrition

Surgical

Internal medicine

Gastroenterology

Respiratory

Intensive Care medicine

Emergency

other_____

6. Physician Title

Resident

Attending physician

Deputy Chief Physician

Chief physician

nurse

7. Clinical experience (years since full medical registration)

<5

5-10

> 10

8. Number of new patients treated per year

<50

50-100

101-300

> 300

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Part 2 Nutrition screening and assessment

9. Do you need to play a nutritional assessment and nutritional support role in routine care for patients?

Yes, because it is part of the diagnosis, treatment program

Play an important role, but not the regular basis of the part

Better understand the condition and treatment of the auxiliary role

other_____

10. Concerning nutrition screening this procedure, in your department is [multiple choice]

Evaluation of the nutritional status of patients at admission is the standard procedure.

Evaluation of the nutritional status of patients during hospitalisation is a standard procedure.

Energy intake during hospitalisation is routine.

Measurement of patient weight at admission is a fixed procedure.

other_____

11. How does nutrition assessment work? [Multiple choices]

Using the multidimensional screening tool (MUST, NRS2002, MNA, NRI, SGA)

By assessing body mass index, according to food intake and instrument evaluation

By assessing BMI

By assessing whether or not to reduce weight shortly

other_____

Part 3 Knowledge and practice

12. What types of nutritional support do you currently offer? [Multiple choices]

Nutritional counseling

Diet

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Oral nutritional supplements

Enteral nutrition (tube feeding)

Parenteral nutrition

13. What are the prescriptions for which patients will be given supportive nutrition? [Multiple choices]

There is a risk of malnutrition or malnutrition during treatment

Nutritional status has been impaired

Has reported spontaneous feeding difficulties

Has been diagnosed at the end of the disease

other_____

14. Will your knowledge of enteral nutrition be? [Multiple choices]

Unit of nutritionist

Policy / guidelines / agreements

Journal article

Graduate courses

In-service education

the Internet

Undergraduate Education

Graduate course or doctoral program

In-service graduate course or doctoral program

Other doctors

Clinical Experience

other_____

15. What are your considerations for choosing enteral nutrition support (oral and tube feeding)? [Multiple choice]

Price

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Brand

Nutrient content

Taste

Convenience

Safety

The patient's disease

The age of the patient

other_____

16. Which of the following diseases do you often support for enteral nutrition? [Multiple choices]

Diabetes

Respiratory system

Kidney disease

Liver disease

Tumor

Muscle attenuation

Trauma, infection, surgery, and other stress conditions

Inflammatory bowel disease

Food protein allergy

Refractory epilepsy

Gastrointestinal disorders, pancreatitis

Fatty acid metabolism abnormalities

Obesity, fat reduction surgery

other_____

17. How does your organisation manage nutrition support?

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Directly by the doctor in charge of the work in the department

Through the unit of nutrition

Through the clinical nutrition department doctors to work in the department

By attending the patient to a community doctor

According to patient requirements

other_____

18. Regarding the current use of enteral nutrition and parenteral nutrition? [Scale]

Very unreasonable

Relatively unreasonable

More reasonable

Very reasonable

Part 4 Suggestions for improvements

19. Which of the following improvements do you think of existing enteral nutrition? [Multiple choices]

The proportion of unreasonable formula

Little variety

Excessive price

Not easy to store

Not easy to use

Poor taste

other_____

20. Which of the following do you think is an obstacle to the patient's enteral nutrition care? [Multiple choices]

Lack of clear guide

Lack of relevant knowledge

Lack of time

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Unclear distribution of tasks

Lack of attention

other_____

21. Which of the following measures do you think may help to improve the patient's enteral nutrition support? [Multiple choices]

Make recommendations and amend the administrative policy

Create specifications within the industry

Education Program

Increase the relevant input

other_____

22. How would you like to know the information? [Multiple choices]

Microsecond subscription number

Medical website

Academic journal

Short-term training courses

Medical website

Hospital or department internal information

other_____

23. Other recommendations

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Annex III-Nutritional support option combination

Nutritional support option combination	n(%)
Diet ¦ Parenteral nutrition	4(1.29)
Diet ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	2(0.65)
Diet ¦ Enteral nutrition (tube feeding)	2(0.65)
Diet ¦ Oral nutritional supplements ¦ Parenteral nutrition	2(0.65)
Diet ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	9(2.90)
Diet ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding)	3(0.97)
Diet ¦ Oral nutritional supplements	4(1.29)
Diet	7(2.26)
Nutritional counseling ¦ Diet ¦ Parenteral nutrition	7(2.26)
Nutritional counseling ¦ Diet ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	25(8.06)
Nutritional counseling ¦ Diet ¦ Enteral nutrition (tube feeding)	10(3.23)
Nutritional counseling ¦ Diet ¦ Oral nutritional supplements ¦ Parenteral nutrition	7(2.26)
Nutritional counseling ¦ Diet ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	64(20.65)
Nutritional counseling ¦ Diet ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding)	17(5.48)
Nutritional counseling ¦ Diet ¦ Oral nutritional supplements	23(7.42)
Nutritional counseling ¦ Diet	14(4.52)
Nutritional counseling ¦ Parenteral nutrition	3(0.97)
Nutritional counseling ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	39(12.58)
Nutritional counseling ¦ Enteral nutrition (tube feeding)	6(1.94)
Nutritional counseling ¦ Oral nutritional supplements ¦ Parenteral nutrition	4(1.29)
Nutritional counseling ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	9(2.90)
Nutritional counseling ¦ Oral nutritional supplements ¦ Enteral nutrition (tube feeding)	1(0.32)
Nutritional counseling ¦ Oral nutritional supplements	4(1.29)
Nutritional counseling	4(1.29)
Parenteral nutrition	4(1.29)
Enteral nutrition (tube feeding) ¦ Parenteral nutrition	5(1.61)
Enteral nutrition (tube feeding)	3(0.97)
Oral nutritional supplements ¦ Parenteral nutrition	8(2.58)
Oral nutritional supplements ¦ Enteral nutrition (tube feeding) ¦ Parenteral nutrition	14(4.52)
Oral nutritional supplements ¦ Enteral nutrition (tube feeding)	2(0.65)
Oral nutritional supplements	4(1.29)

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