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IMPORTANCE OF INFORMATION SYSTEMS IN THE EVALUATION AND RESEARCH OF NUTRITION AND HEALTH OF KEY GROUPS IN CHINA'S RURAL AREAS

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ABSTRACT: The improvement of nutrition and health evaluation research will better help people to strengthen food safety, prevent and control the major diseases, improve medical and health services. This is especially important with key groups in the vast rural areas in China. Under the background of information era, if the nutrition and health assessment methods research can be combined with the actual research findings of statistical analysis using information systems and big data, the research level will be achieved and be good for the reducing of regional differences in levels of development. This paper summarizes and analyzes the important indicators and elements that have great impacts on the level of nutrition and health for the population through the latest development about nutrition and health research at home and abroad first, then describes the parametric modeling research ideas and methods under the conditions of modern information technology, at last revealed widely practical prospect of information technology in the field of nutrition and health. This research has practical significance to the promotion of economic and social development in rural areas and the enhancement of the overall nutritional and health level of the population.

Key Words: information system; rural population; nutritive index; health conditions; evaluation model.

1. INTRODUCTION

Chinese nutrition health and food nutrition safety are gradually becoming one of the major strategic issues in the construction of national quality in China; thus the research on national nutrition health level becomes imperative. Since 2010, aiming at the sustainable development of national fitness and health, the Chinese government has launched and implemented “The 12th Five Year Plan of Food Industry” and “The 12th Five Year Plan of Health Protection” based on the domestic food nutrition safety situation and the development process of nutrition and population health at home and abroad. This is the top-level design and systematic plan for the mid and long term development of national food and nutrition safety and health of the population. Due to the large population of China, health protection development levels varied in different places; health evaluation indicators varied for different key groups, such as for the elderly, women and children; chronic, endemic, occupational and other kinds of diseases are crossed and frequently occurred; all these situations caused the lagging of the investigation and research of nutrition and health of key groups outside the urban areas. However, with the implementation of new health insurance and new rural cooperative medical system (NCMS) and the emergence of potential technologies like the Internet of Things and Big Data, it is predicted that the modern information will become the most effective means in the investigation and research of nutrition and health of the population in China.

Research of nutritional and health level mainly involves two major fields: human nutrition and food nutrition. From the view of academic development, nutriology is closely linked with biochemistry, physiology, pathology, clinical medicine, food science, agricultural science and other disciplines. From the micro perspective, it can provide guidance for the reasonable arrangement of the diet of an individual, a family or a group; it is closely connected with the life processes of human beings, such as the growth and development, physiological function, operational capacity, disease prevention, health protection and longevity; from a macro perspective, it is related to the agricultural production, food processing, the populace's cultivation and economic levels of a country. Therefore, nutriology is a natural science discipline with high potential for scientific applications. For example, the incidence of chronic diseases and lifestyle are closely related, which accounting for about 60% of health issues. The two major factors affecting chronic diseases are nutrition and exercise. People with obesity and overweight have a high risk of chronic diseases. Thus nutrition is the most important factor which affects public health. This paper provides an overview of current studies on the evaluation of nutrition health level and puts forward that the information system can play an important role in this evaluation, particularly for the key groups in Chinese rural areas.

2. ANALYSIS OF RESEARCH PROGRESS

2.1 Research status worldwide

Trophic level evaluation is an important reference for the measurement of population's health level. Currently, a large number of studies have been conducted to evaluate population's nutrition health level based on the indicators, such as heart health, digestive system health, bone health, weight control, mental supplement and blood sugar control, etc. Also, the evaluation methods for nutrition health level have been well documented.

In the field of evaluation for nutrition health level, worldwide, according to the Report of United Nations Standing Committee on Nutrition (2009), the Sixth World Nutrition Situation Report showed obvious progress of nutrition improvement have been made in some countries with nutritional deficiencies, in which the control of iodine deficiency can be taken as one of the very successful cases. In addition, the tendency of dysplasia and underweight in different populations and areas has been effectively monitored. In the end, this report indicated the need of a sustainable solution and a more lasting change to enhance the connection between food safety and nutrition and make it closer. Gu et al. (2007) compared the bone mineral content (BMC) and bone mineral density (BMD) of elderly population. The study included 490 men aged 50-70 and 689 women. The results showed that the BMC and BMD samples of urban population were significantly higher than the samples of rural population. Differences of BMC and BMD of women from urban and rural areas were not limited to the lifestyle, but also included other activities, such as income, milk intake, vitamin D and calcium, the general level of physical activity, walking, and social activities. Aubel (2011) indicated that improvement of nutritional status of infants and young children in developing countries was largely depended on whether the family adopted the optimum nutrient supply, especially, the impacts and functions of women (e.g. grandmother) could not be ignored. Three different cultural backgrounds, namely Africa, Asia and Latin America and social dynamics factors influencing the commonly seen models in child nutrition were involved in this research, including: grandmother's influence on the child nutrition and health issues as the central role; the impact of grandmother on the practices of pregnant women and child nutrition, especially other nutrient levels for children with regard to pregnancy, feeding and care of infants, toddlers and sick children. It also pointed out that the impacts of male members of the families on child nutrition

were relatively limited. Brauw et al.(2011) studied children's weight status in rural areas and indicated that weight of children aged 7-12 inclined to be lighter than the standard weight, and if not taken care of grandparents, children aged 2-6 were less likely to exceed the standard weight. Migration of the parents was positively correlated with the underweight of children aged 7-12. Because members in families that had migrant workers tended to spend less time in cooking. And children aged 7-12 in such families would have to bear part of the house works, mainly cooking. Nutritional status of children aged 2-6 was largely unaffected in families with migrant workers, especially when they were living with grandparents. Fox et al. (2012) reported a survey focused on the health status of children from 35 developing countries and the multi-level regression results of the data showed that the problem of child malnutrition in rural areas was very serious, which was affected and restricted by the socio-economic level, the medical care level as well as the supply of nutrients and other conditions. Meanwhile, the urban-rural gap was shrinking with the countries' gradual development. Delpier et al. (2012) demonstrated that rapid growth of young people's consumption of sugared beverages would cause weight gain, bone damage and tooth decay, as well as the situation of type II diabetes. Also, the results showed that reduction of the consumption of highly sugared beverages had high statistical significance. It also reflected the significance of applications of Internet and smart phone technology in the analysis and nutritional advices. In America, studies showed (Pan American Health Organization, 1998) that in the last decade, health conditions of Americans was steadily improved, which should give the credit to social, environmental, cultural, and technological development and improvement of medical and health conditions. The characteristics of the progress and speed were unique and could not be reproduced in other countries, or other populations. Some countries, like Latin America and the Caribbean, are still facing the distresses brought by traditional health problems such as famine, environmental degradation and the deterioration of living conditions. In many areas of America, nutrient level has been greatly improved, which can be proved by conventional measurements of body weight and height, but lower weight to age ratio and weight to height ratio are still serious, especially in children, the number of children with lower weight and age ratio caused by malnutrition accounted for 50% of the preschool and school-age children. This problem is not only related to the height, but also reflects the physical and mental development. And obesity mainly refers to excessive weight to height ratio, which mainly present in areas with lower level of development. Among urban population and women, this obesity would normally be misunderstood as excess nutrients, but it is actually accompanied by deficiency of some microelements, such as iron, folic acid and zinc. And its prevention and eradication is very complex. Among the deficiency of these microelements, the deficiencies of iodine and vitamin A had been controlled, the deficiency of iron remains as the most commonly seen nutritional problems, especially among pre-school children and pregnant women.

In Brazil, Viera et al. (2011) studied the socio-economic, diets and anthropological characteristics of school-age population. The research of nutritional conditions mainly focused on the BMI/Age ratio (Body Mass Index) and Height/Age ratio (Height Indicator). The research of food intakes used the 24 hours recall method and the results were analyzed through the comparison with Dietary Reference Intake indicators. The population studied included 145 school-age children and adolescents, of which 79% of their legal guardians had no formal occupation (referring to agriculture and handicrafts industries); average monthly income of 82% of the legal guardians were less than the standard level, 35% mothers of the investigated population received less than 3 years of school education. Analysis of the Body Mass Index and Height Indicator results of the population studied, demographic indicators of results indicated that 7.1% of children and 14.8% of adolescents showed weight and height defects. If the results were separated by gender, female children showed more height defect ratio. Compared with the recommended value of daily energy intake, approximately 72.6% of children and 63.9% of adolescents have energy intake deficiency. Analysis on these two groups showed that the intake of microelements such as

iron, zinc, vitamin A and calcium are seriously in shortage. These findings suggest that the level of social and economic development as well as nutritional status is important factors that determine the level of children's nutritional health.

In the field evaluation methods for nutrition health level, for instance, Klein et al. (1997) reported the reality of urgently needed health care resources and intensive medical models for elder population in rural areas. A nutritional risk screening model suitable for the managed health care model targeting elder population in rural areas was also proposed in the research. The nutritional risk screening was achieved through the Geisinger Health Care System; the managed health care model was embedded in its individual remote diagnostics site, which made further screening and case management of malnourished populations possible. And the screening and intervention would be conducted at the clinic sites, which were selected based on the integrated professional knowledge and resources provided by this research. A rational clinic case manager would be developed based on the personalized assessment and intervention programs. Research subjects completed the screening at the remote sites, and the medical records management and selection of nutritional status would be developed according to risk criteria. Tham et al. (2010) reported the evaluation method of integrated health service level in rural areas of Victoria region, Australia. The optimized combination of important parts of the successful basic medical insurance and the target health services and health status indicators was used to establish a conceptual evaluation system. The promotion of this kind of service in Victoria region indicated that there was not enough evidence to prove that this system ran better in rural areas. Although the health service model might have minor differences due to geographical, environmental and other factors, there was evidence to suggest that the health service model could be sustainable be able to feedback and could meet the local medical standards. This evaluation system could provide guidance for evaluation of future health services and provide new ideas for research of health services' influences on the community and residents.

2.2 Research status in China

Nutrition and health condition of the population are indicators that could reflect the economic and social development, health care level and population quality of a country or region. Good nutrition and health status are both the foundation of social and economic development and the important social and economic development goals. However, many regularity things still needed to be explore in the academic research of nutrition and health levels of key groups in rural areas, in practice, there are still many problems to be solved. To study the development law of nutrition and health levels of key groups in rural areas, its system and structure shall be firstly clarified, including the composition of the various elements within the system and their corresponding functions. The introduction and presentation of related concepts concerning nutrition and health levels of key groups in rural areas are the basis and premise for the research of its evaluation and classification.

In China, according to the level of social development, nutrition and health research conducted by domestic scholars mainly focused on: analysis and assessment of health conditions of different population groups, analysis and assessment of nutritional conditions of different groups, economical analysis and assessment of trophic levels of different groups, economical analysis and assessment of health levels of different groups, as well as research on the specific nutrition evaluation of people in the hospital that already had health problems, application of information technology in health management of different population groups and application of information technology in the field of food safety.

2.2.1 Analysis and assessment of health conditions of different population groups

Based on the analysis and assessment of health conditions of different population groups, an indicator system on nutrition and health level of key rural population can be proposed to build its comprehensive evaluation model, which is the Grey Clustering Evaluation Model for nutrition and health level of key rural population.

Based on the WHO definition of health, conformed to the shift from biomedical model to organisms-psychological paradigm-social medicine model and the shift of health measurement from one-dimensional to multi-dimensional and with the introduction of “three elements” in health care, Yao Xuyi (2005) quantified the above elements to establish a three-dimensional mathematical model of integrated health evaluation, which could provide more intuitive, comprehensive, and accurate reflection of the true meaning of individuals or group health from the quantitative point of view, which made the realization of people’s desire in practice became possible.

He Liping (2010) evaluated the health fairness of farmers in three counties in Yunnan Province with the application of range method, Gini coefficient, concentration index and Logistic regression; the results showed that if the impacts of only one factor was taken into consideration, the concentration index would be applicable; but multivariate analysis should be used if impacts of more factors were to be considered.

Based on disease surveillance and the NCMS information system, Wang Hongjuan (2012) established the evaluation index system and evaluation methods for health status of rural residents. The researcher conducted comprehensive evaluation of the health status of rural residents in Miji District with the application of the established evaluation methods for health status of rural residents, which filtered out the major public health problems influenced the health status of rural residents to provide scientific basis for decision-making of local government on the development of health services. Issues of exploration of how to share existing diseases and health monitoring system data and how to effectively apply the evaluation methods of health status of rural residents were also studied.

Zhao Huashuo (2011) studied the grading evaluation of Quality of Life (QOL). Three kinds of multivariate statistical analysis methods (principal component analysis (PCA), cluster analysis, discriminant analysis) were used to conduct grading evaluation on QOL data. The results classified the QOL of 209 elderly people into 3 grades of good, medium and poor; the percentage of each grade was 45.93%, 33.02% and 21.05% respectively. The conclusion was that the comprehensive application of a variety of multivariate statistical methods can successfully solve the problem of grading evaluation of Quality of Life (QOL).

Liu Tanghong (2010) found the best way to evaluate the comprehensive health status through the assessment of the health status of rural residents in Dongying. The understanding of the multi-dimensional health status and comprehensive health status of rural residents in Dongying provided basis for the formulation of various policies concerning the improvement of health level of rural residents and thus could effectively improve the comprehensive health status of rural residents. A combination of quantitative and qualitative research methods was used in the research: in the quantitative study, survey respondents were randomly selected through stratified cluster; household survey were completed by face to face interviews; in qualitative research, health assessment and recommendations from experts were obtained through group discussion and the statistical analysis of the collected data was conducted with the application of SPSS16.0 software.

Hu Yong (2007) described the current status of the overall health of farmers in China from three dimensions, namely: health outcomes, health care utilization and availability, health financing and health insurance and analyzed the major influence factors from the perspective of sociology of health and illnesses, including the public health environmental degradation in rural areas, lagged health concepts of farmers, weak theoretical basis for health promotion of farmers,

constraints of dualistic urban-rural social and economic structure, the coexist “absence” and “overdone” of the government functions.

Ma Xiaorong (2010) believed that the empirical research results of the health needs of rural residents showed that: age and health service prices had significant negative effects on health; but education level and household income per capita had significant positive effects on health; self-rated health evaluation of employed rural residents was better than that of unemployed urban residents; QOL indicators of rural residents in marriage were higher than that of the unmarried, divorced or widowed residents. In general, as a health measurement method, regression results of self-rated health evaluation fitted the predictions of Grossman Model better than the regression results of the QOL indicators.

Nie CuiFang (2007) used the random cluster sampling method to select 1661 elderly person over 45 years old from Lacey City as the research object to conduct physical examination, including measurement of height, weight, waist circumference (WC), hip circumference (HC), blood pressure, blood glucose and hemoglobin, etc. and calculated the body mass index (BMI), waist-hip ratio (WHR), waist / height ratio (WHtR) and other indicators. Correlation analysis was conducted to understand the nutrition-related diseases situation among middle age and elderly population in rural areas of Lacey City. The studies showed that the prevalence of nutrition-related diseases among the elderly population in rural areas remains high. Nutrition and health education could reduce the prevalence of some nutrition-related diseases of the elderly population in rural areas, but chronic disease control was a long-term process. It was recommended that regular and continuous health education for the elderly in rural areas should be conducted.

Gao Hong (2011) reviewed that analysis method had been established on personal health evaluation swarms for Chinese people. Suggestions and opinions of experts on the content arrangement and index selection of the personal health evaluation index for Chinese were collected through Delphi method using questionnaires. A personal health evaluation index system for Chinese was established after analysis and summarization. Then the normal distribution method and percentile method were used to define the medical reference range of physical, psychological, social, medical and behavioral health dimensions of Chinese people. In the end, the reliability and validity of the index system were tested by the application of questionnaire.

2.2.2 Analysis and assessment of nutritional conditions of different groups

To establish an assessment method for the evaluation of nutritional and health conditions of key groups in rural areas, a set of food accessibility –based nutritional level indicators and a set of health condition indicators under the environmental stress conditions shall be defined. Through questionnaire design, representative sample selection; with the application of combination of field research and literature analysis, this research was able to acquire measured data of nutritional and health conditions of key groups in rural areas. Gray cluster theory was used in the data analysis and the interaction between the two sets of indicators mechanisms was discussed in the research. This research also constructed the comprehensive evaluation model for the nutritional and health conditions of key groups in rural areas, which was also modified according to the rural development in China to establish the evaluation methods for the nutritional and health conditions of key groups in rural areas.

Through the investigation of health literacy of residents in Hubei Province, Hu Xiaoyun (2009) analyzed the influencing factors on health literacy of residents and how these factors in turn impacted the health conditions of the residents. She assessed health literacy of individuals and groups by selecting individuals and groups with lower health literacy as the subjects. Her research provided tools for the evaluation and assessment of the effects and achievements of health promotion/education works or projects and further provided reference for the promotion of health

literacy monitoring; for the setting of health promotion and health education related strategies and standards. This research was the first relatively comprehensive description and analysis of the health literacy of residents in Hubei Province. It used the SEM model to build up the relations between the basic information, health literacy and health conditions of the residents and conducted quantitative analysis of the relations to provide reference for the decision-making in residents' health literacy improvement.

Li Jing (2009) carried out a nutrition intervention study about the rural communities in Tianjin from November 2007 to January 2009. The result indicated that rural residents' knowledge in terms of nutrition and other health knowledge had been significantly improved and their attitudes also greatly changed after the intervention, but the changes concerning diet and living habits were not significant. Intake of vegetables and fruits was increased in rural residents since they began to establish a sense of eating fruits and vegetables.

Xiong Guohong (2009) developed and designed a professional health advice website based on nutrition counseling called "My health, My say". With its wide application in community service, people's nutritional awareness had been improved and nutrition knowledge was universally popularized.

Research result of Rao Jianjun (2009) suggested that a significant number of the rural elderly people were in a dangerous state of malnutrition with the coexisting of weight loss and overweight problems. Therefore, nutrition and health issue was a problem existing and needing to be handled among rural elderly people. The overall nutritional status of the elderly people in rural areas of Tongzhou District was higher than that of two other areas in the country (Anhui and Jiangsu Nantong) but lower than the level of elderly people living in urban communities in Wuhan and Shanghai. Among the surveyed elderly people, population with malnutrition accounted for a small proportion (7.6%), but population at risk of malnutrition is relatively high, accounting for 45.7%. Relatively large differences existed between individuals in terms of nutritional status. Appropriate care and interventions should be taken by relevant agencies according to the major influencing factors of the nutritional status and the specific circumstances of different groups towards the elderly.

Li Jing (2011) conducted primary exploration on nutritional intervention and provided reasonable proposals through her investigation of collective meal quality of children in urban areas of Lanzhou City; her physical testing and determination of mineral elements and her assessment of their nutrition and growth conditions, including: 1. dietary and nutritional status: method of continuous 5 days weighing was used in this survey and the evaluation of the results referred to the Diet Guidance for Chinese People and Chinese DRIS; 2. the growth and development status: the evaluation of physical development was done through the tests of height and weight; the recommended height and weight provided by World Health Organization (W110, 2006) were used as the reference standard, weight for age Z score (WAZ), height for age Z score (HAZ) and weight for height Z score (WHZ) of each child were calculated for the evaluation of their growth and development; integrated growth retardation, low birth weight and weight loss were the three indicators used in malnutrition evaluation; three, minerals determination: fingertip peripheral blood of children were acquired and analyzed with the use of atomic absorption spectrometry to determine the levels of calcium, iron and zinc.

2.2.3 Research on the specific nutrition evaluation of people in the hospital that already had health problems

Wu Kun's (2005) definition of the original meaning of the nutrition was "to seek health", which referred to the process of intake, digestion, absorption and utilization of nutrients in food to meet the body's physiological needs of human body. That proper nutrition meant through a

scientific cooking process, reasonable diet could provide sufficient energy a variety of nutrients to the body and maintain a balance between the various nutrients to meet the body's normal physiological needs and to maintain the healthy nutrition in human body.

Xu Shiwei (2008) believed that development of modern agriculture aiming at nutrition and health improvement involved a wide range of research work. Research of agriculture as the foundation of scientific research should be strengthened, such as research on the "high-yield, high-quality, high-efficiency, ecological and safe" agricultural production theory and technology; research on the collaborative development of production and environment approach and study of the impacts of agricultural investment on food quality and safety and its reduction ways. Currently, research on the food safety risk assessment theory and method should be strengthened; the stimulation system of plant food quality and safety risks assessment should be established; the ancient analog systems of animal food quality and safety risks assessment should be established; processed food quality and safety risk assessment system taken animal and plant agricultural products as raw materials should be established; quality and safety of analog systems of food from farm to fork shall be established; interdisciplinary integrated research should be deepened to provide a scientific basis for the food quality and safety risk assessment and early warning. Research on agricultural early warning should be strengthened at the same time reduce agricultural production risks and promote the healthy development of modern agriculture.

2.2.4 Applications of information technology in the field of nutrition and health education

Currently, in many rural areas, nutrition and health information took on the one-way propagation, which was confined to merely pass information to the farmers and failed to timely feedback the needs of farmers and various customer-tailored information services were relatively weak. Meanwhile, the farmers' needs for nutrition and health information became more widely, but the existing services lacked of pertinence and thus failed to meet the huge needs of the farmer groups for finer and real information more suitable to local needs, thus the problem of dispersed nutrition and health information failed to match with the needs of farmers occurred. In addition, nutrition and health information provided lack of time-validity, mainly showed by the weak ability in the collection, analysis, processing and dissemination nutrition and health information and the updates of website content were slow, including too much outdated information and inadequate up-to-date information.

Zhu Xiumin (2009) believed that modern information technology provided a framework for modernization model of the nutrition and health education. Its conception was based on the thought of taking computer as the basis and carrier of the transmission of digital contents of nutrition and health education; the "networked" and "intelligent" information technology was taken as the driving power for the efficient storage and transmission of education contents in the carriers. "Digitalization" was the opportunity that triggered IT revolution for its realization. Text, graphics, images, sounds, videos, animations and other teaching content elements can be input into the computer in a certain number format, so as to achieve the purposes of using computer for storage and transmission. Popularization of internet facilitated the IT take-off and broadened the spreading time of information technology. "Intelligentized" multimedia, hypermedia and artificial intelligence, etc. could improve the performances of nutrition and health education software.

Information resources construction is the foundation and guarantee for the nutrition and health status of key groups in rural areas. Information resources and energy resources, material resources together constitute the three pillars of resources of the modern socio-economic and technological development, which plays an important role in all aspects of social development. Database construction of nutrition and health information resource is the major form for the large-scale, high-efficiency development and utilization of information resources in rural areas. After

processing, handling and ordering, these information resources could be massive accumulated to form the formatting information resource database, which can easily store, retrieve, transmit, publish and share information with the application of modern information technology.

2.2.5 Applications of information technology in the food industry

Fang Hai (2006) believed that in order to maximize the control of China's food safety incidents, the using modern information in food safety management was imperative. In terms of construction of the food safety expert advisory system and the perfection of the database system, the expert consultation work should be normalized and institutionalized. Development of expert system, database, knowledge base and rule base, etc. that would be used in a variety of food safety-related aspects should be included to substitute for the relevant experts in providing technical guidance.

Liu Zhen (2008) introduced food safety systems in the United States, European Union, Japan and other developed countries; summed up food safety problems currently existing in China; discussed and analyzed these various issues. Combined with foreign management experiences and the actual conditions in China, based on the ISO9001, HACCP system and GAP, SSOP norms, he focused on the research of food traceability system; analyzed the difficulties existed and put forward prospects based on the principles of this system.

Based on the introduction of relevant theories of database systems, food consumption and dietary balance, Su Yanyan (2007) explained the transformation basis and methods of food consumption and nutrients and described the sources of essential data in detail. The research introduced the requirements analysis, data table structure design choice of development environment and data processing instructions and other system design related works of the system and made a detailed description of how to create a database and how to achieve the functions of the system through code design. The research also designed the application system of the database for the conversion between food consumption and nutrient of Chinese residents, which solved the problem and difficulty lied in the conversion between food consumption and nutrient over the years and also provided a possible way to the offer comprehensive, continuous dietary intake data.

With the Hospital Information System (HIS) as the basis and the smart card reservation system as the backbone, Zhao Hesong (2007) achieved the comprehensive information management of nutritious diet center. This integrated hospital nutritional and dietary management information system integrated the functions of reservation management, nutrient management and inventory management and it was able to share information with the HIS system. The introduction of information technology into the present nutritional and dietary safeguard works greatly reduced the manual errors and improved work efficiency through the application of automatically customized recipes and enhanced ordering data examination and verification, which was also greatly improved implementation rate of diet therapy and thus made the dietary treatment security of the PLA General Hospital reached domestic advanced level.

2.2.6 Application of information technology in health management of different population groups

The information era brought new opportunities for the nutrition and health research of the key groups in rural areas since the information science provided modern theory and methods for the development of nutrition and health level of the key groups in rural areas while the information technology provided more advanced and powerful research tools for the decision-making concerning the nutrition and health level of the key groups in rural areas. The establishment of the

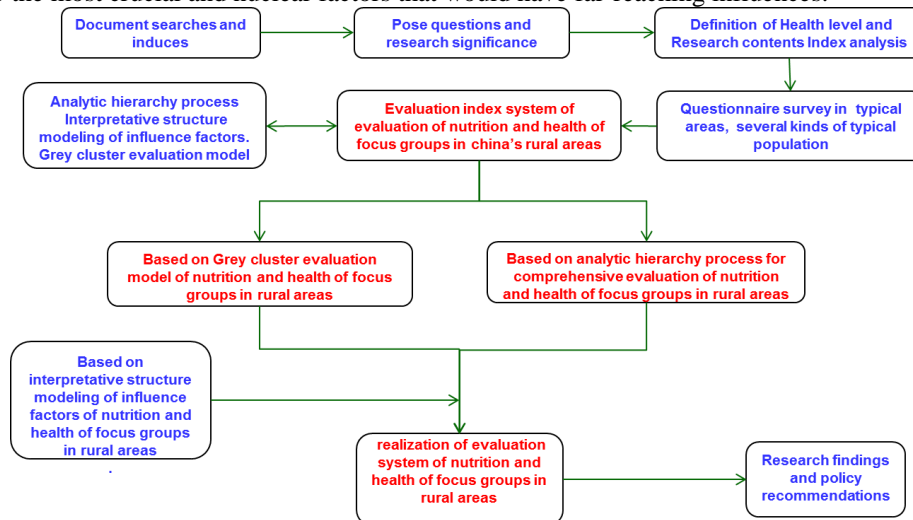
online evaluation system of the nutrition and health level of the key groups in rural areas would provide strong support for the improvement of the nutrition and health level of the key groups in rural areas.

Combined with the health needs of the elderly population, Xu Xiangyi (2009) designed and implemented an all round elderly health management system that covered four aspects, including: management of personal health information, health assessment, preventive health checks and health knowledge consultation.

Taken the traditional Chinese medicine theory as the core of the clinical actual needs center of Guangzhou Hospital of Traditional Chinese medicines, Chen Xiao (2010) made specific and detailed design plan of the construction of the system based on the analysis of the detailed needs. Through the jointly work with software development company, the advanced three-tier B / S architecture Microsoft.net development tools were combined with large databases to achieve the research and development of computerized health management system software with Chinese characteristics and the successfully trial application of the system in clinical practices.

Through the usage of software engineering methods, Ji Yu (2008) developed “health management system for cadre population in armed forces” to provide an information platform for the good health management of the cadre population in armed forces. Used the software as the electronic platform, 6 months of health management services were provided for 209 armed police cadres at their posts. The effects evaluation of the services was conducted from the aspects of relevance, feasibility, appropriateness, effectiveness, efficiency, impacts and sustainability.

The theory of system interpretative structure model (ISM) was used to analyze the elements that influenced the key groups in rural areas and the ISM method was used to build its multi-layered structure. The results would show that the factors that had profound impacts on the entire health and nutrition level of key groups in rural areas were a number of factors; the factors that had medium impacts were also a number of factors and the factors that had surface impacts were a number of factors, which indicated that the current development of information technology in rural areas was closely related to the factors that had profound impacts. Those factors were the key factors in the improvement of health and nutrition level of key groups in rural areas, which were also the most crucial and nuclear factors that would have far-reaching influences.



We should search and induce relevant document of the evaluation of nutrition and health of focus groups in China's rural areas. Pose out the relevant questions and research significance of the research. Definition of health level and index analysis of research contents should be clarified. Then do the questionnaire survey in typical areas and several kinds of typical population. Evaluate

nutrition and health of focus groups in china's rural areas based on the different evaluation model such as analytic hierarchy process, interpretative structure modeling of influence factors, grey cluster evaluation model. Especially study on the optimization of grey cluster evaluation model and analytic hierarchy process. Combined to the Interpretative structure model, the evaluation system of nutrition and health of focus groups in rural areas will be realized. At last, summarize the research findings and propose policy recommendations of the evaluation of nutrition and health of focus groups in china's rural areas.

3. CONCLUSIONS

Based on current studies worldwide, it was obvious that nutrition and health are taken as an holistic object to conduct systematic researched from the disciplinary perspective, while the domestic researchers still take nutrition and health as two separate objects and the scientific and rational link between the nutrition and health for the key groups in rural areas had not been established yet. Thus, by means of modern information technology, the investigation on the health and nutritional needs of the key groups included women, children, the elderly, the disabled and the mentally ill in China's rural areas should be carried out as soon as possible. It will be beneficial to obtain basic data for the construction of evaluation models and methods. Then combining the the evaluation methods of nutrition and health and the practical research results to analyze the factors affecting nutrition and health level of key group in vast rural area.

Information system can play an important role in monitoring nutrition and health situation of key group in rural areas. This would greatly push forward the further strengthen of the prevention and control of major diseases, the improvement of medical and health services, the strengthen of food security and reducing regional differences in development levels in rural areas in China. It can also provide strong theoretical foundations and advanced technical supports. Related research would have practical significance in the promotion of rural economic and social development and improving the nutritional and health levels of whole chinese population.

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REFERENCES

1. Aubel, J. The role and influence of grandmothers on child nutrition: culturally designated advisors and caregivers, *Maternal & Child Nutrition*, 2012, 8 (1), 19-35.
2. Brauw A., Mu, R. Migration and the overweight and underweight status of children in rural China, *Assessing the Impact of Migration on Food and Nutrition Security*, 2011, 36 (1), 88-100.
3. Chen Xiao. Construction and application of the health management system of traditional Chinese medicine [D]. Guangzhou: Guangzhou University of Chinese Medicine , 2010, in Chinese.
4. Delpier, T., Giordana, S., Wedin, B. M. Decreasing Sugar-Sweetened Beverage Consumption in the Rural Adolescent Population, *Journal of Pediatric Health Care*, In press, Available online 26 August 2012.

5. Fang Hai. Studies on information-based management structure of food safety in developed countries and suggestions on establishing China food safety management structure. [D].Shanghai: East China Normal University, 2006, in Chinese.
6. Fox, K., Heaton, T. B. Child Nutritional Status by Rural/Urban Residence: A Cross-National Analysis. *The Journal of Rural Health*, 2012, 28 (4), 380-391.
7. Gao Hong. Study on Chinese Health Status Assessment Indicators System [D].Wuhan: Huazhong University of Science and Technology, 2011, in Chinese.
8. Gu, W. Rennie, K. L., Lin, X., Wang, Y. F., Yu, Z. J. Differences in bone mineral status between urban and rural Chinese men and women. *Bone*, 2007, 41 (3), 393-399.
9. He Liping, et al. Study on the evaluation methods of health equity [J]. *Soft Science of Health*, 2010, 24(2) , in Chinese.
10. Hu xiaoyun. The characteristics of health Literacy of residents in Hubei Province and its impact on health status [D]. Wuhan: Huazhong University of Science and Technology, 2009, in Chinese.
11. Hu Yong et al. Analysis on actuality of peasant's health in China and it 's main influencing factors [J]. *Chinese Primary Health Care*, 2007, 21(3):1-2, in Chinese.
12. Ji Yu. The development and application of armed cadre health management software system [D]. Shi jiazhuang: Hebei Medical University, 2008, in Chinese.
13. Klein G., Kita Kimberly, Fish Judith, BARBARA SINKUS, GORDON L. JENSEN, Nutrition and health for older persons in rural American. *J Am Diet Assoc*. 1997; 97: 885-888.
14. Li Jing, et al. The primary effect of nutritional intervention in farmers [J].*China Academic Journal Electronic Publishing House*, 2009, 17(2):161-163, in Chinese.
15. Li Jing. Studies on nutrition and growth of children aged 3-6 years on Lanzhou city urban area in 2010 [D]. Lanzhou: Lanzhou University, 2011, in Chinese.
16. Liao Tanghong. Comprehensive health evaluation research on rural residents living in dongying region [D].Jinan: Shandong University, 2010, in Chinese.
17. Liu Zhen. Research and application of the traceable system of food [D]. Xiamen: Xiamen University, 2008, in Chinese.
18. Ma Xiaorong. An empirical research on residents' health demand in rural china [D]. Nanjing: Nanjing Agricultural University, 2010, in Chinese.
19. Nie Cuifang. Health status of middle-aged and elderly People in rural area of Laixi and effects of health education [D]. Qingdao: Qingdao University, 2007, in Chinese.
20. Pan American Health Organization. Health in the Americas, 1998 edition. Washington, D.C.: PAHO.
21. Rao Jianjun. A survey of the rural elderly nutrition state in Tongzhou district of Beijing and analysis of the related factors [D]. Wuhan: Hubei University of Traditional Chinese Medicine, 2009, in Chinese.
22. Su Yanyan. The design of database application on transform from food consumption to nutrients of Chinese residents [D].Beijing: Chinese Academy of Agricultural Sciences, 2007, in Chinese.
23. Tham, Rachel; Humphreys, John; Kinsman, Leigh; Buykx, Penny; Asaid, Adel; Tuohey, Kathy; Riley, Karen. 2010. Evaluating the impact of sustainable comprehensive primary health care on rural health. *Australian Journal of Rural Health*. 18, 166-172, DOI: 10.1111/j.1440-1584.2010.01145.x
24. United Nations Standing Committee on Nutrition. 6th report on the world nutrition situation. Switzerland: Geneva, 2009.
25. Vieira, D. A. dos S.; Costa, D. da; Costa, J. O.; Curado, F. F.; Mendes-Netto, R. S. 2011. Socio-economical characteristics and nutritional status of children and adolescents in rural settlements in Pacatuba, Sergipe. (Características socioeconômicas e estado nutricional de crianças e adolescentes de assentamentos rurais de Pacatuba, Sergipe.). *Nutrire - Revista da Sociedade Brasileira de Alimentação e Nutrição*, 36 (1): 49-69.
26. Wang Hongjuan. Study of rural residents health evaluation based on the disease monitoring and new-rural cooperative medical system-to take Maiji district of Tianshui for example[D]. Lanzhou: Lanzhou University, 2012, in Chinese.
27. Wu Kun, et al. Nutrition and food hygiene [M].Beijing: People's Medical Publishing House, 2005, in Chinese.
28. Xiong Guohong. A preliminary design of nutrition information sharing system [D]. changsha:Central South University of Forestry and Technology, 2009, in Chinese.

29. Xu Shiwei, et al. The modern agricultural development for Nutrition and health goals [J]. *Food and Nutrition in China*, 2008, 1, in Chinese.
30. Xu Xiangyi. The researeh and development of old People's Health management and analysis system [D]. Xi'an: Xidian University, 2009, in Chinese.
31. Yao Xuyi, et al. Human health state comprehensive evaluation method research [J]. *Chinese Journal of Preventive Medicine*, 2005, 6(5), in Chinese.
32. Zhao Hesong. Hospital nutrition and meal management system development based on the HL7 agreement [D]. Tianjin: Nankai University, 2007, in Chinese.
33. Zhao Huashuo, et al. Study on grading assessm in the quality of life of family with children absent elderly in Xuzhou countryside [J]. *China Health Statistics*, 2011, 05:492-494, in Chinese.
34. Zhu Xiumin, et al. Modern information technology and the nutrition health education [J]. *Examination Weekly*, 2009, 51:166, in Chinese.

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