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Development Strategy of Integrative Pharmacy

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Abstract: Integrative pharmacies have been proposed owing to the increasingly profound understanding of complex diseases. This is a result of new drug research and development, innovation in traditional Chinese medicine, clinical drug practice, evolution of the pharmacy discipline, and growth of pharmacy professionals. To promote the practice of integrative pharmacy in China, this study clarifies the concept and connotation of integrative pharmacies and proposes future development strategies. The research methods used included literature research, academic exchange, and expert consultation. To integrate modern and traditional pharmacies, we suggest that clinical practice guidelines for integrative medication should be established and improved, innovative research into traditional Chinese medicine based on integrative thinking should be encouraged, and the clinical application of Chinese and Western medicine should be integrated and standardized. To promote new drug research and development based on integrative pharmacies, the design of integrative drugs should be undertaken, a drug evaluation system that adapts to integrative pharmacies should be developed, and a new drug development system should be established for integrative drugs. To promote the clinical application of integrative pharmacies, patient-centered clinical medication guidance should be further improved, individualized treatment should be encouraged, clinical practice of integrative pharmacies should be enriched, and the rational application of integrative drugs should be emphasized. To promote the creation of the integrative pharmacy discipline, the theoretical and practical curricula for undergraduate education should be enriched based on integrative pharmacy, and educational training and professional collaboration should be strengthened. Integrative pharmacy development is based on the theories and practices of modern pharmacy and integrates the theories and practices of all related pharmacy disciplines. It is a new pharmacy theory and practice system that can promote human health and improve the existing medical system in China.

Keywords: integrative pharmacy; integrative drugs; new drug development; drug evaluation; clinical medication guidance

1 Introduction

With the standard of living continually increasing worldwide and the increasing awareness of personal well-being, people are putting greater effort into improving their quality of life by maintaining close surveillance of their health status and longevity. Contemporary medicine has shifted from a simple biomedical model to a complex and integrative social—psychological—biomedical model since the beginning of the 21st century. Accordingly, medical research and services are also being transformed from simple biomedical research and

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practice to comprehensive biological, psychological, and social research. As such, systemic measures that take into consideration multifactorial human diseases are being implemented in the population to safeguard public and individual health.

Holistic integrative medicine integrates psychological, social, and environmental factors with biological factors, the most frontal scientific discoveries in all areas of life sciences with the most effective clinical practice in all areas, and the simplex mode of thinking of natural science with the multiple modes of thinking of philosophy. The aim is to build a comprehensive, systematic, scientific medical system to promote health, facilitate disease diagnosis, and improve disease treatment and prevention. As the clinical health science that links medical science with chemistry is charged with the discovery, production, disposal, safe and effective use, and control of medications and drugs, pharmacy has the responsibility to advance the development of holistic integrative medicine with all its strengths and to establish holistic integrative pharmacy (HIP), a new sub-discipline of pharmacy adaptable to China's national conditions. This article introduces the concept and connotations of HIP and suggests suitable development strategies for China.

2 The concept and connotations of holistic integrative pharmacy

The theoretical basis of holistic integrative medicine mainly includes holism, integration, and medication. It regards human beings as a whole and examines this wholeness in the context of a larger whole by integrating environmental, social, and psychological elements. Holistic integrative medicine is formed by the combination of medical experience formed from the transformation of medical research findings and clinical practice knowledge, as well as new biomedical technologies and the art of in-depth communication with patients [1,2]. Integrative pharmacy strives to apply the concept of integration to the innovation of traditional Chinese medicine (TCM), the research and development of new drugs, the safe and effective use and control of medications and drugs, and discipline development. Integrative pharmacy helps to integrate the methods and knowledge of various sub-disciplines and to establish a new theory and practice system to promote human health and improve the medical system.

Integrative pharmacy originates from integrative medicine as well as the holistic philosophy of TCM and other traditional medicines, based on our deepened understanding of the complex nature of human diseases. Integrative pharmacy aims to regress to the root of holism philosophy on the foundation of high, precise, and sophisticated development in pharmaceutical science. This goal can be achieved only by organically integrating knowledge with practice and the future with reality in all fields and all levels of pharmacy. Integrative pharmacy is an intersection of multiple disciplines, departments, systems, and perspectives, involving all-parties academic and professional collaborations among modern and traditional pharmacy, basic research and clinical practice, new drug development and evaluation, etc. Therefore, multidisciplinary integration is the key to the development and practice of integrative pharmacy and is also the key to improving medical quality [3]. Integrative pharmacy is the transformation and development of modern pharmacy theory and practice. Its connotations are plentiful, including the integration of modern and traditional pharmacy, the research and development of new drugs based on integrative concepts, the clinical use of drugs, discipline development, and professional training.

3 Development strategies of integrative pharmacy

3.1 Promoting the integration of modern and traditional pharmacy

Traditional pharmacy, guided by holistic thinking, has unique perspectives on physiology, pathology, and disease prevention. It attaches great importance to judging health status and disease progression based on the wholeness of the body functions and emphasizes individualized dialectical and people-oriented treatment. Integrative pharmacy, directed by systematic thinking, reveals the interactions between drugs and the human body and pathogenic organisms. It is also a systematic, inherently interdisciplinary, nonlinear science that combines nature with humanities and believes that the whole is more than the sum of its parts. The integration of modern and traditional pharmacy integrates the concept of people-oriented and dialectical treatment in traditional medicine into modern pharmacy, which promotes the implementation of integrative pharmacy in clinical practice. In addition, the integration of modern and traditional pharmacy effectively incorporates the theory and experience of traditional medicine with modern science and technology to produce original drugs and promote the innovation of TCM [3]. The aim is not simply to strengthen the combinational applications of modern medicine and TCM. Moreover, we must utilize rigorous scientific methodologies to explore the path for the development of integrative

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pharmacy and to apply the respective advantages of traditional and modern medicine to clinical practice to tackle health issues and provide better services to meet ever-increasing medical demands.

3.1.1 Establishing and improving clinical guidelines for integrative drug use

With years of dissemination of information and education, physicians and patients have become increasingly prepared to accept the therapeutic concept of "integration of modern medicine and traditional medicine." Clinical practice has accumulated increasing evidence for traditional medicine as an important player in the treatment of some human diseases. However, such effectiveness has not been firmly supported and explicitly explained by evidence-based medicine. Another obstacle that impedes the application of traditional drugs to disease therapy is the lack of general guideline for clinical practice, which restricts the common acceptance and scientific development of traditional medicine. Therefore, it is necessary to establish and improve clinical guidelines for the use of drug-based integrative medicine to ensure high efficiency and safety. Appropriate clinical guidelines not only provide a decision-making basis for the rational use of integrative drugs in clinical practice, but also promote information exchange between two different pharmaceutical systems to promote the integration of basic theory and clinical practice of the two medical systems.

3.1.2 Innovation of TCM research based on integrative thinking

The key to innovation in TCM research lies in the stability of its curative effects and the scientific nature of the research methods. TCM is a unique resource with the advantages of originality and it being a strategic emerging industry with great potential for future development. An effective way to modernize TCM involves using contemporary science and technology to excavate the wealth of TCM-related knowledge. Specifically, the first step toward the innovative research and development of TCM is to let creative thinking lead the way. TCM is rooted in the concept and theory of "principle–method–prescription–medicine." Principle refers to the understanding of the pathogenesis and progression of diseases. Only with a more insightful understanding of diseases can we renew the intervention strategies and treatment methods and develop new drugs and formulations. The formulations should contain multicomponent and multitarget drugs, which underline the regulation of whole-body functions. Therefore, based on TCM theory and integrative thinking, the scope of clinical applications of TCM will be greatly expanded [4]. Second, the efficacy of TCM needs to be proved both experimentally and clinically in line with the general principles and standards of contemporary science and clinical guidelines, so that it can be more widely recognized and accepted as a source of adjunct or even mainstream treatment modality [5]. It is necessary to establish a complete technical system based on conceptual innovation for drug screening, pharmacodynamics research, safety evaluation, formulation preparation, quality control, and clinical evaluation. In clinical practice, new hypotheses need to be generated, and prescriptions should be optimized to improve therapeutic efficacy. An innovative TCM research model of theory–clinical–new drug–experiment–evidence-based medicine needs to be established to identify the breakthrough point for innovation of the discipline and achieve the goal of TCM transformation [6,7].

3.1.3 Standardizing the clinical applications of integrative medicine

To date, there are no authoritative guidelines or standards for TCM practice in China. Therefore, the clinical application of integrative TCM and modern medicine still faces great challenges. According to the existing government policies and regulations, pharmacists in TCM and modern medicine have different scopes of professional practice, and cross-disciplinary practice is not permitted. Under such circumstances, pharmacists are unable to play a role in formulating a rational combination of drugs. In recent years, TCM pharmaceutical companies in China have begun to gain momentum in rapid development; however, official practice norms for the integrative clinical application of TCM and Western medicine remain unavailable. Therefore, there is an urgent need to establish authoritative and standardized policy guidance and determine professional decision-making grounds for integrative applications of TCM and Western medicine in clinical settings [8].

3.2 Promoting the research and development of innovative drugs based on integrative pharmacy

Clinical efficacy is the ultimate criterion for evaluating and judging the effectiveness of a drug. The human body is composed of multiple types of cells, organs, and systems. Diseases are generally caused by a series of abnormal changes, including gene mutations and expression deregulation, protein deregulation and malfunction,

and functional impairment at the cell, tissue, organ, and system levels. Human diseases are generally multietiological, polygenic, multifactorial, and multifaceted in nature with complex pathomechanisms. To date, a large number of genes or proteins that can regulate pathological processes have been identified and characterized through basic biomedical research as targets for disease treatment and drug development. However, the therapeutic efficacy of currently available medications has often been disappointing in the clinical setting. It is likely that this lack of therapeutic efficacy is due to the unattacked targets being maintained, thus proceeding with the pathological process [9]. Indeed, the "one drug, one target, one disease" paradigm in drug discovery has recently shifted to a "multitarget drugs" strategy. Multitarget drugs offer optimal solutions for treating systemic multifactorial human diseases, thereby maintaining better coordination of physiological functions of the human body.

3.2.1 Innovating design ideas for integrative drugs

In the design of new drugs based on integrative pharmacology, we should attach importance to the fundamental change in drug design; the transition of the drug discovery paradigm from single-component to multicomponent drugs, from single target to multitarget network pharmacology and systems biology, and focusing on the chemical composition of drugs to focusing on the overall effects of the drugs.

(1) Design of multicomponent and multitarget drugs for complex diseases. In the 20th century, specific activation or inhibition of a target molecule by monomer drugs was the dominant paradigm for new drug discovery in both pharmacological research and the pharmaceutical industry. Biomedicine elucidates the etiology of diseases by discovering the key regulatory molecule for a specific disease and taking that molecule as a drug target for the pathological entity. However, accumulating evidence has clarified that majority of human diseases with high incidence, such as diabetes, cardiovascular diseases, and cancers, as exemplified by chronic diseases, are caused by multiple physiological, pathological, environmental, and lifestyle factors, as well as their complex interactions. The use of single-target drugs to treat diseases that are regulated by complex biological networks has failed to match expectations, with lower efficacies and higher toxicities than expected. Often, even if screened and validated by benchtop studies and preclinical animal experiments for its pharmacological effects, the compound may not elicit satisfactory efficacy clinically and has a high probability of failing to pass a clinical trial. Such a challenge has become a driving force pushing forward the transition towards new and more advantageous multitarget and multicomponent compounds for drug discovery [10]. Multitarget and multicomponent drugs act on more than one molecule (genes and/or proteins) that play a key role in predisposing to diseases and can exert synergistic and integrative actions to potently and effectively correct and reverse abnormalities to improve the prognosis of patients. At present, three different strategies are employed for the development of multitarget and multicomponent drugs. One is empirical drug combinations based on the observation and experience acquired from long-term clinical practice, which are believed to elicit synergistic effects after careful screening and optimization. The second is by screening the bioactive components in TCM formulae that have been clinically proven to be effective for a certain disease, and formulating multicomponent drugs that are more effective by constructing structure–activity relationships of multicomponent drugs. The third strategy is to deconvolute drug targets followed by evaluating the effects of multicomponent drugs to elucidate the pharmacological mechanisms and verify the target specificity of actions based on DNA sequences, genomics, proteomics, and metabolomics. In such a scenario, an in-depth analysis of molecular regulatory networks for specific diseases would allow the generation of better ideas for multicomponent drug design [11].

(2) Reversed drug design has been adopted based on clinical evidence of efficacy. The drug design strategy based on solid clinical evidence of efficacy is a reversed path of drug discovery and a new idea for the innovative development of TCM. This reversed protocol is the first step in drug design by identifying new compounds or new components from TCM formulas with proven clinical efficacy, and subsequently recombining these compounds/components proportionally, according to their relative bioactivities, efficacies, and other pharmacological properties, into a single formulation to yield consolidated therapeutic efficacy and defined compositions of a new medication. Traditionally, the method of developing new drugs involves first determining the key proteins that underlie a disease, then identifying the target proteins from the disease-related proteins, designing a drug that specifically acts on the target proteins, and, finally, evaluating the clinical efficacy and safety of the drug, followed by analysis of its bioactivities and medicinal properties. However, the efficacies of single-target drugs designed based on molecular targets in preclinical animal studies and clinical trials vary with poor certainty due to multiple influencing factors, such as toxicity and the non-specificity of drug action. TCM

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formulas are the most widely used TCMs clinically, and considerable therapeutic evidence for their efficacy has been obtained through long-term clinical practice. Elucidation of the pharmacodynamics, mechanisms of action, and safety profiles based on these TCM formulas with proven clinical efficacies is an important path leading to the discovery of new drugs or components. This reversed strategy is best epitomized by the discovery of artemisinin, by Professor Tu Youyou, as an antimalarial lactone derived from *Artemisia annua*. It is expected that the development of multitarget drugs based on TCM formulas with proven clinical efficacy will allow the discovery of innovative drugs with greater efficacy and potency as well as better safety profiles [5].

(3) Exploring new indications for existing drugs. Repositioning or repurposing existing drugs by identifying new indications and applications has emerged as an important strategy in the pharmaceutical industry. Drug repositioning offers new opportunities and advantages of risk reduction and cost cutting in the development of therapeutic drugs and shortens the time lag between drug discovery and marketing. In recent years, drug repurposing has received widespread and strong support from governments and academic institutions worldwide. In the United States, the new drugs developed via the drug repurposing strategy accounted for 20% of the 84 drugs approved for marketing by the US Food and Drug Administration in 2013. In addition, several public databases for drug repositioning have been established for public use, and various financial incentives are provided to motivate research into drug repositioning for rare diseases. There are three general strategies for the development of new drugs based on drug repositioning: (1) identification of new indications of commonly used medicines that have been on the market for many years with widely recognized safety profiles; (2) exploitation of the potential off-label effects and the underlying mechanisms of existing drugs based on the experience of first-line clinicians; and (3) redevelopment of new indications for drugs that have failed clinical trials or expert panel reviews. In general, the safety profiles of these compounds have been well-established; however, they are delayed or even abandoned mostly because of their poor efficacy, as revealed by phase II clinical trials. However, the potential effectiveness of these compounds against other diseases remains unknown. Therefore, these failed drugs can be used as resources for review and reanalysis to identify those worthy of repurposing for their therapeutic potential [12–14]. In summary, drug repositioning is an important strategy for discovering new drugs and new indications for existing drugs, and unfolds new opportunities for drug research and development [15,16].

3.2.2 Establishing a drug evaluation system for integrative pharmacy

Preclinical studies lay the foundation for clinical studies and, ultimately, the clinical applications of new drugs. However, the results obtained from *in vitro* benchtop experiments at the cellular or tissue level cannot be extrapolated to the complex *in vivo* physiological and biochemical systems. Therefore, preclinical studies of drugs in whole-animal models of the disease of interest is an essential and necessary step for efficacy and safety evaluations, which bridges drug discovery with clinical application. However, as much as 92% of drugs that are safe and effective in animal studies fail to pass clinical trials due to their unacceptable toxicity and/or ineffectiveness. Half of the remaining 8% of drugs that successfully pass clinical trials are eventually withdrawn from the market or restricted in their application due to serious side effects. The use of improper animal models is the main cause of the increasing failure of drugs that enter clinical trials, especially for drugs positioned to treat chronic and complex diseases [17]. The rational use of suitable animal models with comparability and compatibility to humans is the most crucial step for the successful development of new drugs. At present, the animal models commonly used in preclinical studies are generally oversimplified models of complex diseases, which are not a true representation of all characteristics and mechanisms of human diseases because of the lack of stratification of clinical, pathological, environmental, social, and psychological factors and adjustment for chronic diseases, age, comorbidities, gender, genetic similarities, environment, and other factors. As a result, many drugs fail to proceed to the clinic because they do not show the same or even similar effects in patients as those seen in animal models. On the other hand, some compounds that do not demonstrate expected effectiveness in animals might have appreciable therapeutic efficacy in humans.

Meaningful and efficient translational medicine research requires improved animal models for basic research that have high reproducibility and applicability to multiple pathological factors of complex human diseases for the research and development of new drugs. In addition to developing innovative and more advanced animal models of human diseases, basic scientific discoveries need to be combined with sophisticated detection tools to render the drugs identified through non-invasive and quantitative approaches applicable to *in vivo* pharmacodynamic and pharmacokinetic studies. In addition, an array of high-resolution imaging technologies, such as micro-computed

tomography (CT), micro-positron emission tomography, and micro-single photon emission CT, can help detect disease progression and monitor the body's responses to therapeutic drugs in a repetitive and non-invasive manner. These technologies enable the real-time collection of data at multiple time points over a long study period, allowing the completion of research procedures in each animal without having to euthanize it for data collection and the acquisition of self-control data with baseline and after-drug comparisons to minimize the possible experimental variability. Moreover, these new technologies provide insights into the mechanistic links at the molecular, cellular, organic, and holistic levels. Furthermore, these technologies can be applied to the verification of pharmacodynamics, detection of drug transport, elucidation of drug clearance pathways, and identification of factors leading to individual variations in therapeutic efficacy, drug interactions, and genetic polymorphisms, laying a solid foundation for subsequent thorough investigations of pharmacokinetics and pharmacodynamics in humans [18,19].

3.2.3 Establishing a new drug research and development system based on integrative pharmacy

Despite the continuous expansion of the global drug market, China's research and development capacity for innovative drugs remains relatively weak, and the market is primarily occupied by a large proportion of generic drugs with few original drugs. State-owned pharmaceutical enterprises of a larger scale and greater strength in innovative drug research and development predominate the drug market in China, owing to the advantages of their strong brands and intellectual property rights. The advances in genomics and life science technologies have been rapid; however, the research and development of innovative drugs has fallen behind and requires greater financial investment, talented professionals, and time. Thus, China should establish relevant policies to encourage original drug research and development and increase investments in the form of research funds, technical support, and scientific researchers to avoid delays and/or interruptions in drug research and development projects due to insufficient or ineffective investment. Pharmaceutical institutions able to pursue innovative drug research and development should be encouraged to focus on the research and development of original drugs. In short, the future of drug research and development in China lies in the conceptual and strategic transformation and upgrading of research institutions and pharmaceutical enterprises according to the actual circumstances and conditions of the country. The overall process of transformation and upgrading may consist of the following three stages: (1) The combinational imitation and innovation stage. This strategy involves producing similar compounds based on new drugs appearing in the international market, which yields equivalent or improved efficacy and safety profiles to the original ones. (2) The secondary innovation stage. Secondary innovation refers to the modification and optimization of the molecular structure of original drugs with proven therapeutic effectiveness, which allows for improved pharmacodynamic and pharmacokinetic properties as well as better safety profiles. This is a feasible method of innovation at present, and where the main efforts of research and development of innovative drugs are focused in China. (3) The original drug stage. This strategy requires innovative drug research and development from A to Z or from designing to synthesis, as well as the clinical validation and application of new compounds. It is the ultimate route for China to eventually grow into a powerful country in medicine [20].

The research and development of new drugs is an enterprise with high risk, technological difficulties, huge investments, and long cycles. The capability of the research and development of new drugs is the core competitiveness of the innovative pharmaceutical industry. Integrative pharmacies provide new ideas and strategies for the research and development of new drugs in China. The application of the integration concept to new drug research and development can promote the convergence and integration of basic pharmaceutical knowledge with cutting-edge applied science and technology and clinical practice experience as well as new drug research and development, which will facilitate the discovery and transformation of more and better original drugs with proprietary intellectual property rights [3].

3.3 Promoting the clinical practice of integrative pharmacy

Many drugs are available for clinical use in China, but there are also some serious issues related to unregulated and nonstandard use based on experience, tentativeness, and arbitrariness. The ongoing appearance and alterations of new diseases impose ever-increasing requirements for clinicians and pharmacists in clinical practice. The clinical use of drugs must conform to the guidelines (if any) and the principles of safe and rational medication. Integrative pharmacy engenders a more rational way of thinking and a more rigorous norm of practice in drug use in the clinical setting [21]. In clinical practice, the purpose of integrative pharmacy is to integrate medicine and pharmacology. Patients are individuals who experience constant changes. Patient gender, age, basic physical

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conditions, disease characteristics, progress, prognosis, and other factors must be comprehensively and systematically appraised in the course of disease treatment. At the same time, drug selection, medication, and treatment regimens must be re-adjusted accordingly. The idea behind this is to treat patients well while treating their diseases. In addition to their primary pharmacological effects and indications, drugs can affect other organs. Therefore, before selecting the drugs for treatment, the patient's overall status should be fully assessed, and the medication should adhere to the holistic concept of patient–disease–drug, rather than the old dogma of symptom–target–drug. Only in this way can we improve the effectiveness and safety of medicines. Simply put, holistic and integrative thinking should be applied to guide every step of clinical medication selection and provide more suitable medical services for patients [22].

3.3.1 Improving the practice guidelines of patient-centered clinical medication

The rapid development of medical science has opened up more pathways and methods for the treatment of diseases. Nonetheless, many challenges and unresolved issues remain in clinical practice in terms of the safety, rationality, and specificity of drug applications. Clinical medication should conform to patient-centered concepts and principles. However, patient-centered clinical drug application is a long-term practice involving many aspects at different levels subject to gradual development, improvement, and renewal. For example, in cancer treatment, targeted therapy based on monoclonal antibodies has become an indispensable regimen, because it minimizes the adverse responses caused by chemotherapy and helps improve patient quality of life, which has produced profound fundamental changes in the clinical practice of tumor therapy. The matching method of drug and tumor-specific inducible gene provides a new strategy for the individualized treatment of tumors. Currently, there are approximately 50 compounds available for the treatment of specific types of tumors with specific inducible genes, and 10 drugs are being evaluated in clinical trials for the targeted therapy of tumors. The main mechanism for the high effectiveness of targeted therapy is that it addresses the problem of single gene mutations in the development of tumors. However, in certain circumstances, targeted therapy can be ineffective. Therefore, patient-centered targeted therapy should consider the complexity of tumorigenesis and the heterogeneity of tumor cells in different individuals. Combination therapy strategies adopted according to individual differences can address the complexity of tumorigenic genes or oncogenes, tumor cell heterogeneity, and drug resistance. Studies support that integrative therapy can substantially improve the survival rate of cancer patients. Various therapeutic modalities, such as small-molecule drugs, monoclonal antibody drugs, immunotherapy, and bispecific antibodies, should be integrated into the treatment of cancer. More rational combinations of various modalities should be examined and employed to achieve prospective therapeutic effects in cancer patients. In addition, enhancing the targeting precision of multiple joint target molecules based on a more detailed and comprehensive characterization of tumors opens up a new opportunity for tumor treatment [23,24].

3.3.2 Selecting the most appropriate drugs to achieve individualized therapy based on the comprehensive assessment of the disease phenotype using advanced technologies

Individualized therapy not only attaches great importance to the selection of the most appropriate drugs for patients, but also to the treatment of patients with the most appropriate dosage at the most appropriate time point. Moreover, individualized therapy requires sophisticated and advanced methods for identifying pre-existing pathological symptoms in the early stages of disease development to initiate targeted preventive measures as early as possible and reverse pathological manifestations and disease progression. With the reduced cost of advanced molecular biology technologies, in-depth analysis at the single-cell level, quantitative gene analysis, and molecular docking of drug–gene spectrum–disease spectrum will provide new standards for disease treatment and efficacy appraisal. Proper integration of these data into a multi-disease model will improve the course of treatment and prognosis of patients. For example, in tumor therapy, single-cell mass spectrometry can be used to perform a deep phenotypic analysis of tumor cells to determine tumor phenotypes. In addition, comprehensive diagnosis, analysis, and monitoring of tumor invasion can provide clues for the selection of specific drugs targeting specific tumors [25]. Furthermore, a combination of whole genome sequencing, exon sequencing, and transcriptional profiling can be used to accurately identify possible changes in patient genomes. A drug for targeted therapy, which is selected based on the genomic alterations of patients and from the clinically available drugs or those under clinical trials, is expected to yield better effects and prognosis [26]. In addition to sequencing, metal isotope labeling technology combined with laser ablation imaging technology can provide accurate information for determining tumor phases,

cell heterogeneity, and cancer inducers; predicting potential therapeutic targets; and monitoring the response of the target to therapeutic drugs, which can optimize the matching between the tumor and therapeutic drugs [27]. In conclusion, predictive, preventive, and individualized medicine is the ultimate goal of improving the quality of medical services and the level of healthcare.

3.3.3 Enriching the clinical practice of integrative pharmacy

Clinical pharmaceutical services cover all regions of China. However, many problems remain in the practice of clinical pharmacy; for example, the work mode centered on ensuring drug supply has never changed and there is a lack of effective communication between clinical pharmacists and clinicians, a lack of guidelines for rational drug use, and a lack of clinical pharmaceutical research. Integrative clinical pharmaceutical practice requires not only the professional qualifications of pharmacists but also communication and cooperation between medical professionals from different disciplines and fields, guidance and monitoring of the patient's status during the course of drug treatment, and guidance and follow-up of daily medication. The overall task of integrative clinical pharmaceutical practice should include the essential components in accordance with the goal of drug therapy, that is, the rational selection of drugs, close attention to drug use, and patient-centered treatment outcomes. In this process, we should ensure that the selection of drugs is patient-centered, the use of drugs is justified, and the combination of drugs is coordinated, cooperative, comprehensive, and integrative. As important participants in clinical medication, pharmacists should strengthen their communication and collaboration with doctors and nurses, assist patients in selecting appropriate drugs, monitor and guide them to use medications correctly, participate in patient medication care, and evaluate the outcomes of drug therapy [28].

3.3.4 Promoting the rational applications of integrative drugs

Integrative clinical medication should have strict regulations for practice and convincing evidence of clinical effectiveness. (1) The clinical guidance and scientific basis for rational drug use should be established to ensure the rational use of therapeutic drugs and appropriate appraisal of the rationality of drug use. (2) The supervisory standards and mechanisms for rational drug use should be established to mandate qualified professionals to supervise rational drug use and medical staff to strictly adhere to the principle of rational drug use. (3) The theoretical system of rational drug use should be established and improved, and knowledge of rational drug use should be continuously collected, summarized, and condensed, and fragmented knowledge about rational drug use should be integrated into systematic clinical practice and norms. (4) An education and training system for rational drug use personnel should be establish to train personnel and evaluate the conduct of medical staff to better implement rational drug use. In an integrated healthcare system, such practice standards and guidelines must be established as soon as possible to serve as a benchmark for professional practice in rational drug use [21].

3.4 Promoting discipline construction and talent cultivation in integrative pharmacy

3.4.1 Enriching theoretical and practical courses for pharmacy undergraduates with integrative pharmacy

Interdisciplinarity will promote discipline construction and talent cultivation in integrative pharmacy. The theory of combinational TCM and Western medicine should be incorporated into the theoretical course of pharmacy undergraduates to promote multidisciplinary infiltration and the integration of pharmaceutical theory and practice. Courses related to TCM should be incorporated into the curriculum for students majoring in pharmacy and in practical training in pharmacy to better promote the integration of traditional and modern medicine theories. In addition, the relevance between pharmaceutical courses and clinical medication should be intensified to avoid overemphasis on the theory of professional knowledge and to facilitate the integration of pharmaceutical theory and practice. In pharmacy training, it is necessary to cultivate the ability of pharmaceutical professionals to evaluate the rationality and safety of a drug prescription to accelerate and improve the construction of the integrative pharmacy discipline and talent cultivation system at both theoretical and clinical practice levels.

3.4.2 Strengthening the collaboration among clinicians of different medical specialties and attaching importance to education and training

Integrative pharmacies play an important role in clinical diagnosis. A system and mechanism should be set up for physicians and pharmacists to be able to maximally demonstrate their knowledge and expertise and to encourage their exchange and cooperation so that they can provide comprehensive pharmaceutical services, especially in relation to the rational and safe combination of TCM and Western medicine. It is necessary to

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strengthen the policy-driven development of integrative pharmacies, construction of new disciplines, and cultivation of professional talent.

The authority and related administrators governing pharmacies and the pharmaceutical industry should formulate practice standards and promote collaborations among research institutions, universities, and pharmaceutical enterprises to speed up the development of integrative pharmacy as a new discipline. It is necessary to develop specific training plans for pharmacists and residents in pharmacies, offer high quality programs for continuous training, and intensify the education and cultivation of pharmaceutical professionals. Education and training of pharmaceutical professionals should focus on pharmaceutical information, pharmaceutical therapy, and physician–patient communications. In addition, we should focus on the accumulation of clinical practice experience and follow-up of patients on medication and enhance pharmaceutical professionals' sense of responsibility in their clinical practice.

4 Conclusion

Integrative medicine is not only a new idea, model, and medical concept for maintaining health status at all levels throughout the human lifespan, but is also a major theoretical innovation and technological support for transforming the Healthy China initiative into reality. "Medicine and pharmacy are teachers for each other." Medicine is the basis of pharmacy, and pharmacy is the means of distributing medicine. In China, the exact definition of integrative pharmacy has not yet been perfected. Nevertheless, the concept of holistic integrative medicine and supportive policies has become a powerful driving force with momentum by which integrative pharmacies are gradually including innovation in TCM, research and development of new drugs, the clinical use of therapeutic drugs, discipline construction, and talent cultivation for pharmacy, among others. However, the practice of integrative pharmacy requires further improvement. It is necessary to incorporate the integrative concept into basic and translational pharmaceutical research and clinical pharmaceutical practice, as well as pharmaceutical education, training, and management. There is also a need to facilitate the development and application of integrative pharmacy in all related areas, including policy making, pharmaceutical education, clinical medicine, and pharmaceutical industry, to push forward the strategic transformation of pharmacy towards the integrative mode in favor of the realization of the core goal of Healthy China.

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