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Chapter

Empower the Science of Organ Donation by Multidisciplinary Collaboration

Wenshi Jiang, Xiaotong Wu, Liansheng Ma, Jing Shu, Juan Yan, Liming Yang, Yajie Ma and Xiangxiang He

Abstract

Inter-discipline is formed by the interpenetration and integration of multiple disciplines, which has become a notable trend involving interdisciplinary activities and a combination of research and development. Learned from experience worldwide, the management mode for organ donation and procurement activities varies among countries, but the core of the disciplinary construction of organ donation remains the same. The theoretical basis and practice of organ donation is not purely a matter of coordination, but its ground of knowledge is built upon multidisciplinary integration and its implementation relies on a joint-effort approach and requires collaboration of multiple teams. From the sociological viewpoint, organ donation represents the gift of life for transplant patients, which founds the key element in enhancing the harmony of society. While, from a practical perspective, its professionalism has been widely recognized by the international medical community. As a complex medical and social act, organ donation is a medical-centered subject with sociological, humanistic, ethical, psychologic, and juristic attributes. This chapter will provide an overview of how multidisciplinary collaboration empowers the science of organ donation, followed by the summary of recent efforts taken in China in pursuit of this goal as an example.

Keywords: organ donation, multidisciplinary integration, organ procurement organization, brain death, ICU

1. Introduction

The interdisciplinary approach connects interdependent knowledge and skills from more than one subject area to examine a central theme, which can be adopted to effectively address new problems and challenges facing mankind and represents a general trend in the disciplinary and professional development. In the real world, it is sometimes difficult to further develop knowledge without mutual penetration and supplementation between disciplines. Complex problems have to be solved through the synergy of multiple ideas, methods, tools, and instruments, requiring collaboration and cooperation among multidisciplinary professionals. Quite a few examples

including the discovery and application of penicillin show that scientific and technological advances are the outcomes of interdisciplinary cooperation.

To promote interdisciplinary integration, many countries have introduced encouraging policies, launched series of state-level disciplinary research projects, and set up interdisciplinary professional degrees at the college level [1, 2]. Meanwhile, academic activities themed on multidisciplinary integration can be seen more frequently in the recent decade, and more clinical guidelines have been jointly compiled by a multidisciplinary panel of experts to achieve thoughtful solutions to the questions concerned.

Empirical evidence has proven that the knowledge basis of organ donation (OD) is a medical-centered subject with sociological, humanistic, psychological, ethical, and juristic attributes. It represents a typical example of multidisciplinary collaboration driving professional development in the field. In this chapter, we try to explain the necessity and feasibility of adopting multidisciplinary collaboration to advance the OD disciplinary system by analyzing the nature of its bottleneck problems and the key processes, with an introduction of current efforts taken in China to reach such a goal.

2. The necessity of promoting the building of OD discipline system through multidisciplinary collaboration

The professionalism of the OD discipline has been widely recognized by the international academic community, as exemplified by the establishment of the International Society of Organ Donation and Procurement (ISODP) and national/regional professional associations for OD in different countries [3]. This recognition indicates the necessity and feasibility of the building of the OD discipline system as the core to guide daily practice and create academic environment.

The overall goal of building the OD discipline system is to protect the legitimate rights and interests of donors and their families, maximize the transplant benefit of recipients and promote harmonious development of human society through establishing a sound scientific theoretical system with distinct characteristics of social humanity to guide actions and practices. Meanwhile, upon which it also drives, in a sustainable fashion, both the development of professional skills and qualified personnel. The establishment and development of the OD discipline system are in conformity with the goal of “self-sufficiency” in organ donation and organ transplantation (OD and OT).

Empirical evidence shows that the establishment of such a theoretical system and its operation practice requires the collaboration of multidisciplinary expertise and the support of multiple teams. We will explain the details in the paragraphs below and the fact that the OD discipline and OT discipline can develop with their own focus and are mutually reinforcing.

2.1 The solution to bottleneck problems of OD requires the multidisciplinary effort

The sustainable and sound development of OD and OT has been a concern of the international community and local governments, which has been driven by two main factors [4]:

Firstly, organ shortage is still a common issue worldwide, despite the fact that the global number of OTs has been increasing in the recent decade. According to data

collected by the WHO Global Observatory on Organ Donation and Transplantation, there are more than 1,200,000 patients on a current transplantation waiting list, while only 120,000–130,000 transplants are performed a year globally [5]. In recent years, the outbreak of the COVID-19 pandemic has had a great impact on people's daily life and has posed grave challenges to the building and operating efficiency of OD and OT systems in all countries. In the circumstance that the burden of disease and transplantation demand did not decline, the global OT number in 2020 declined by 17.6% compared with that in 2019 [5].

Secondly, donated organs are valuable national resources, giving OD an attribute of social public welfare [6] and its natural links to society. As advocated in the WHO guiding principles on human cell, tissue, and organ transplantation (WHO guiding principles) [7], OD and OT activities should be strictly regulated by the government of member countries, and illegal organ trading should be prohibited. In order to achieve “self-sufficiency” and sustainability of OT, the development of OD and OT programs needs to be based on legal and ethical requirements, with maintaining equity, transparency, accessibility, high quality, and patients' safety at the core.

By further analyzing the nature of the above requirements, it is not difficult to identify a more in-depth demand: The development of the OD program does not only depend on any single community but also requires the support and participation of multiple parties from various sectors and knowledge transferred from multi-disciplines.

2.2 The whole process of OD requires collaboration among multi-teams

The management mode of organ procurement varies in different countries. Whether built inside medical institutions or being independent outside the hospital, the Organ Procurement Organization (OPO) represents a professional team/organization responsible for the procurement, distribution, and coordination of organ & tissue donation activities at the practical level. The OPO is composed of professionals from different fields such as intensive care medicine, transplantation medicine, anesthesiology, nursing, bioengineering, sociology, psychology, medical ethics and information technology, etc. Its mission and goals are to maximize local donation rate and the number of transplantable organs so as to save more transplant patients and improve their living quality. OPOs and the transplant coordinators serve as a bridge for overall coordination in the entire process at the institutional and individual levels, respectively. Such a collaborative network covers multidisciplinary teams within medical institutions, such as the health care teams in the intensive care unit (ICU), emergency department, neurology department, neurosurgery department, laboratory, transplantation centers, and also expanded to other relevant governmental sectors beyond medical institutions [3].

The following text will focus on the key processes of OD and elaborate on the required multidisciplinary expertise and the involvement of multidisciplinary professional teams.

2.2.1 Identification and referral of potential donors

The clinical procedure of OD begins with the identification of potential donors. The potential donor identification rate determines the total scale of organs for transplantation [8]. Identification of potential donor and referral by the health care team to the OPO should occur in a timely manner. A timely referral is built upon a working

mechanism of OD within donor hospitals with OPO [9]. In the United States (US), in addition to the fact that Centers for Medicare and Medicaid Services (CMS) require each imminent death should be referred by hospitals to the OPO for assessment, OPO will sign a contract with every single donor hospital in its donation service area to consolidate such partnership [10]. In the Netherlands, the roles of emergency physicians, neurosurgeons, and neurologists were clearly defined for the identification of potential organ donors [11]. In China, the health authority has included the potential donor reporting rate as one of the key performance indicators in the accreditation of third-grade hospitals [12].

In addition, research results have illustrated the importance of the ICU team's attitudes and recognition toward OD, as well as the active participation in OD to improve OD rate and organ procurement efficiency [13, 14]. Spanish recommendation even advocates that intensive care to facilitate OD (ICOD) is a legitimate practice that should be considered as part of the health care service portfolio of any country that has a regulated OD and OT system [15].

2.2.2 Death determination

All OD cases must strictly adhere to the internationally recognized ethical principle of "Dead Donor Rule". Either neurological or circulatory standards are adopted in death determination, such clinical practice has to be performed in accordance with local clinical protocols and legal and ethical requirements.

Although there exists global variability in brain death (BD) diagnosis, donation after brain death (DBD) still represents the main organ source of transplantation, accounting for 77.2% of global deceased donation in 2019 [5]. In this chapter, we focus on the BD determination.

Various protocols and guidelines for BD diagnosis have made clear requirements on the clinical criteria, operational specifications, and personnel for determining BD [16]. As for "who can certify", the World Brain Death Project report [17] provides a minimum recommendation. The physician performing the BD determination must be certified to practice medicine and trained in BD diagnosis. The determination team needs to include a neurologist, a neurosurgeon, an anesthesiologist, and an intensivist at least.

Although personnel in charge of OD and OT cannot take part in the process of death determination, whether the BD diagnosis can be carried out in a timely manner may have impacts on the subsequent step of the OD procedure and result in the donor loss. Thus, it can be seen that the support of neurological expertise and the involvement of a team specialized in performing BD determination are indispensable in this critical aspect of death determination.

2.2.3 Evaluation and maintenance of potential donors and organs

Potential donor evaluation is one of the key parts of OD workflow, which includes clinical assessment of the donor and organ viability, as well as the risk assessment of the donation process.

Clinical assessment involves risk assessment of donor-driven infectious disease to recipients and assessment of organ viability [18]. For detection of malignancies, it is necessary to know whether the donor has a history of malignancy diagnosis, chemotherapy, and surgery [19]. As for screening of infectious diseases, viral infections such as hepatitis, herpes, human polyomavirus, and acute neoplastic virus; bacterial

infections such as acute infections, bacterial sepsis, meningitis, pulmonary infections, urinary tract infections, and multidrug resistant bacteria; and other pathogenic infections such as fungal infections, parasitic protozoan, and nematode infections, and prions need to be included [20]. In the case of evaluating elderly or marginal donors, cooperation between OPO medical specialists and transplant surgeons with extensive experience is needed. The entire medical evaluation also requires the professional support from the fields of laboratory medicine, infection, oncology, medical imageology, and pathology.

The other part of the evaluation process includes a general review of personal, social, and medical information of the potential donor as well as information regarding his/her family status and next of kin. The transplant coordinators need to screen and analyze risk points at hand and seek professional help from ethical and legal experts, social workers, and religious figures, if necessary.

Donor management is the longest-lasting step of the entire process and one of the key factors affecting the quality of organs and the transplant outcome [21]. ICU specialists have the professional advantage of carrying out donor maintenance thanks to their background and clinical experience [22]. Studies indicate that the engagement of ICU medical staff in donor management with an aggressive approach can improve the organ utilization rate and organ quality [23].

2.2.4 Communication with the family of the potential donor

As one of the core steps in OD procedure, family communication is considered a serious and professional matter. The family's distrust of the communicator and the content of the conversation is one of the major reasons for the refusal to donate. The family trust is built upon continuous communication and empathy demonstrated by the communicators. Effective communication with the donor's family requires knowledge reserves of medicine, ethics, law, psychology, social humanities, narrative medicine, communication, etc., close cooperation between coordinators and the health care team, as well as timely coordination among sectors such as traffic police, the forensic team, airlines company, civil affairs, and funeral institutions [24].

In addition to providing families with professional advices in a respectful, honest, cooperative, and empathetic manner during the process, psychological knowledge is needed to grasp the fluctuating psychological state of the family. Communication about death diagnosis and medical condition requires professional medical knowledge and then needs to be transferred to the family in an easy-to-understand way with communication skills. At the same time, traditional cultural and religious views also influence their willingness to donate to some extent. Positive arguments of traditional culture and religion on OD need to be invoked to guide the family to make appropriate decisions based on respecting their religious and cultural beliefs [24].

2.2.5 Organ allocation

Although organ allocation policies vary among countries in detail, all of them are based on the principle of fairness, equity, and transparency. The WHO guiding principles require that the allocation of organs, cells, and tissues should be guided by clinical criteria and ethical norms, not financial considerations [7]. The WMA Statement on Organ and Tissue Donation (The WMA Statement) regulates those policies governing the management of waiting lists should ensure efficiency and fairness [25]. Therefore, to balance the gains and losses posed by different dimensions, the

research and development of organ allocation policies should be conducted by a panel of experts in multiple fields such as transplantation medicine, biomedicine, health economics, public health, statistics, ethics, law, etc.

To ensure the implementation of organ allocation is inconsistent with the targeted manner and adheres to the predefined allocation rules, the calculation of the matching list and the allocation processes afterward shall be carried out via an informative system [6]. Unlike any other data registries, the informative system for organ allocation has specific application characteristics such as faithful implementation of allocation policies, and real-time assistance in clinical decision-making. The design, development, and maintenance of the allocation system require a panel of medical experts as well as technical support of professionals in mathematics, information science, and computer science.

2.2.6 Organ procurement and preservation

A sound and reliable process of organ procurement, preservation, and transportation can improve the utilization of donated organs, and ensure the safety of the recipients [26]. According to the EU Guidelines on Quality and Safety of Transplanted Organs (6th edition) (The EU Guidelines) [27], a joint-effort approach among OPO, the donor hospitals, and the surgical team is required. In addition, the importance of establishing a specialized organ surgical team is emphasized in the EU Guidelines, which, if possible, shall consist of surgeons specializing in abdominal and cardio-pulmonary organ retrieval, physician for anesthesia, and technicians responsible for organ perfusion preservation [27].

2.2.7 Education and publicity

Studies suggest that donation rates can be effectively increased through various types of campaigns for different targeted groups [28]. The WMA statement indicates that public awareness of OD should be raised through multifaceted and multilevel media awareness and public campaigns [25]. Through long-term and effective social publicity, it is expected to gradually create a favorable cultural and social atmosphere for OD.

Multilevel and multichannel popularization and publicity require strict standards and the guidance of communication knowledge, which itself is a multidisciplinary integration of narrative medicine, sociology, psychology, journalism, and communication. The promotion of OD requires the participation of ambassadors of OPOs, medical practitioners, media workers, educators, volunteers, and university (medical) students, etc.

2.3 Improvement of operational efficiency and service quality requires the support of multidisciplinary and multi-team professionals

The “conversion rate” is considered a key indicator to measure the professionalism and performance of the involved teams in the OD process. The “conversion rate” refers to the number of actual donors over the total number of potential donors, which is in contrast to the proportion of donor loss. The “critical pathway for deceased organ donation” systematically describes 13 common causes of donor loss (**Table 1**) [9]. In addition to objective factors (e.g., patients with contraindications

Systematical reasons	Fail to identify/refer potential donors
	Fail to confirm death determination
	Fail to declare circulatory system death within the appropriate time
	Logistical problems
	No suitable recipients
Donor or donor organs reasons	Medical examination does not meet the requirements (with contraindication to organ donation)
	Hemodynamic instability/unexpected cardiac arrest
	Anatomical, histological, and/or functional abnormalities of organs
	Organ damage during repair
	Inadequate organ perfusion or thrombosis
Reasons for permission/informed consent (communication issues)	The deceased explicitly declined to become a donor during lifetime
	Donor's family refusal to organ donation
	The forensic coroner or other judicial officer does not agree to organ donation

Table 1.

Reasons why potential donors do not become actual donors (donor loss causes).

to OD), some of these causes are related to the level of awareness and expertise of practitioners engaged in different steps along the process. These causes of donor loss can be improved by providing professional training to practitioners. But it is further illustrated here that potential donors cannot be converted into actual donors or the organ quality and the rights of recipients cannot be protected without the support of relevant expertise and the involvement of professional teams.

3. OD discipline built upon multidisciplinary integration

The construction of discipline includes building of theoretical system, carriers, talent training and career path, academic environment, and scientific research innovation.

3.1 Building of theoretical system

The multidisciplinary integration of OD discipline is reflected at two levels, which is firstly reflected in the integration of knowledge in the area within the medical domain (transplantation medicine, critical care medicine, neurology, infection, oncology, and pathology). The second level of multidisciplinary integration is the integration of knowledge in the area of law, ethics, public health, humanities, health economics, management, psychology and communication, etc. [3]. The multidisciplinary knowledge base supporting multi-team collaborative practice meets the fundamental needs of the construction of OD discipline.

3.2 Building of carriers

Although management models used in different countries vary, administrative organizations at all levels for OD and OT, donor hospitals, OPOs are practice bases of OD discipline.

The essence of multidisciplinary-supporting in OD practice indicates that effort should not only be paid for the construction of any single carrier for OD program with high operating efficiency but also for the long-term work collaboration mechanism between carriers. In the OD context, a collaboration mechanism means an efficient network of collaborations, at the institutional level, between community, OPO, medical institutions, hospice institutes, relevant government sectors, charities, and academic organizations, as well as at the individual level, volunteers, social workers, ICU teams, coordinators, medical experts, transplantation teams, legal medical experts, undertakers, scientific researchers, and other professionals.

3.3 Path of talent training and professional development

The building of the OD discipline requires the active engagement of multidisciplinary professionals and needs to train a host of application-oriented composite professionals and make them the main force for driving the development of the field.

A transplant coordinator is a profession derived from the development of the OD program and is key to promoting multi-team coordination and cooperation in the process of OD [29]. As the work of OD coordinators involves many aspects, efforts shall be made to strengthen their multidisciplinary theoretical reserve and develop their comprehensive abilities. Meanwhile, coordinators in different countries vary in their professional background, employer, requirements on qualification review, performance management system, etc. Actions should be taken to effectively utilize local occupational planning and policies on talent training, arrange and establish an appropriate professional development path and a system of occupational promotion for OD coordinators, and establish corresponding knowledge, ability, and technology training system in accordance with different features and work needs in different stages of career development. These actions are the fundamental guarantee for the continuous growth of the OD talent team and the basic guarantee for steady development of local OD [29].

3.4 Academic environment and scientific research innovation

In terms of creating a favorable academic environment, specialized international and national/regional associations related to OD have been created, and their members are experts and scholars in emergency and critical care medicine, neurology, OPO, transplantation medicine, oncology, ethics, law, medical humanities, hospital management, communication, sociology, health economics, public health management statistics, etc.

These associations regularly launch academic research and activities participated by multiple parties, produce high-quality scientific publications, guidelines, and expert consensus related to organ and tissue donation, organize and take part in multidisciplinary forums and offline academic seminars, so as to create a favorable academic environment for building the OD multi-discipline system and continuously promote the professional development of OD.

The common research goals in OD-related scientific research tasks include how to maximize the outcomes linked to the mission of the OD program. These key indicators include the donor per million population (PMP), the donor conversion rate, authorization rate, the organ utilization rate, the degree of efficiency of the management mode and the collaborative network, and satisfaction of donor's family or relevant practitioners. The involvement of multi-discipline teams in these researches enhances the ability to find comprehensive solutions to the questions concerned. With regard to technical innovation, recent years have seen the development of technologies such as regional perfusion, ex vivo perfusion, mechanical preservation, and tissue regeneration to provide better conditions for organ viability and quality. Advances in biochemistry and tissue engineering have provided technical support to improve the quality and utilization of donor organs. Besides, with the development of aeronautical engineering technology, the concept of organ transportation by unmanned aircraft systems has been put into practice [3], indicating the enormous potential and value brought by the "medical + engineering + information" integration in the process of building of the OD discipline.

4. China's efforts

Over the past decade, China has made breakthroughs in OD and OT. Since the launch of the national program for deceased OD in 2010 and continuously driven by the patients' demands for transplantation, China has formed a national ethical OD and OT system in line with WHO guidelines and international standards [3]. China has become the second largest country in the world in terms of an annual number of OD and OT [5]. As of August 2022, the number of deceased organ donors has exceeded 40,000, and over 120,000 organs have been donated for saving life [30].

However, similar to other countries, China is still faced with the huge gap between supply and demand for OT. Meanwhile, China's PMP, 3.6 in 2020, is globally at the middle level [5], indicating room for improvement. The lack of a complete scientific theoretical system to guide professional and career development in OD is one of the reasons for the current results, rather than Asian or traditional cultures. In addition, the current number of transplant coordinators in China is insufficient, with around 2,000 certified coordinators [3] serving a population of 1.4 billion. Actions should be taken to implement countermeasures of talent attraction and talent encouragement for the field. To study and solve bottleneck problems facing the country, the work team consisting of multidisciplinary experts has made a proposal and reached a consensus on promoting OD discipline building through multidisciplinary integration and support.

4.1 Policy support

In recent years, China has advocated the development strategy of interdisciplinary collaboration and introduced a raft of policies, making multidisciplinary penetration and integration of interdisciplinary professionals a general trend [31]. Moreover, Chinese laws and regulations related to OD and OT advocate that administrative departments, red cross societies, and medical institutions at all levels and medical professionals shall support and take an active part in the work of OD. The introduction of these policies provides multidisciplinary integration and development of OD with institutional support [32, 33].

4.2 Tasks and actions

4.2.1 Building of OPOs

The degree of specialization of the operating carrier and its talent team is the basis for maintaining the efficient operation of the OD system. In 2013, advocated by the national health commission, China started building of OPOs nationwide [34], which, together with donor hospitals, become the carriers and initial base for the practice of the OD discipline. Subsequently, more than 130 OPOs have been developed either in a hospital-based or an independent institutional structure [35]. The standards for building, operation, and management of OPO and the indicators matrix of quality control for organ procurement have been also released by the national health commission [34].

4.2.2 Building of talent team

For the talent development of OD, the multidisciplinary knowledge and skill enhancement of professionals have been emphasized in its training model and contents in recent years. China has been exploring educational models for different target groups in practice, and the talent training includes the following aspects:

At the national level, comprehensive training courses and qualification tests are provided by China OD administration center for transplant coordinators, forming a national training and qualification system.

At the regional level, professional training is conducted by academic associations and OPOs for medical and nursing staff of critical care units, as well as public charity publicity and education activities for communities, schools, nursing homes, etc.

In terms of linking with the educational system, China has made explorations and practices in integrating education related to OD in the higher education system. The China-Europe Knowledge Transfer and Leadership in Organ Donation (KeTLOD) has established OD higher education (postgraduate) programs in seven Chinese universities to provide a master's course on organ donation [36]. In addition, a number of universities and colleges have introduced undergraduate elective courses on OD and OT [37]. In regions such as Zhejiang province, "popular science articles regarding OD" has been included in secondary school textbooks to popularize relevant concepts [38].

4.2.3 Academic environment

At the academic level, China has established professional associations for OD, which consist of medical experts from departments related to OD and OT, as well as scholars from medical ethics, law, social humanities, health economics, psychology, mass communication, biological tissue engineering, and anatomy. An expert consensus on development of a multidisciplinary supporting system for OD has been reached. Under the supervision of these associations, the scientific papers, consensus, guidelines, and books focused on the theme of multidisciplinary integration have been published, and academic activities with the participation of experts from multiple fields have been organized on a regular basis.

4.3 Social engagement

In terms of public education and publicity of OD, from the public-welfare publicity activities initiated by the administrative department, news media, and various

public-service organizations to individual's spontaneous publicity activities, the concept of OD has been popularized. April has been granted as the memorial month for organ donors in the country. As of August 2022, the number of voluntary organ donor registrants in China has exceeded 4.9 million [30].

5. Conclusion

The construction of the OD discipline system is in line with the fundamental requirement of promoting sustainable development of OD and OT. Promoting the OD discipline development is of positive significance for enhancing the professional identity of OD practitioners and the credibility of the OD undertaking.

According to its attribute of public welfare and work characteristics of the OD undertaking, its disciplinary building needs interdisciplinary support. Through years of efforts, China has been improving relevant laws and regulations, besides, it strives to boost interdisciplinary collaboration of OD through diversified popularization and publicity, comprehensive training for professional teams, and creation of a collaborative network with more extensive multidisciplinary support and engagement.

In summary, whether to cope with the bottleneck problems in the development of OD, or to improve the efficiency of work system and the quality of medical services by taking key measures to meet the demands in the whole process, it shows the necessity and feasibility of promoting the building of OD-related disciplines through multidisciplinary collaboration. Therefore, under the strategy of multidisciplinary development, we need to center around safeguarding the rights of donors and their family members and protecting recipients' rights to health, focus on the quality of the work of OD and OT, effectively integrate resources, give full play to professional forces in different fields, build an OD discipline system that meets the professional medical requirements, and fully shows the features of social humanity, thereby promoting the standardized, systematic, and professional development of OD. It is a common topic requiring policymakers, experts, and practitioners in the field to think deeply and make research, explorations, and practices persistently. We believe, by adhering to the coordinated multidisciplinary development strategy, the visible progress of the organ donation discipline in the future would be the result of the joint-effort gained from interdisciplinary collaboration and innovations.

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Author details

Wenshi Jiang^{1*}, Xiaotong Wu¹, Liansheng Ma², Jing Shu³, Juan Yan⁴, Liming Yang⁵, Yajie Ma¹ and Xiangxiang He¹

1 Shanxi Provincial Organ Procurement and Allocation Center, Taiyuan, China

2 First Hospital of Shanxi Medical University, Taiyuan, China


3 Zhejiang Xin'an International Hospital, Hangzhou, China

4 Shanxi Medical University, School of Humanities and Social Sciences, Taiyuan, China

5 The Sixth Hospital of Shanxi Medical University, Taiyuan, China

*Address all correspondence to: wenshi.jiang@hotmail.com

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