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Towards A Competency-Based Healthcare Management: The Case of the Attending Physician

QIN Dawei

Doctor of Management

Supervisor:
PhD Nelson Ramalho, Associate Professor,
ISCTE University Institute of Lisbon

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BUSINESS
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Abstract

The reform of the healthcare system in China opened room for the creation of the position of the attending physician, being entrusted with critical clinical functions. This position is crucial, but traditional hospital human resource evaluation in China mostly focuses on qualifications rather than competencies to select and evaluate attending physicians. However, a competency-based management offers better guarantees for high professional level.

Therefore, there is a need to build a competency-based management of attending physicians and research is lacking in China. This study is set to fill this research gap.

To achieve this, three empirical studies were conducted. The first, qualitative, identified a list of primary competencies for the attending physicians through interviews, reaching consensus via Delphi technique. Based on a sample of 406 healthcare professionals as well as patients, study 2 report findings from a conjoint analysis and questionnaire survey on rankings of the framework of competencies and other aspects generated by the first study. This produced a weighted evaluation index for attending physicians. The last study tested the predictive validity of such competency framework with a sample of 183 director-physician dyads, testing a moderated mediation model that linked competency and performance via work engagement while testing for the interaction effect with perceived organizational support. Findings supported the conceptual model thus indicating the competency framework proposed for attending physicians is robust in grasping their primary competencies, and that it can be used to conduct further research as well as to manage and improve professionalism throughout the healthcare system.

Keywords: Attending physician; Competency; Index system; Work engagement

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Resumo

A reforma do sistema de saúde na China abriu espaço para a criação do cargo de médico assistente, sendo-lhe confiadas funções clínicas críticas. Esta posição é crucial, mas a avaliação tradicional dos recursos humanos hospitalares na China centra-se sobretudo nas qualificações e não nas competências para seleccionar e avaliar os médicos assistentes. Contudo, uma gestão baseada nas competências oferece melhores garantias para um elevado nível profissional.

Assim, afigura-se necessário promover uma gestão dos médicos assistentes, baseada nas competências e falta investigação na China. Este estudo destina-se a preencher esta lacuna de investigação.

Para o efeito, foram realizados três estudos empíricos. O primeiro, qualitativo, identificou uma lista de competências primárias dos médicos assistentes através de entrevistas, chegando a consenso através da técnica Delphi. Com base numa amostra de 406 profissionais de saúde, bem como pacientes, o estudo 2 relatou os resultados de uma análise conjoint sobre rankings do quadro de competências e outros aspetos gerados pelo primeiro estudo. Isto produziu um índice de avaliação ponderada para os médicos assistentes. O último estudo testou a validade preditiva desse quadro de competências com uma amostra de 183 díades director-médico assistente, testando um modelo de mediação moderada que liga competência e desempenho através do envolvimento no trabalho enquanto testou o efeito de interacção com o apoio organizacional percebido. Os resultados apoiam o modelo conceptual, indicando assim que o quadro de competências proposto para os médicos assistentes é robusto para retratar as suas competências primárias, e que pode ser utilizado para conduzir mais investigação, bem como para gerir e melhorar o profissionalismo em todo o sistema de saúde.

Palavras-chave: médico assistente; competência; sistema de indicadores; envolvimento no trabalho

JEL: M12, I1

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摘　要

中国的医疗体制改革为主诊医师这一岗位的设立提供了空间，主诊医师被赋予了关键的临床职能。这个职位非常重要，但中国传统的医院人力资源评估主要是以资格而不是岗位胜任力来选择和评估主诊医师。然而，基于胜任力的管理为高专业水平提供了更好的保障。

因此，有必要建立基于胜任力的主诊医师管理制度，而这方面的研究在中国还很缺乏。本研究旨在填补这一研究空白。

为了实现这一目标，我们进行了三项实证研究。第一项是定性研究，通过访谈确定了主诊医师的主要胜任力清单，并通过德尔菲技术达成共识。第二项研究以 406 名医护人员和病人为样本，报告了对第一项研究产生的胜任力框架和其他方面的排名进行联合分析和问卷调查的结果。这产生了一个主诊医师的加权评价指数。最后一项研究以 183 名主任医师为样本测试了这种胜任力框架的预测有效性，测试了一个调节的中介模型，该模型通过工作投入将胜任力和绩效联系起来，同时测试了与感知组织支持的交互效应。研究结果支持了概念模型，从而表明为主诊医师提出的胜任力框架在把握他们的主要能力方面是强有力的，它可以被用来进行进一步的研究，以及管理和提高整个医疗系统的专业性。

关键词：主诊医师；胜任力；指标体系；工作参与

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Chapter 1: Introduction

Human resource is the primary resource of an organization, which can promote and improve the allocation of various resources (Boon et al., 2019). With the continuous development of science and technology and the continuous improvement of knowledge and skills, human resources contribute more and more to value creation, and social and economic development relies more and more heavily on human resources (Macke & Genari, 2019). How to construct a human resource management evaluation system for scientific selection of talents within the organization and in line with the characteristics of the organization itself, and how to rely on high-quality talent team to win a place in the fierce market competition and stand out is an important issue in the human resource development and management of organizations. As the main body and core competitiveness of hospital medical service, medical staff is an important and special human resource of hospital (L. Chen et al., 2004). With the continuous emergence of new medical technologies, new formats and new modes, and the increasing diversity and complexity of medical and health demand side (Ensor & Cooper, 2004), the medical and health market is facing severe opportunities and challenges. The competition between medical institutions at all levels is becoming increasingly prominent. Whether to have a sufficient number of high-level talents is increasingly becoming the key to the strategic development of medical institutions.

With the increasing demand for medical and health services, the human resource management model and organizational structure of Chinese medical and health institutions are undergoing profound changes (Y. C. Wang & Chang, 2016). The Chinese government has put forward higher requirements for medical and health personnel, which promotes the standardization and institutionalization of human resource management of medical and health in China. In the decade from 2011 to 2021, the State Council and the Health Commission of China have successively issued several policies, emphasizing that health professionals are an important part of China's professional and technical personnel and the backbone of the implementation of the Healthy China strategy in the new era. It is necessary to improve the evaluation system for health professionals, formulate evaluation standards for health professionals, innovate the mechanism for the use of health professionals, and scientifically and accurately evaluate the professional ability and level of health professionals. The evaluation

system should adhere to the principle of having both political integrity and ability, and evaluate talents by their ability, achievements and contributions.

With the deepening of China's medical and health system reform, the medical management model has also changed. In this context, the attending physician system as a new medical model arises at the historic moment, which broke the traditional Chinese diagnosis and treatment management mode. Instead of the three-level responsibility system consisting of resident physicians, attending physicians and chief physicians, the medical team under the charge of the attending physician will provide patients with quality diagnosis and treatment services under the new clinical mode (Ying et al., 2021). The new model changes the department director to assume responsibility for the development of the department for everyone to care about the work efficiency of the department, the quality of service and the development of the discipline, so that the outpatient service, the ward, the operation to achieve integration. The mode of relying on the main consultation group makes the diagnosis and treatment process seamless and improves the timeliness, accuracy and effectiveness of the diagnosis and treatment activities to a certain extent (C. H. Wang et al., 2021). As a full-time manager, the section director is fully responsible for the technical innovation and connotation construction, service management, quality management and development management within the department. The system of attending physicians can also avoid the phenomenon that doctors with high seniority and high professional titles are sought after while doctors with low seniority are neglected, thus reducing the enthusiasm of medical staff (P. X. Wu & Wang, 2021).

Under the new diagnosis and treatment mode, the attending physician, as the leader of the treatment group, is the core of the attending physician responsibility system, and plays a very important role in the diagnosis and treatment activities and daily management. The attending physician is the medical decision maker of the group, and the final decision is in the hands of the attending physician in the outpatient, hospitalization, surgery, discharge and other links of the patient (Ying et al., 2021). Meanwhile, the attending physician is the main body of medical responsibility, and his technical level, knowledge and experience are directly related to the therapeutic effect. In large medical centers, the competence of the attending physician plays an important role in hospital diagnosis and treatment, and its comprehensive ability and level is an important embodiment of the core competitiveness of the hospital.

Traditional Hospital human resource evaluation in China is mostly determined by the superior department of the hospital or simply considers the qualifications of the candidate doctors, ignoring the core competencies that really affect the job performance of attending physicians and the hidden characteristics that are difficult to evaluate (S. Yang et al., 2022). As

the hospital's overall business strategy, hospital culture, service concept and other values cannot be integrated, the traditional system will result in the mismatch between personnel and posts, and the job responsibilities cannot be effectively differentiated. As a result, the ability value of attending physicians cannot be evaluated comprehensively and objectively, excellent clinical attending physicians cannot be accurately screened, and incompetent attending physicians cannot be accurately eliminated. Therefore, we aim to establish a set of scientific, standardized and highly operable evaluation index system for attending physicians, so as to make up for the randomness of the hospital in talent evaluation, so as to strengthen talent construction, form the long-term core competition mechanism of the hospital, and promote the healthy and sustainable development of the hospital. Based on the connotation of competency, we combined the basic requirements of attending physicians and the analysis of discipline construction to find the effective and key factors for the comprehensive evaluation of attending physicians.

For such purpose we devised a set of empirical studies that considered Z. Liang et al. (2018) four-step recommendations. These authors, stated that a competency building process should: 1) identify tasks and competencies, 2) confirm the tasks and competencies through focus groups and a survey, 3) identify the behavioral items that match competencies, and 4) confirm these items by surveying supervisors distinguishing levels of competency. Therefore, we combined interviews, Delphi technique, and questionnaire based quantitative analysis, to comprehensively evaluate the work content and competencies of attending physicians. We opted to include some recommended research techniques interrater agreement indices, confirmatory factor analysis, and predictive validity as they offer greater quality and rigor to findings. The expected outcome is a scientific, standardized and highly operable evaluation index system for attending physicians that provides objective reference for the appointment, selection and assessment of attending physicians, so as to rely on a standardized competency-based evaluation and improve high-level talent echelon to promote long-term development.

This thesis is structured so to offer an overview of the research motivation, to revised akin literature pertaining to competency evaluation index system of attending physicians, and to propose a set of competencies (study 1a) that will be validated by experts via a consensus seeking technique (study 1b), and ranked importance with a large sample of individuals directly or indirectly involved with the attending physician position so to grasp a multistakeholder view (study 2) which produces a framework of competencies that will be tested for its predictive validity, namely by gauging its ability to explain job performance of attending physicians while taking into consideration the explanatory mechanisms and boundary conditions (study 3).

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Chapter 2: Literature Review

This chapter mainly reviews the literature related to the research. Firstly, we introduce the medical and health situation in China, including the achievements of China's medical reform and China's health personnel evaluation policy. Then we introduce the development of attending physicians and other advantages of the system as well as its implementation in China. Lastly, we introduce the concept of competency and the construction of competency model in the field of healthcare, so that readers can better understand the background knowledge and current research status of the topic.

2.1 Healthcare in China

2.1.1 Medical reform in China

After the founding of People's Republic of China, China's social and economic level was backward, health resource was very scarce, but China still established a basic urban and rural medical security system and a basic health system with extensive coverage but low level, greatly improved the health level of the Chinese people (Sun et al., 2017). Since reform and opening up, China's economic system transformed into a market economy, the health service industry has been marketized and privatized. As a result of the economic reform policies of the time, and government spending on health declined, health care coverage has declined significantly, and medical costs are rising significantly and access to health services is declining (Yip & Hsiao, 2020). The income of medical and health institutions mainly depends on drug added income and service income, which leads to the antagonism between doctors and patients. In 2003, SARS broke out, the Chinese government realized the shortcomings of the health system caused by the market-oriented and privatization policies during the reform and opening up period, as well as the importance of the public welfare of medical and health services and public health. The government began to increase financial support for public health institutions, which greatly promoted the provision of public health services in terms of infrastructure construction, personnel capacity strengthening and public health service project provision (Meng et al., 2019). At the same time, the Chinese government begun to reflect on the problems existing in the health system, and has made efforts to solve the problems of "emphasizing

medical treatment over prevention" and "emphasizing urban areas over rural areas". The public health services were strengthened, rural health construction and urban community health construction promoted greatly (Wang, 2004). However, the positioning of market and government functions in the medical and health system had not been fully clear. Medical institutions still relied too much on market competition to maintain their own development, and the situation of "difficult and expensive medical treatment" was still prominent. The multi-level health needs of people were not well satisfied (Blumenthal & Hsiao, 2015). In March 2009, the Chinese government issued “Opinions on Deepening the Reform of the Medical and Health care system” (The State Council, 2009), pointing out that the government planed to achieve the near-term goal of "effectively reducing the burden of medical expenses on residents, and effectively alleviating the difficulty and high cost of medical treatment", and to achieve the long-term goal of "establishing and improving the basic medical and health system covering urban and rural residents and providing safe, effective, convenient and affordable medical and health services to the masses". Through the above, the Chinese government wanted to establish a medical and health system with Chinese characteristics, gradually realized the goal of everyone having access to basic medical and health services, and improved the health of the whole people. China's medical reform includes eight strategies and policies, including the construction of health human resources, the reform of health financing, and the reform of the management system and operation mechanism of medical and health institutions. The new medical reform focuses on five areas: reform of the medical security system, medical service system, basic medicine system, equal access to basic public health services and public hospitals. In 2016, the Chinese government issued “the 13th Five-Year Health Plan” (The State Council, 2016) which pointed out that China has basically established a relatively complete public health service system and medical service system, a sound medical security system, standardized drug supply guarantee system and comprehensive supervision system, scientific management system and operation mechanism of medical and health institutions. In 2022 the State Council promulgated the "14th Five-Year national health plan" (General Office of the State Council, 2022), and points out that: after continuous efforts, China's basic set up basic medical and health system covering both urban and rural residents, realized everyone will have access to basic medical and health services, basic to meet the needs of people's multi-level medical and health care, to improve the health of the people. From 2015 to 2020, the average life expectancy increased from 76.34 years to 77.93 years, the infant mortality rate dropped from 8.1‰ to 5.4‰, the mortality rate of children under five dropped from 10.7‰ to 7.5‰, and the maternal mortality rate dropped from 20.1 per 100,000 to 16.9 per 100,000, ranking among the highest

in middle and high-income countries in terms of major health indicators. The share of personal health expenditure in total health expenditure has dropped to 27.7%.

2.1.2 Policy of health personnel evaluation in China

As the main body and core competitiveness of hospital medical service, medical staff is an important and special human resource of hospital (L. Chen et al., 2004). Whether the ability of medical staff can meet the people's increasing medical needs and requirements will seriously affect the medical service ability of hospitals and even the whole society. At present, the number of medical talents and health personnel in China is steadily increasing, new medical technologies, new business forms and new modes are constantly emerging, as well as the diversity and complexity of the medical and health demand side (Ensor & Cooper, 2004), leading to severe opportunities and challenges for the survival environment of the medical and health market. The competition between medical institutions at all levels is becoming increasingly prominent. Whether to have a sufficient number of high-level talents is increasingly becoming the key to the strategic development of medical institutions.

As the health of China's strategic continues to advance, the transformation of medical model and the deepening of the concept of humanistic management as well as the people's growing health care service demand increases, China's health medical institutions of human resource management mode and organization structure is witnessing profound changes (Y. C. Wang & Chang, 2016), the government put forward higher requirements for medical and health personnel, Therefore, the medical and health human resource management in China is gradually moving towards standardization, institutionalization and scientization. In 2011, the National Health Commission issued the “Medium and Long Term Talent Development Plan for Medicine and Health (2011-2020)” (The Ministry of Health, 2011), emphasizing: "We should strengthen the construction of high-level medical and health personnel, innovate the evaluation mechanism for the use of medical and health personnel, establish and perfect the evaluation index system for health personnel and improve the evaluation standards for all kinds of health professional and technical personnel according to the work characteristics and ability requirements of all kinds of health personnel. Widen the channel of the medical personnel evaluation, improve the methods of health talent evaluation, medical and health institutions of different ownership of the scientific and reasonable evaluation on the professional and technical personnel, create favorable pharmaceutical and health care personnel training and development, selects and the assign, flow configuration, incentive evaluation found, safeguard mechanism,

to mobilize enthusiasm and creativity." In 2015, The State Council issued the “Outline of The National Medical and Health Service System Planning (2015-2020)” (The State Council, 2015), which pointed out that the overall quality of medical and health personnel should be improved, based on the requirements of post responsibilities, with morality, ability and performance as the guidance. Scientific and socialized evaluation mechanism in line with the characteristics of health talents. In 2016, the CPC Central Committee and The State Council issued the "Healthy China 2030 Plan Outline" (The Central Committee of the Communist Party of China & The State Council, 2016), which proposed to further optimize and improve personnel evaluation standards in nursing, midwifery, auxiliary medical services, medical and health technology, in line with the international prevailing pattern. Innovate the talent evaluation mechanism, do not regard papers, foreign languages and scientific research as mandatory requirements for the professional title evaluation of grassroots health talents, and improve the talent evaluation mechanism that conforms to the characteristics of general practitioners. In 2021, the “Circular of The General Office of the State Council on Printing and Distributing key Work Tasks for Deepening the Reform of the Medical and Health System in 2021” (The State Council, 2021) emphasizes that the talent evaluation mechanism should be improved according to the performance of post responsibilities. Subsequently, the Ministry of Human Resources and Social Security, together with the National Health Commission and the National Administration of Traditional Chinese Medicine, issued the “Guidelines on Deepening the Reform of the Professional Title System for Health Professionals (Ministry of Human Resources and Social Security et al., 2021), emphasizing that health professionals are an important part of China's professional and technical personnel. Are the backbone of the new era to carry out the strategy of health in China, we need to improve the health evaluation system of professional and technical personnel, improve the health professional and technical personnel evaluation standards, innovating the mechanism of health professional and technical personnel to use, scientific and accurate evaluation of health practice ability and level of professional and technical personnel, insist on having both ability and political integrity, attention to talent with ability, achievements and contribution evaluation, Get rid of the tendency of only papers, only academic degrees, only awards and only "the title of honor" .

2.2 Attending physician

In this study, the attending physician refers to the leader of the attending physician group in the system of attending in charge. The treatment group consists of one attending physician as the

leader and several primary physicians as the assistants. Attending in charge is a new clinical medical management mode in which the attending physician group as an independent unit is fully responsible for and carry out a series of work such as patient diagnosis, treatment, teaching and scientific research (Greganti & Andrew, 1982). This model originated in the United States, where clinicians are divided into residents and attending physicians. Residents refer to doctors who are receiving training and are not qualified to practice medicine independently, while attending physicians have completed training and are qualified to practice medicine independently, and are responsible for all medical procedures from outpatient service to hospitalization, surgery and discharge. In China, traditional clinicians are usually only responsible for a single procedure, such as outpatient service, hospitalization and surgery. Under the new attending physician in charge system, the attending physician is the leader of the group, the medical responsibility subject of the group, the core of the system, and the medical decision maker and direct manager of the group (Yang, 2020). Similar to the United States, the attending physician is fully responsible for the implementation of all medical activities such as outpatient service, hospitalization, surgery, consultation and follow-up after discharge (Han, 2018).

The complexity of the tasks and requirements of the attending physician position is increasing due to changes in policy and societal needs. The transition from resident to principal physician has different job requirements and responsibilities, and their education in school and residency experience can provide them with sufficient medical knowledge and skills, but the pressure to master new non-clinical tasks and roles is much greater (Westerman et al., 2010). With the increase of economic pressure on hospitals and the limitation of working hours for residents, the workload of attending physicians is increasing, and the lack of work quality may decrease. Michtalik (2013) conducted a study to analyze the relationship between attending physicians' workload and the patient safety. Through statistical analysis, the study found that when the workload was too high, the attending physician could not adequately discuss treatment options, resulting in delayed admission and/or discharge, and reduced patient satisfaction. This will lead to the loss of patients, increased morbidity and mortality. For this reason, the workload of the attending physician should be appropriate and not overloaded. Lucas (2012) compared the impact of the rotation period of attending physicians on the proportion of unplanned patient re-visits, participants' participation in evaluation and attending burnout tendency. Through statistical analysis, the study found that the proportion of unplanned patient revisits was associated with better self-assessment measures of burnout and emotional exhaustion among attending physicians, and no relationship was found in the other variables yet. Joseph (2018)

constructed a generalized estimation equation to predict the work efficiency of attending physicians in the emergency department through a retrospective cohort study. Through statistical analysis, the study found that the attending physician saw the most patients in the first hour, and saw significantly fewer new patients an hour later. In other words, the main workload of the attending physician is concentrated in the first hour of the visit.

2.2.1 Implementation of attending physician in China

In China, Zhejiang Run Run Shaw Hospital was the first to implement and gradually explore the attending physician responsibility system based on China's national conditions (Lou, 2012). Then, a large number of hospitals in Jiangsu, Zhejiang and Shanghai began to explore and implement the attending physician responsibility system (Cao et al., 2010; Chang & Xie, 2016). Subsequently, there was a climax of the reform of the attending physician responsibility system in China. In general, the attending physician was evaluated by the review panel and appointed by the dean, and the attending physician managed the attending group comprehensively, and the attending physician and the physicians in the group were selected in a two-way way. The attending physician comprehensively manages the medical, teaching, research, performance and other aspects of the attending group.

In China, the three-level physician responsibility system has been implemented in the health and medical system for a long time (Ying et al., 2021), which means that in the whole medical activities of clinical departments, three-level physicians (department director and third-level physicians in the ward) are responsible for the diagnosis and treatment of second-level physicians (deputy director and attending physician). The secondary physician is responsible for the diagnosis and treatment of the primary physician (resident physician, sickbed supervisor physician). In the diagnosis and treatment activities, junior doctors should report to the superior doctors in time and listen to the guidance of the superior doctors. The superior doctors have the responsibility to inquire about the diagnosis and treatment work of the subordinate doctors. This system is smooth and forms a complete diagnosis and treatment system. The advantage of the three-level physician responsibility system is that the medical activities of the department are in principle checked by superior physicians layer by layer, and the medical quality and patient safety are guaranteed. The disadvantage is that front-line physicians' judgment and diagnosis of patients' conditions are easily limited, which affects the timeliness and effectiveness of diagnosis and treatment activities to a certain extent.

With the continuous reform of the current medical and health system, the clinical medical

diagnosis and treatment mode was gradually changing from "disease-centered" to "patient-centered" (Hurwitz & Vass, 2002), and the health industry management mode had correspondingly undergone a series of reforms. Under this background, the attending physician responsibility system emerged as a new diagnosis and treatment model. Under the new diagnosis and treatment mode, an independent principal diagnosis group composed of one attending physician, several leading physicians and treated physicians is fully responsible for the whole process of diagnosis and treatment of patients after admission, including outpatient, hospitalization, surgery, follow-up, consultation and a series of medical activities (Han, 2018).

In China, the attending physician is the leader of the attending physician group, which is the core of the attending physician responsibility system and plays a very important role in the diagnosis and treatment activities and daily management. The attending physician is the main part of the medical liability, since the group was patients of outpatient, hospital, diagnosis, treatment, discharge and follow-up of all major medical behavior of medical procedures, as well as the patients' medical records, prescription as well as a variety of inspection documents (X. Xu et al., 2020). The technical level, knowledge and experience of the attending physician are directly related to the therapeutic effect. As the medical decision maker of the principal patient group, the attending physician has the final decision in the outpatient, hospitalization, operation and discharge of patients in the group. In addition to clinical practice, attending physicians are responsible for teaching subordinate physicians and postgraduates of the attending group (Mattern et al., 1983), and leading the attending physicians to determine the direction of scientific research, form scientific research achievements and complete scientific research tasks. As the leader of the main consultation group, the attending physician is the direct manager of the main consultation group and has certain management responsibilities. Some tertiary public hospitals have taken the leading consultation group as an independent unit and implemented independent accounting. The attending physician conducts performance assessment on the attendance and workload of the group members (Lin, 2020). In the diagnosis and treatment of provincial regional medical centers, the competence level of attending physicians plays an important role in hospital diagnosis and treatment, and its comprehensive ability and level is an important embodiment of the core competitiveness of hospitals.

However, it should be noted that the attending physician responsibility system will inevitably be affected by the inertia of the "three-level physician round system", which has been implemented in China for many years. Therefore, under the current special national conditions, China mainly implements a system combining the original Chinese system, that is, the attending physician responsibility system under the leadership of the department director (P. X. Wu &

Wang, 2021). Under this system, the department director is responsible for the medical treatment, medical quality and medical safety of the department. The attending physician is responsible for the work of the group, and under the leadership of the department director, completes other medical work assigned by the department director, and participates in the medical quality control of the department. This system not only endows the main treatment group with certain medical rights and autonomy, but also ensures that the department director can coordinate the whole department and emphasizes the key role of department director coordination.

2.2.2 The advantage of the attending physician

As an effective tool of personnel system reform, the implementation of the attending physician responsibility system is an effective way to cultivate doctors' competitive consciousness and drive technological innovation, and an important way to promote doctors towards precision medicine. It also provides soil for hospital administrators to practice fine management, which is in line with the patient-centered service concept in the new era.

2.2.2.1 Optimizing hospital management

The attending physician group responsibility system to medical quality, efficiency and safety of give attention to two or more things, flattening the management system, improve the management level of hospital refinement, it is produced in the process of hospital development of a new hospital management mode, especially the hospital in the critical period of development, the pursuit of scale and benefit the attending group management mode can arouse the activeness of medical staff, It is of great significance to strengthen medical characteristics, improve the quality of medical care, improve doctor-patient relationship, reduce medical disputes and curb medical accidents (P. X. Wu & Wang, 2021).

2.2.2.2 Improving the work enthusiasm and efficiency of doctors

The hospital implements the team service mode of the attending physician responsibility system. This essentially flattens the management system, endowing the attending physicians with corresponding powers and clarifying the responsibilities of the attending group. At the same time, the benefits of performance appraisal are distributed to the group and implemented to individuals, which fully embodies the concept of the unity of rights, responsibilities and interests. The attending physician responsibility system makes the responsibilities of different positions more clear. By means of competition and examination of the hospital in accordance

with the standards of prior has announced the selection and matching of the medical staff, the appraisal and separate system can optimize the distribution of personnel, in order to revitalize the hospital vitality, tap potential, improve the medical staff's enthusiasm and initiative, shorten the average such confinement, speed up the turnover efficiency of hospital beds, realizing the maximization of the efficiency of the use of medical resources (Ren et al., 2021).

2.2.2.3 Improving patient satisfaction

The attending physician group provides the patient with a personnel structure equipped with reasonable professional medical team, provide patients from outpatient, hospital, surgery and follow-up the whole process of all-round service, ensure the diagnosis and treatment of timeliness and continuity, enhance the communication between doctors and patients, to better implement the patient centered medical service concept. At the same time, the attending physician responsibility system can enhance the work enthusiasm and sense of responsibility of the medical staff, improve the competitive consciousness of the attending physician group members, improve the medical technology level, and ultimately enhance the satisfaction of patients (C. H. Wang et al., 2021).

2.2.3 Comparison of various medical service management modes

In recent years, the attending physician responsibility system has gradually become a familiar term in every hospital. For domestic hospitals, the introduction of the attending physician responsibility system will inevitably encounter the inertial influence of the practice of "three-level physician ward round system" for many years. Traditional tertiary physicians' system "has its objective advantage, in the existing health service management system play a proper role, so if the introduction of the attending physician responsibility system, hospital administrators should clarify the advantages and disadvantages of both, understand oneself in the existing phase want to solve the problem of what, how to solve, all this should have overall plan, In this way, the advantages and functions of the system can be brought into full play.

2.2.3.1 Department director in charge system

Department director responsibility system refers to the administrative department in charge of the undergraduate course room, director of the management work and is responsible for the management department of the whole business technology such as medical treatment, teaching and scientific research work, therefore, director of the department is general administrative and clinical business leader, our department of clinical operations, administration and development

department unified organization, command set, responsibility, right, It has a central position in the department (Han, 2018). Assume overall responsibility for the department of department follow doctors at a lower level to the superior doctors, all doctors to work principle, director of the department, chief physician (associate chief physician), attending physician, resident according to the level of diagnosis and treatment, low qualification of resident is the direct perpetrators of clinical activities, the doctor's diagnosis and treatment of intermediate activity responsible, Senior chief physicians (associate chief physicians) are the leaders of clinical activities. But in reality, there are many problems in the division director responsibility system: many levels of responsibility make it difficult for superior doctors to understand and guide the behavior of subordinate doctors, which is not conducive to the growth of young doctors; Senior physicians transfer the first diagnosis to junior residents, which makes patients unable to receive direct diagnosis and treatment from high-level physicians, and seriously affects the accumulation of clinical experience and ability improvement of senior physicians. Following the separate diagnosis and treatment mode of "out-patient is out-patient and inpatient is in-patient", that is, patients are not in charge of the same doctor from out-patient to ward to operation, so that patients cannot receive continuous follow-up treatment from doctors (Tian & Li, 2010). The department director responsibility system puts the authority of the department director in an absolute position, and the different opinions can not be effectively dealt with. Although the department director responsibility system played an important role in the historical stage of insufficient human resources, which rapidly kept the medical activities and administrative management of the department in step, its own limitations also made it difficult to meet the requirements of the times.

2.2.3.2 Three-level physician in charge system

Three-level physician in charge system is a common practice of domestic hospital medical mode, the clinical departments in the medical activity, step-by-step for instructions, namely three physicians (three line), ward, director of the department of secondary physicians, deputy director of the (doctor) in the diagnosis and treatment work is responsible, the secondary physicians in primary physician (resident, bed head doctor) in the diagnosis and treatment work is responsible for, The advantage is that the medical activities of the department are in principle checked by superior physicians layer by layer, and the medical quality and patient safety are guaranteed; The disadvantages are that front-line physicians' judgment and diagnosis and treatment of patients' conditions are easily limited, which affects the timeliness and effectiveness of diagnosis and treatment activities to a certain extent (Ying et al., 2021). In

addition, the traditional three-level physician responsibility system is easy to separate the work of outpatient and inpatient, and the outpatient physicians receiving patients are not necessarily the primary physicians in the inpatient, which is not conducive to the whole process of patient disease management by the department. In this mode, the doctor have no enthusiasm, competitive, less selective patients, hospital performance is difficult with the doctor's medical service link, it is easy to appear "dry good dry, dry more dry less bad is the same" phenomenon, there are easy to "no matter how you medical level, when the director of" phenomenon (Xu, 2015).

2.2.3.3 Attending physician in charge system

Traditional the attending physician responsibility system of the core is the medical team was in charge of the patient work of the whole process of diagnosis and treatment, including outpatient, hospital, surgery, organization consultation, follow-up, its fundamental goal is to fully mobilize, the attending physician, director of the department and young medical personnel's enthusiasm, improve medical quality and efficiency (X. Xu et al., 2020). Traditional the attending physician responsibility system breaks the original three-level physician system and re-stimulates the enthusiasm of doctors in providing medical services (P. X. Wu & Wang, 2021). The traditional attending physician responsibility system requires a group of independent attending physicians with strong medical teaching, research and management ability. For small hospitals, this requirement may be difficult to achieve.

However, in the actual implementation of the attending physician responsibility system, there are many difficulties: Firstly, the attending physician responsibility system requires the attending physician to have a high comprehensive ability, which including independent diagnosis and treatment ability of patients, scientific research and teaching ability, as well as certain operational management ability; Secondly, the traditional attending physician responsibility system reduces the administrative power of department directors to a certain extent, and requires more directors to drive and manage each attending group with their professional ability and personal level. However, when there is a limited difference between the ability of the director and the attending physicians, the management of the department is weakened (Wan et al., 2021). Thirdly, in performance appraisal, it is difficult to balance the interests of oneself and other attending physicians, and it is easy to form conflicts between department directors and attending physicians (Zhan, 2018). At the same time, due to the imperfect performance appraisal mechanism of the main treatment group, the treatment group may focus on treating patients and neglect the training of doctors. There will also be competition

among the diagnosis and treatment groups to treat the "benefit" patients with common diseases and frequently-occurring diseases, hard-to-treat patients will be shunted off to other groups, resulting in the division of the whole department and a vicious circle of medical treatment. The attending physician will pay more attention to the patients who can bring performance, which will prevent the complicated patients from getting timely treatment.

2.2.3.4 The attending physician in charge system under the leadership of the department director

Under the leadership of the attending physician, director of the department shall assume overall responsibility for the later, with the attending physician, director of the department, has formed a clear division of responsibilities, each have emphasize particularly on, are back in the control of the management mechanism, on the one hand, director of the department has a "free the attending" management power, helps to fully arouse the enthusiasm of the business work, director of the department, improve the work quality and work efficiency. On the other hand, under the overall management of the department director, the attending physicians can actively implement their rights and obligations of quality management, and their work efficiency is greatly improved, as well as out-patient and emergency visits, discharge visits and bed utilization rate (Ren et al., 2021). The attending physician responsibility system under the leadership of the department director strengthens the attending physician's responsibilities in medical work, changes the management process, reasonably realizes energy level management, clarifies the responsibilities of all levels in energy level management, and better improves efficiency and quality (S. W. Wu & Sun, 2019). This service model takes the main treatment group as the management unit, and the management organization is flatter. Competition and incentive mechanism are introduced to encourage professionals to come out of the top. Meanwhile, medical personnel at all levels are encouraged to take the initiative to study their business and improve their medical technology and service level.

In terms of medical treatment, the medical team led by the attending physician is fully responsible for the outpatient service and hospitalization of patients. The attending physician responsibility system reform to promote the attending physician and group attaches great importance to the diagnosis and treatment of medical quality, greatly improving the level 4 operation rate, the proportion of difficult critically ill patients, class a medical record rate and rescue success rate and medical quality and the technical key indicators (Y. Q. Wang et al., 2019), ensure the medical quality and safety, and promote the technological progress and innovation. At the same time, through patients' selection of medical teams and physicians,

patients' right of choice and initiative are reflected, and the improvement and quality of medical services are promoted, from which patients get substantial benefits and satisfaction is improved (C. H. Wang et al., 2021). Put the interests of doctors and patients choose degree, thus breaking the pot, faced with intense competition between groups of doctors, physicians try to attract patients, constantly meet demand and the expectation of patients, well and truly establishing competitive, have the responsibility, the operation of the incentive and constraint, dynamic mechanism, embodies all the service concept of "taking patients as the center".

Hospitals implementing the attending physician responsibility system generally improve their work efficiency, reduce medical disputes, improve medical technology and service quality, and achieve good economic benefits, but some problems in the implementation process can not be ignored. The economic accounting of the attending physician responsibility system is based on the group as a unit and distribution according to work. The profit-driven consumption of medical staff is easy to lead to excessive medical treatment, excessive examination and increased medical service behavior (Wan et al., 2021). Current lack of direct index reflecting the quality of medical science or monitoring method, the hospital is still hard to comprehensive and efficient in all subjects, various diseases targeted medical quality management, also can't comprehensive management for clinical economic income, the attending group personnel quality is different, some people thought consciousness is not high, the interests of the chase high, one-sided pursuit of economic income, easy to aggravate the burden of patients. Group at the same time, the attending physician will be entirely responsible for patients from outpatient and inpatient to the hospital, the diagnosis and treatment in the whole process of the follow-up services, various evaluation of hospital, between groups of motivation and the increase of competition between groups, patients request is too high, prompting doctors need to constantly improve the medical technology, the doctor-patient communication skills, the workload increased significantly, the medical staff self-compression, The workload of medical staff increases (Michtalik et al., 2013).

2.2.4 Summary of attending physician

The attending physician is the leader of the attending physician group and the core of the attending physician responsibility system. The complexity of the tasks and requirements of the attending physician position is increasing due to changes in policy and societal needs. First of all, the attending physician is the subject of medical responsibility, and is the principal person in charge of the whole medical process of outpatient service, admission, diagnosis, treatment,

discharge and follow-up from the patient's enrollment. His technical level, knowledge and experience are directly related to the treatment effect. In addition to clinical practice, attending physicians are responsible for teaching subordinate physicians and postgraduates of the attending group, and leading the treatment group to determine the direction of scientific research, form scientific research achievements and complete scientific research tasks. As the leader of the group, the attending physician is the direct manager of the treatment group and has certain management responsibilities. In the diagnosis and treatment of provincial regional medical centers, the competence level of attending physicians plays an important role in hospital diagnosis and treatment, and its comprehensive ability and level is an important embodiment of the core competitiveness of hospitals.

After constant exploration in practice, under the current special national conditions of China, China mainly implements a system combining the original Chinese system, that is, the attending physician responsibility system under the leadership of the department director. Although the system of attending physician group is still in the exploratory stage in China, a large number of studies have shown that in the process of the detailed implementation of the hierarchical diagnosis and treatment system, the continuous adjustment of income structure and disease structure, and the emphasis on specialty characteristics and hospital brand, the objects of medical service evaluation in China are gradually focusing on. From the perspective of policy orientation of hospital management, at the hospital level, the state issued "Performance Assessment Indicators of Tertiary Hospitals public Hospitals"; At the specialty level, the state has formulated the National Pilot Scoring Standard for Key Clinical Specialties. At the physician level, the specific evaluation indicators of the attending physician position have not been established. Therefore, it is necessary in the construction of the attending physician system for reference, and appraisal experience, on the basis of applying scientific hospital management tool, combined with the practice of local concrete exploration to build "the attending physician evaluation index system", the thinning of the attending physician post evaluation index evaluation, is to promote the hospital internal fair and orderly competition, The beneficial exploration of strengthening operation management and sub-specialty construction, optimizing talent structure and perfecting incentive mechanism.

2.3 Competency

In 1973, McClelland, a psychologist at Harvard University, used some basic methods and technologies to lay the foundation for competency research for the first time in his research to

help the Us State Department design the selection method for diplomats. He compared and analyzed a number of characteristics of outstanding and ordinary diplomats, and found that the most important differences between the two are cross-cultural interpersonal sensitivity, political judgment and other potential personality traits related to the characteristics of the post. In the same year, McClelland (1973) put forward the concept of competency for the first time in his paper "Measuring Competency rather than Intelligence" published in American Psychologist magazine . In his opinion, whether a person is competent for a job and whether he has better performance and behavior than others at work depends on whether the employee has the professional knowledge and skills to complete the specific job, but more importantly, on the hidden personal personality traits, motivations and values. McClelland believes that in future talent selection and job recruitment, competency evaluation should be used instead of the traditional selection method, so as to achieve a better match between people and posts and appointment based on merit. The publication of this article has attracted extensive attention from the academic circles such as management and psychology, and the research upsurge of competency has started and gradually spread to the global scope. It has also played an important role in the field of human resource management and revolutionized people's understanding of talent selection and job recruitment standards.

2.3.1 Definition of competency

The concept of competency is similar to that of traditional competence, but there are important differences. Ability generally refers to the comprehensive characteristics necessary for individuals to successfully complete certain activities, and is the necessary condition for people to successfully complete certain activities. Competency is based on job responsibilities and oriented by job performance. It can not only reflect whether the individual can complete the basic work objectives or job responsibilities, but also pay more attention to whether the individual can complete the job tasks better than others and achieve better work performance (Parry, 1996). Compared with the concept of ability, competency is more specific to the post, has a higher degree of fit with the post, and has a more direct impact on the post performance. Therefore, competency can be understood as the part of ability that matches the post.

For a long time, there has been no unified definition of the concept of competency in the academic circle. At present, there are three main differences on the concept of competency: One view holds that competency refers more to an internal quality of an individual, emphasizing that competency is a potential and lasting personal characteristic and has a causal relationship

with excellent performance in a certain job or situation (Mcclelland, 1973; Spencer et al., 1993). This concept is relatively easy to understand and trace the merits and demerits of performance, but in the practical application of the model, it is easy to be confused and difficult to implement (Lucia & Lepsinger, 1999). The second view is that competency refers to people's external behaviors related to work performance, which are specific and can be observed, measured and verified (Woodruffe, 1993). This view uses intuitive behavior to explain and measure the competency level, which is highly targeted and can be better applied to implementation. The third view holds that competency is the sum of internal characteristics and external behaviors to effectively complete a job (Ledford Jr, 1995). Table 2.1 shows the classical definition of competency in existing studies. At present, Spencer's definition of competency is highly recognized in the academic world and has been widely used in various studies.

Table 2.1 Definition of competency in studies

Researcher	Definition
McClelland (1973)	Competency refers to knowledge, skills, abilities, traits or motivations similar to or related to work or work performance and other important achievements in life.
Hornby and Thomas (1989)	Competency refers to the knowledge, skills and qualities of an effective manager/leader.
Boyatzis (1991)	Competency refers to an individual's potential characteristics, such as motivation, characteristics, ability, self-image or social role, or the body of knowledge it uses.
Fletcher (1992)	Competency refers to the ability and willingness to use knowledge and skills to perform the job requirements.
Spencer (1993)	Competency refers to the comprehensive performance of individual characteristics that can distinguish excellent performance from average performance in a job, including motivation, characteristics, self-image, attitude, values, knowledge or skills, and any other characteristics that can be reliably measured.
Woodruffe (1993)	Competency refers to a set of behavior patterns that a job holder needs to bring to a position in order to be competent for his or her tasks and functions.
Ledford (1995)	Competency refers to personal verifiable characteristics, including knowledge, skills and behaviors that may produce performance. It has three characteristics: 1) personal characteristics, including knowledge, skills and behaviors; 2) verifiability, that is, the verifiable qualities of an individual; 3) Performance, reflecting current performance and generating performance in the future.
Parry (1996)	Competency refers to the sum of internal characteristics and external behaviors that enable individuals to effectively complete their work, such as knowledge, skills, abilities, traits, attitudes, actions.

Considering the reviewed literature, we believe that competency should have the following characteristics: Firstly, competency is not the sum of all the characteristics of a person, but should be targeted at a specific identity or job position and closely related to work performance. Competency profiles differ according to occupations but also according to the industries, positions and cultural environments. We should place the concept of competency in the whole

of individual-position-environment. Secondly, competency should be able to effectively distinguish excellent performance from average performance, and even predict the performance of different individuals; Thirdly, competency should be an organic combination of latent and deep individual characteristics and knowledge and skills. The traditional matching of man and position focuses on the knowledge and skills that meet the current needs of the post, while competency focuses on the potential and development of the individual in the post. Fourthly, competency is dynamic and will change with the change of personal thought, learning progress and time and place. Lastly, competency should be observable and measurable. This is in line with Roe (2002) and Bartram (2005) conception of competencies as being related to job performance, being described by action verbs, having a beginning and an end, and being changeable due to learning.

Combining with the characteristics of the above, this study departs from Roe's (2002) definition of competency "a learned ability to adequately perform a task, duty or role" to define competency as follows: individual competency refers to the effective response in a particular job or identity to show good or general of potential can be observed, the sum of the individual characteristics of deep, including the explicit knowledge and skills, as well as the invisible motivation, personality, attitudes and values.

2.3.2 Construction method of competency evaluation index system

At present, there are many methods used in the construction of competency evaluation index system, among which the more commonly used methods mainly include behavioral event interview method, questionnaire survey method, expert consultation method (Delphi method), job analysis method, or job log method.

2.3.2.1 Behavioral event interview

Behavioral event interview is an open and retrospective follow-up method, which is the most commonly used modeling method in competency research (McClelland, 1998). Behavioral event interview method in advance according to the interviewee's performance will be divided into blue-chip group and performance form, ask the interviewee to review in recent years in encountered in the actual work of positive negative all three key event, key events and events described in detail the origin and development of after, duration, the final result, involves characters, the interviewee the idea and behavior. After that, the specially trained interviewers made analysis and collating, statistically compared the frequency of various elements in the descriptions of the two groups of interviewees, screened the unique competency elements of

the interviewees in the excellent group, and established the competency model of the post. The whole process required double-blind design. Behavioral event interview method can obtain comprehensive and detailed information of interviewees, but the collection process is time-consuming and laborious, and the data analysis needs special training.

2.3.2.2 Questionnaire survey

The questionnaire survey method adopts structured questionnaire to collect and analyze the competency items of a position. This method can be a post with specific design, through the paper questionnaire or network, electronic questionnaire survey, rapid access to post competency information, collect information of high efficiency, convenient and quick, can help researchers get needed information quickly, in the effective promotion is one of the most convenient and fast modeling method. In the process of competency model construction, questionnaire survey method can be combined with factor analysis method to comprehensively analyze the sum of competencies required by a certain post. This method is generally suitable for a large range of information collection, but questionnaire design requires a high level of professional knowledge and statistical knowledge. Questionnaire survey is the most widely used method in competency model construction. Many scholars use questionnaire survey to construct competency model. Jin (2014) used questionnaire survey method and exploratory factor analysis in the construction of competency model of traditional Chinese medicine. X. Yang et al. (2015) also studied 1400 rural general practitioners in six provinces in central China by questionnaire survey, and finally constructed the competency model of rural general practitioners.

2.3.2.3 Critical event interview

Critical event interview is similar to behavioral event interview, which is named because it mainly collects key events in target positions or jobs (Mansfield, 1996). The critical event interview method does not distinguish the samples before the interview, but conducts the interview immediately after the research object is determined. In the interview, interviewees are required to display several important events related to the work, and the interviewer guides interviewees scientifically to explain each specific detail of each event as much as possible. Including the cause of the incident, the duration of the incident, who was involved in the incident, the final development of the incident and the outcome. To list successful cases separately, you need to list failed cases. At the end of the interview, the researcher makes statistics, induction and analysis of the interview text, and analyzes the key elements that really

lead to the success or failure of the event, so as to determine the competency characteristics required by the position or job. The difference between the critical event interview method and the behavioral event interview method is mainly in two aspects. Firstly, the critical event interview method mainly collects the key events in the target post or work, so it is not as tedious and laborious as the behavioral event interview method. Second, the critical event interview method does not distinguish the samples before the interview, so there may be a possibility of bias in the research results.

2.3.2.4 Delphi

Delphi Method (Dalkey & Helmer, 1963), which belongs to expert group method or expert consultation method, refers to the establishment of post competency entry pool on the basis of a large number of literature research and the anonymous form of multiple rounds of letter consultation with the authoritative experts in relevant research fields. Qualified experts conduct in-depth analysis and discussion on various competency elements and items. The results of the letter consultation will be summarized and revised in time, and will be fed back to the previous experts for further discussion. The competency model will be developed after several rounds of revision until the expert opinions tend to be unified. This method can synthesize the opinions of senior experts in the field, and the results are more authoritative. Moreover, due to the anonymity in the consultation process, there is no communication between experts except the feedback results, and the subjective influence caused by psychological factors or other social reasons is avoided to the greatest extent. Delphi method, as a mature method, has the advantage of objectively collecting the advice of authoritative experts in various related fields, with higher efficiency in collecting opinions and effectively saving time and energy. Of course, due to the differences in different professional fields and the different views and experiences of each expert, the results may also have some deviations. Many scholars use expert consultation method or Delphi method in the construction and exploration of competency model. Yu (2013) used the expert consultation method to extract the competency factors of emergency physicians in each stage of growth in the study on the competency construction of emergency physicians. Hua (2013) takes the staff of Guilin Library in Guangxi as the research object and uses Delphi method to construct the general competency model of library staff.

2.3.2.5 Job analysis

Job analysis is a method to distinguish and describe the task characteristics of employees with excellent performance and those with ordinary performance. Job analysis mainly focuses on

specific positions, focusing on specific jobs rather than individuals at work (Chong & Eggleton, 2007). The work analysis method does not care about how employees finish their work, nor does it care about the behavioral differences of employees with different performance. It only focuses on what employees have done and completed in their work. Specific modeling process: Under the guidance of the specific development strategy and organizational culture of the organization, collect and investigate the information of the corresponding post or job through scientific means, gradually establish the job nature, job responsibilities, job tasks, job rights, qualifications, working conditions and environment of the post, and then describe and standardize the job. A series of core individual characteristics and other skills needed to ensure high performance are extracted, and a competency model is established within the relevant theoretical framework. Finally, the model is verified and modified through data analysis results. The operation of job analysis method is relatively simple, with low cost in manpower and material resources, and it has a comprehensive and rich understanding of specific job information. The disadvantage of this method is that it lays too much emphasis on job function and pays insufficient attention to human ability and knowledge. Table 2.2 shows the advantages and disadvantages of each model construction method.

Table 2.2 Advantages and disadvantages of model construction methods

Construction Methods	Advantages	Disadvantages
Behavioral event interview	can get more detail, it can get comprehensive and detailed information about the individual	The data collection process is laborious It takes a lot of manpower and resources The process of collecting samples is difficult The personnel who analyze, refine and describe the interview results need special training
Questionnaire survey	High information collection efficiency; Quick and convenient operation; Suitable for a wide range of information collection	Designing questionnaire requires high professional knowledge; Analysis of the results requires a good knowledge of statistics
Critical event interview	Unlike the behavioral event interview method is tedious and laborious	The results may be biased
Delphi	The results are more authoritative, the collection efficiency is higher and the results are relatively objective	It is difficult to agree among experts
Job analysis	Relatively simple to operate The cost of manpower and material resources is low Comprehensive knowledge of specific job information	In the process of modeling, too much emphasis is placed on job functions and too little attention is paid to people's ability and knowledge

The above methods of establishing competency model have their own advantages and disadvantages. Which method to adopt in practice should be chosen according to the objective environment and specific work situation. At present, most scholars tend to adopt a combination of multiple methods to construct models in order to ensure that the models built have good reliability and validity.

2.3.3 Researches of competency in medical field

Since the formal emergence of the concept of competency in the 1960s and 1970s, the research and application of competency assessment or training had been carried out rapidly around the world, covering fields were expanding, and the research objects were constantly refined according to positions and identities. In the field of health, there is a wealth of research on clinicians, nursing, administrative and other positions or identities. Epstein and Hundert (2002) gave his own definition of clinician competency. He believed that clinician competency refers to the ability to skillfully and accurately use professional academic knowledge, technical means, clinical thinking, communication skills, emotional expression, value orientation and personal experience in daily medical services. So as to obtain the benefits of individuals and groups served. Frank (2010) published an article on the Lancet entitled "Medical Health Talent development for the New Century: Reforming Medical Education to Strengthen Health Systems in an Interdependent World", which states: "The trend of the new generation of medical education reform is to improve the performance of the entire health system by building on the health system and drawing on global experience to establish targeted job competencies." This paper further promotes the research on competency in health field, and makes competency-based medical talent evaluation, selection and training increasingly become a research hotspot of human resource management in health field.

2.3.3.1 Clinicians

Many countries have conducted research on the competency of clinicians. The Accreditation Council for Graduate Medical Education has developed a comprehensive competency model for physicians, which contains six dimensions: They are patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, and systems-based practice. Each dimension contains a number of competency indicators (Batalden et al., 2002). This model has been widely recognized since its release and has been widely used in the evaluation and training of residents.

Frank (2005) reported for the Royal College of Surgeons of Canada and defined seven roles of clinicians based on competency: 1) Medical expert: they should have rich medical knowledge, solid clinical skills, good professional ethics and attitude; 2) Communicator: should have the ability to communicate with patients in a friendly and effective manner and properly handle doctor-patient relationship; 3) Collaborator: should have good collaborative ability and be able to work actively and effectively with each other in the medical team; (4) Health advocate: have a sense of responsibility to promote the healthy development of groups and individuals through their own medical knowledge; (5) Managers: In addition to clinical work, physicians should participate in medical care management, effectively organize internship activities, properly allocate medical resources, and help establish an appropriate medical system; (6) Scholar: Should have the ability of lifelong learning, based on clinical practice, continue to enrich knowledge and skills. (7) Professionals: Professionals should be supervised by professional leaders through ethical practices and be committed to promoting the health of individuals and society. Czabanowska (2012) develops a comprehensive competency framework for European general practitioners for continuing professional development and continuing medical education. It consists of a list of 35 competencies divided into the following areas: patient care and safety, effectiveness and efficiency, equity and ethical practice, methods and tools, leadership and management, and continuing professional education.

The Ministry of Education of China entrusted a domestic authoritative research team to develop a nationwide general model of the competency of Chinese clinicians (X. H. Yang & Chen, 2013). This model divides the clinician's job competency into three levels, including 8 first-level factors and 65 second-level indicators. The primary factors include clinical skills and medical services, disease prevention and health promotion, information management ability, medical knowledge and lifelong learning ability, interpersonal communication ability, teamwork ability, scientific research ability, core values and professional quality of doctors. X. Chen and Yu (2015) constructed petal competency model with emergency specialist clinicians as the research object. The model includes diagnosis and treatment service ability, business knowledge and skills, communication and cooperation ability, management skills and scientific research and teaching ability. The model fully considers the growth of clinicians, and the strength of each ability determines the size of a petal. Zhang (2018) constructed the clinical competency model of physicians under the domestic biopsychosocial medicine model, including 58 questions in 4 dimensions, including knowledge and skills, decision-making ability, professional values and personality characteristics. Sun (2015) conducted behavioral events interviews with 88 clinicians, conducted investigations and empirical studies in China,

and formulated a general model for the competency of Chinese clinicians based on the specific situation in China. The model includes clinical skills and medical service, disease prevention and health promotion, information and management ability, interpersonal communication ability, teamwork ability, scientific research ability, medical knowledge and lifelong learning ability, core values and professional quality of doctors. Tang (2012) used behavioral event interview method to interview 30 doctors to obtain the competency model of doctors, including 22 characteristics such as responsibility, ability to write medical records, observation, relevant knowledge and skills. Wang (2018) constructed the job competency model of stomatological medical students through questionnaire survey, including six common factors, such as knowledge improvement, professional skills and doctor-patient relationship.

2.3.3.2 Nursing Staff

How to define nurses' basic competencies is critical to patient safety and nurse protection, as well as to identify advanced, extended and specialized practices in nursing (Tilley, 2008). Scholars have done a lot of research on nurse competency. McGarvey (2000) defined the competence of surgical nurses as the minimum level of knowledge, skills and abilities necessary to meet the professional role functions of registered nurses in the operating room. Benner (2009) proposed and revised the framework of nurse competency, believing that nurse competency includes seven categories: help, teaching guidance, diagnosis, situation management, diagnosis and treatment, quality assurance and job responsibilities.

Researchers in a number of countries have studied the nurse competency model based on their own national conditions. The Australian Nurses and Midwifery Association has summarized the competence of registered nurses into four competencies: professional practice ability, critical thinking and analysis ability, ability to coordinate, organize and provide nursing services, and therapeutic practice ability (Chiarella et al., 2008). Canadian scholars (Carter, 2010) believe that nursing practitioners should have five competencies: health assessment and diagnosis, health care and treatment intervention, health promotion, disease prevention and disease deterioration, and responsibility.

Other responsibilities besides nursing are also considered in the study of nursing competency. For example, Carlson (2016) determined the dimensions in the study of nursing competency in military hospital. In addition to 4 items related to nursing (Teamwork, empathy, respect for patients, communication), the particularity of nursing in military hospital is also taken into account. It added dimensions such as the ability to master military culture and the key tasks of retired soldiers. The competency model proposed for AIDS nurses includes five

dimensions: AIDS prevention ability, clinical AIDS management ability, AIDS treatment ability, prevention of mother-to-child transmission ability, and nursing ability of AIDS children (Smith et al., 2016).

Nursing competency research in China started late, and is still at the stage of considering the professional characteristics of nursing itself. Most people believe that nursing competency model should include nursing professional knowledge and skills, auxiliary knowledge and skills, and personal inherent traits, but the specific differences of different nursing positions are not taken into account. For example, according to the research on the post competency of emergency nurses, the competency model of emergency nurses includes occupation and cognition, care and service, self-concept characteristics and interpersonal development (Q. Wang et al., 2011). Bian (2011) used in-depth interview method, questionnaire survey method and expert consultation method to obtain the competency model of clinical nursing teachers, including professional quality, teaching ability, interpersonal coordination ability, professional attitude, professional ability and personality characteristics, a total of 36 competency characteristics. Dai (2014) studied the competency of clinical nurses in general hospitals and established a competency model for clinical nurses in grade A general hospitals by using critical event method and Delphi method, which included five dimensions, namely motivation, knowledge, social ability, personal characteristics and professional skills. This study also confirmed that age, educational background, working years and other factors will affect the competency of clinical nurses.

2.3.3.3 Manager

The research on the competency of health managers in China is earlier than that of clinicians. In 2006, the Personnel Exchange and Service Center of the Ministry of Health carried out the "Competency Study of Health Institution Managers", which used the behavioral event interview method to construct the competency framework of health institution managers for the first time for the presidents and directors of various health institutions (Li et al., 2006). Xu (2018) interviewed 20 clinical department directors of large general hospitals. According to the peer review method of senior experts, the differential competency characteristics of the excellent group and the ordinary group were extracted, and the competency model of clinical department directors in large general hospitals was constructed, including 4 dimensions and 17 items in total: professional ability, management ability, personal characteristics and interpersonal skills. Taking the leaders of Changzhou Hospital in Jiangsu Province as the research object, Zhang (2009) constructed a competency model for hospital leaders, including 16 competency elements

including achievement, service, management, cognition, influence and personal characteristics, which is used to guide the training of hospital leaders. Liu (2012) used behavioral event interview to study the competency of directors of clinical departments in different hospitals in Qingyuan city. The results show that there are 13 discriminative competency factors of clinical department directors in the city, including adaptive thinking, motivating others, innovation, quality, initiative, teamwork, decision-making ability, developing and subordinates. He believes that excellent clinical department directors should perform better in management. Zheng (2011) used behavioral event interview method, literature research method and expert discussion method to construct the competency model of Hospital administrators in China. The model consists of 13 competency characteristics, including innovation, team leadership, interpersonal understanding, communication and coordination, conflict management, service consciousness, influence, achievement orientation, learning ability, problem solving ability, integrity, professional skills and flexibility. She also proposed that different competency characteristics should be evaluated by different methods.

2.3.4 Summary of competency

According to existing studies, although the health competency models constructed by different countries are roughly similar, the competency models constructed by western countries mostly place them in a broader social and cultural background and pay more attention to the abilities of medical personnel as other roles. While the competency model of Chinese medical staff pays more attention to the qualities closely related to the profession of doctors or nurses, due to the different social responsibilities of medical staff in different countries. It is worth noting that most competency models value the continuing learning ability of medical staff. Even if they have started their work, every medical staff should actively have the willingness to learn for life. Although competency research has been relatively comprehensive, there are still some deficiencies:

2.3.4.1 There are most studies on the theoretical model of general competency, but few empirical studies on different situations, especially the lack of discussion on the social value of competency research.

The original intention of the competency theory is to solve the problem of how to choose the right person for the position (Lawler, 1994). There is no doubt that the application of competency model provides a more scientific reference in the selection and employment of organizations, and is of great significance in the history of human resource management reform

and development. With the continuous development of competency research, how to apply competency theory to the training and development of organizations, so as to enhance the core competitiveness of individuals and even the entire organization, has gradually become the focus of attention. The basic purpose of training is to continuously improve the personal quality and work performance of employees, so as to enhance the overall core competitiveness of the organization. We can flexibly face the changes of organizational strategy and job positions based on the perspective of enterprise strategy, with key positions as the core and competency model as the scale. Based on the competency training system, the company can accurately find out the gap between the existing ability and quality of employees and the competency requirements, and develop a more scientific and effective human resource management program.

2.3.4.2 Competency model Construction Is mainly based on the research results of other countries, and there is a lack of localized theoretical research combined with China's national conditions and policies.

With the deepening of competency research, while focusing on basic research, scholars gradually attach importance to applied research. In China, although the research on competency theory has been attached great importance and developed, and has developed in parallel with the international research, many excellent practical experiences of foreign countries cannot be copied and used for reference due to different national conditions, policies, social and cultural backgrounds. Applied research is still in its infancy. There are few organizations can really apply the competency model theory to the actual human resource management to guide and perfect the mechanism of talent selection and appointment.

2.3.4.3 Domestic competency studies are mainly conducted by universities and are mostly limited to theoretical research.

After all, the application and promotion of competency model should base on scientific and perfect empirical research. If there is no objective and quantifiable data as a fulcrum, it can only get conclusions that are too abstract and lack operability of the constructed model in practical application. Theoretical research will lose its important social significance and application value and lack of matching human resource management system combined with it, lack of empirical analysis and practical application .

Competency model is not a simple superposition of competency features. There is not only logical correlation among various elements of competency, but also dynamic and

developmental characteristics, which will change when combined with specific work situations. Earlier studies did not treat competence as a dynamic whole. In the study of individual competency, the influence of organizational strategy, organizational culture, environmental changes, job requirements and other factors on the competency model is often ignored. Only after the interaction with the environment can the competence truly match the person and post.

This chapter offered an overview of the Chinese healthcare system with an emphasis on the challenges it faces and how the medical reform has set new objectives, among which, the important role of attending physicians and the improvement of system based on their management. This implies competencies play a key role into fulfilling the reform objectives. We also introduced the concept of competency and the construction of competency model in the field of healthcare, so that readers can better understand the background knowledge and current research status of the topic. Then we profiled attending physician competencies by interview and Delphi method.

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Chapter 3: Study 1 Profiling Attending Physician Competencies

Literature review suggests a plethora of competencies that can be ascribed to physicians, which might seem to have the advantage of being comprehensive at a first sight but is plagued with redundancy and eventually adds to conceptual confusion as lack of focus. Only those competencies that are at the core and are considered critical by professionals themselves should be taken into consideration so to strike a balance between comprehensiveness and efficiency. Likewise, the international literature may not capture the Chinese characteristics of hospital organizations and therefore it is important to conduct a qualitative primary-data based study that is able to identify the main competencies and their rank of importance for attending physicians. To achieve this, we deploy a two-phased study. Study 1a is intended to identify a list of plausible competencies or aspects that condition the performance of attending physicians. This is expected to be a matured list but not necessarily one that gathers consensus or that is already trimmed to be maximally efficient. For this purpose, we conduct study 1b which will use Delphi technique to achieve such consensus as well as level of required efficiency.

3.1 Study 1a

The healthcare professions have been facing pressure for change so as the overall healthcare system in China. This change is expected to progress towards and improvement of quality and efficiency. In this context, new technologies, new forms of business and new models are emerging in the medical field, as well as the diversity and complexity of medical demand side (Ensor & Cooper, 2004), the medical and health market is facing severe opportunities and challenges. Competition between medical institutions at all levels is becoming increasingly prominent. Whether to have a sufficient number of high-level talents is increasingly becoming the key to the strategic development of medical institutions. With the continuous promotion of the Healthy China strategy, the medical model has changed, and the humanistic management concept has been deepened, and people's demand for the growing medical and health care services has increased. The human resource management model and organizational structure of Chinese medical institutions are undergoing profound changes (Y. C. Wang & Chang, 2016). The government has put higher demands on health workers: "In the field of health, we should strengthen the construction of high-level medical and health personnel, innovate the evaluation

mechanism of medical and health personnel, establish and improve the evaluation index system of health personnel according to the work characteristics and ability requirements of all kinds of health personnel, and improve the evaluation standards of all kinds of health professional and technical personnel; To widen the channel of the medical personnel evaluation, improve the methods of health talent evaluation, medical and health institutions of different ownership of the scientific and reasonable evaluation on the professional and technical personnel, create favorable pharmaceutical and health care personnel training and development, selects and the assign, flow configuration, incentive evaluation found, safeguard mechanism, to mobilize enthusiasm and creativity" (The Ministry of Health, 2011).

One can infer that HR play a central role in all this transformational process. Each professional individual, taken as a talent, is now the focal point of management attention. Talents are the most valuable resources for any organizations, and it is of great significance for organization to select talents scientifically, and establish a human resource evaluation system with its own characteristics. One feasible option is to achieve that by evaluating competences, which is a set of relative knowledge, attitudes, motivations and skills, influencing individual working performance, and it can be optimized through training and development (Mcclelland, 1973). The competence theory has been widely used in research on hospital management, such as in 2017, several Chinese researchers, based on existing studies, proposed a competence-based hospital recruitment indicator system and measurement approach, consisting of 15 level-1 indicators and 16 level-2 indicators (H. Zhang et al., 2017).

There is another change worth noticing, i.e. the position and duty shift has happened on physicians, especially attending physicians. Traditionally, physicians are expected to carry out not only diagnosis and treatment responsibilities, but also research and teaching works. Yet the current evaluation system within hospitals has confronted several challenges given its failure to include all competences that physicians should possess rather than what are expected from them, especially those practitioners working on the front line. As the core of a new diagnosis and treatment system, attending physicians lead medical groups to provide services for patients. Thus, their competences will be determinative to service quality of hospitals which have such a new system. It will be essential for hospitals' development to find a way to evaluate the competences of attending physicians, and this progress starts by listening to attending physicians and senior staff themselves. The leading question is: What are the competencies that differentiate attending physicians' performance? What competencies are needed for the attending physician's work? To offer an answer we opted to chose interview as a data collection

technique. Before identifying the methodological aspects, we will present the technique itself and why it is adequate for this purpose.

3.1.1 The choice for interviewing

From the handbook of interview method, it is a form of conversation used to obtain desired information by researchers (Gubrium & Holstein, 2001). It can be used to explore factors influencing various behaviors (Young et al., 2018). The interview method is one of the most important research methods that has been widely used in social science research. Researchers will usually prepare structured interview with cautiously worded questions, unstructured interview or semi-structured interviews. The first one follows a series of standardized steps with minimum randomness, and is conducted with pre-designed questionnaires or scales. Unstructured interview, or free interview, does not follow specific interview outlines or any steps. Interviewers will communicate with interviewees by following a topic to get the opinion of the respondents. It features in flexibility. Semi-structured interview also follows questionnaire or scales, but interviewees are allowed to express their own ideas (He et al., 2019). For interviewees or respondents, it is generally agreed among scholars that interview questions should go to knowledgeable individuals in the field of the subject matter. With rational choice of respondents, every one of them is expected to provide significant views and feelings (Alasuutari, 1998).

The interview method has several ways of organization, thus it is very flexible and under the control of interviewers. Under specially designed settings, relatively accurate results could also be achieved. Considering other clues during interviews, such as emotional expressions, body gestures and tones, in-depth information could also be revealed.

According to the methodological guide of interview (Young et al., 2018), there are three major steps: first, an initial design to decide types of interview and formulate questions. Second, data gathering, i.e. the actual execution of interview including sampling, pilot study and the undertaking of interview method. Finally, results analysis.

3.1.2 The applications of interview method in public health management

Interview method has become very common in different fields of study, especially in the public health sector. Interview method is used not only for overall hospital management, but also for disease control and national healthcare services. For example, in 2018, several scholars designed 51 structured interviews to what implementations can be done to promote the

organizational structure and processes of evidence-based public health, or EBPH in public health agencies (Allen et al., 2018). They interviewed leaders and program managers to identify factors facilitate EBPH. Then in 2020, a health interview survey was done to see the correlates of type 2 diabetes and glycaemic control in adults in Saudi Arabia, which was aimed at identifying factors directly related to diabetes (Al Slamah et al., 2020). Similarly, there is a research in China from the same year, exploring the effects of national primary public health services (He et al., 2020). The interview method was used with 26 respondents working in public health sectors, and coded the results based on the Grounded theory. The next year, a public health service interview was conducted in China, searching on the role of basic public health service programs in controlling hypertensions (Qin et al., 2021). It is concluded based on a cross-sectional interview survey.

The adoption of interview is not only limited to the above studies on better management or disease control. For example, a study was done in 2021 exploring nurses' perceptions on factors of children's mental health (Savolainen et al., 2021). This study involves 23 respondents from child health center, maternity clinics and schools. There are many studies, no matter qualitative or quantitative, trying to reach some conclusion by interviewing medical staff. A study in 2019 used interview method to see the effect of simulation-based training on junior doctors in coping with critically ill patients (Marker et al., 2019). The researchers invited 20 first-year doctors after a simulation-based training to telephone interviews, and transcribed the verbatim for content analysis. Similarly, another study also focused on the junior doctors, but on factors influencing their mental health and well-being via semi-structured interview in Australia (Petrie et al., 2021).

Besides, on human resource management in hospitals, a research was done to find key interventions of burnout of hospital physicians (Walsh et al., 2019). 32 physicians were included in a semi-structured interview, with the hope to find priority interventions to provide care and psychological support for them to reduce work stress. The same year in Poland, a study was carried out to figure out the impacts of doctor deficit on hospital management, which was a mixed-method study. And the first stage of the empirical study was in-depth interview, to allow doctors to be engaged to express their feelings towards the shortage of talent stock in their hospitals.

To sum up, there are many uses of interview in optimizing hospital management as well as in talent management, yet there is few studies focusing on the update of evaluation system of attending physicians in China and internationally. Thus, it will be of great theoretical and

practical significance to interview practitioners, hospital managers and even scholars to seek for possibilities in building such a system.

3.1.3 The applications of interview in building evaluation indicators

Evaluation indicators are vital to any organizations' development. For example, profit is an important indicator for company's performance. Similarly, one of the major steps to retain talents is scientific evaluation, which provides reference for promotion and other positional changes. However, such evaluation system should be holistic, well-based and capable to be adapted according to external changes.

The interview method has already been used in building indicators, such as for health city building (H. L. Zhang et al., 2022) and hospital quality management (Weggelaar-Jansen et al., 2018). It is a qualitative interview study with 12 hospital managers and 12 supporting staff, to set up technical and organizational indicators for hospital development. And the method is also used in constructing a nursing quality indicator for hemodialysis facilities, resulting in a system included 3 primary indicators, 15 secondary indicators and 46 tertiary indicators (Dong et al., 2021).

There was a study publish on The Lancet in 2013 pointed out that the evaluation of medical doctors is inadequate in China (Ye & Liu, 2013). Though in the following years, there have been studies shedding light on building an evaluation indicator system, but it is far from enough. For example, there are discussions a building such systems for general physicians (Wang, 2017; Zhu et al., 2014), but many of them were not updated to follow the changes in hospital systems, that is no focus on attending physicians or a holistic indicator system consisted of both medical duties and also other personal traits or research skills, same with another study (Yao et al., 2019), trying to build an evaluation system for specialized physicians through semi-structured interviews.

3.1.4 Method

3.1.4.1 Developing the interview outline

This study used a structured interview outline. The interview outline mainly focused on the work content and job responsibilities of attending physicians, the current evaluation system and specific evaluation or selection criteria of attending physicians in each hospital, as well as the suggestions of the interviewed experts on indicators that should be included in the evaluation system of attending physicians. We asked respondents to think from clinical and non-clinical

perspectives. The content of the attending physician we want to know was fully considered in the determination of the interview outline. Please refer to the Annex A for details.

3.1.4.2 Eligibility criteria

In the sampling process, interviewees were purposively chosen from a variety of departments. In the same vein of gathering different perspectives, these interviewees were selected also because they include attending physicians, the attending physician's manager (department director) and members of the attending physician's leading group. The interviewees were required to meet the following criteria: 1. To have an intermediate professional title or above; 2. With more than 5 years of clinical work experience; 3. And more than 3 years of attending physician related work (most hospitals adopted attending physician later). At the same time, in the selection process, all interviewees should come from medicine, surgery, gynecology, pediatrics and other disciplines as much as possible, so that the expert samples have better representativeness.

3.1.4.3 Expert panel

A total of 10 people were interviewed, including 8 males and 2 females, with an average age of 38.3 and an average working time of 11.9 years. The reason the number of men was significantly higher than that of women was simply due to random sampling. Eight of interviewees have sub-senior professional title, and two have intermediate professional title. Four people have administrative position, and six without administrative position. The departments involved concern internal medicine, surgery, gynecology, pediatrics, otorhinolaryngology, ophthalmology department and medical management division. Experts including four attending physicians, four attending team member, and two attending physician direct manager (department director). The description of the sample is showed in Table 3.1. The basic information shows that the respondents selected in this study have high authority, wide coverage and good representativeness.

Table 3.1 Description interviewed experts

No.	Gender	Age	Years of working	Professional title	Managerial position	Department	Role
I1	Male	35	8	Intermediate	No	Surgical	Team members
I2	Male	38	12	Sub-senior	No	Internal medicine	Attending physician
I3	Female	39	14	Sub-senior	No	Gynecology	Attending physician

No.	Gender	Age	Years of working	Professional title	Managerial position	Department	Role
I4	Female	44	20	Sub-senior	Yes	Pediatrics	Leader of attending physicians
I5	Male	39	15	Sub-senior	Yes	Otorhinolaryngology	Attending physician
I6	Male	41	15	Sub-senior	No	Ophthalmology	Team members
I7	Male	38	11	Sub-senior	No	Medical Management	Leader of attending physicians
I8	Male	35	7	Intermediate	No	Surgical	Team members
I9	Male	36	7	Sub-senior	Yes	Internal medicine	Team members
I10	Male	38	10	Sub-senior	Yes	Internal medicine	Attending physician
Sum	8 male, 2 female	Avg: 38.3	Avg: 11.9	8 Sub-senior, 2 Intermediate	4 yes, 6 no	7 departments were included	-----

3.1.4.4 Procedure

In this study, convenience sampling was adopted, and qualified interviewees were contacted via the professional network of the researcher. The time and place were agreed with the interviewees, and the researcher visited and interviewed them in person or online. Besides the author of this thesis, an assistant was invited to support the interviews and was entrusted with backing up and supporting the recording, note taking and auxiliary processes that could distract the attention of the interviewer. Before the interview, the assistant was sufficient trained and be able to complete the tasks assigned in the interview. Interviews lasted on average about 40 minutes. Firstly, the interviewer introduced the basic information and purpose of the interview, and the guarantees of anonymity and confidentiality as well as the expected length of the interview, so that the interviewees have a comprehensive understanding of this interview. After the interviewees fully understand and gave the informed consent to record the interview, interviewees were asked the questions according to the interview outline And were guided to think deeply and from multiple perspectives.

3.1.4.5 Data collection and analysis

During the interview, an assistant was invited to ask questions and take notes with the researcher. Researchers and assistants will guide the interviewees to think deeply and from multiple perspectives. At the same time, we will record the interview. Both the researcher and the assistant took notes separately. After the interview, both records were crossed to identify the

main elements that emerged from the interview and the full record was transcribed. After full communication, researchers and assistants reach a consensus to avoid omitting some key words. The taped interviews were translated into text. MAXQDA software was used to encode and sort out the interview records, identify and count the frequency of occurrence of related words, and complete the analysis.

3.1.5 Results

3.1.5.1 What are the duties and work contents of attending physicians?

In the interview, we collected 8 clinical items and 8 non-clinical items in terms of respondents' views on the responsibilities of attending physicians, and the total frequency of clinical items (F=46) was basically the same as that of non-clinical items (F=43). The most frequent clinical items were treatment (F=14, N=9), follow-up (F=8, N=6), clinical communication (F=7, N=6), and diagnosis (F=6, N=6). Besides, surgery (F=5, N=4), monitor patients' conditions (F=2, N=2), humanistic care (F=3, N=2) and referral (F=1, N=1) were also mentioned. Apparently, almost all (9 out of 10) agreed that the primary duty of the attending physician was to treat illness. The most frequent non-clinical items were teaching (F=13, N=9), scientific research (F=10, N=7) and patient management (F=7, N=5). Besides, non-clinical communication (F=4, N=4), team task coordination (F=3, N=2), team relationships coordination (F=2, N=1), performance distribution (F=2, N=2) and learning (F=2, N=2) were also mentioned. Obviously, almost everyone thought of teaching when considering the non-clinical work of the attending physician (Table 3.2).

"The attending physician, unlike the general practitioner, is responsible for everything from treatment to follow-up."

"Communicating with patients is as important as treating them."

"On the non-clinical side, the attending physician has some teaching and research responsibilities."

“The attending physician manages a team, including task division and performance allocation”

Table 3.2 Duties and work contents of attending physicians

Dimension	Category	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	Frequency	N
Clinical	Treatment	1	1	3	2	1	1		1	2	2	**14**	**9**
	Follow-up	1	1	3	1			1		1		**8**	**6**
	Clinical communication	1		2		1		1		1	1	**7**	**6**
	Diagnosis	1			1	1	1			1	1	**6**	**6**
	Surgery			1	1				1		2	**5**	**4**
	Monitor patients' conditions	1							1			**2**	**2**
	Humanistic care			2					1			**3**	**2**
	Referral	1										**1**	**1**
	Total	**6**	**2**	**11**	**5**	**3**	**2**	**2**	**4**	**5**	**6**	**46**	**10**
Non-clinical	Teaching	1	1	2	2	2	1	2	1		1	**13**	**9**
	Scientific research	1			2	2	2	1	1		1	**10**	**7**
	Patient management					2		1	1	2	1	**7**	**5**
	Non-clinical communication					1	1			1	1	**4**	**4**
	Team task coordination				2			1				**3**	**2**
	Team relationships coordination					2						**2**	**1**
	Performance distribution						1		1			**2**	**2**
	Learning						1		1			**2**	**2**
	Total	**2**	**1**	**2**	**6**	**9**	**6**	**5**	**5**	**3**	**4**	**43**	**10**

N: The number of persons mentioned this item

3.1.5.2. What are the criteria used to recruit and select attending physicians?

During the interview, interviewees reported that at present, almost no hospitals have a formal selection system for attending physicians and some hospitals have appointment procedures for attending physicians and some objective conditions, which are not strictly implemented in practice. None of the interviewees reported their hospital as having written criteria or standardized selection test. Only three respondents (I7, I8, I9) said that their hospital had written procedures for the appointment of attending physicians, but there were no clear written standards and no selection examinations.

"At present, there is no formal selection process and standard in the hospital, only a simple appointment process of attending physicians and some objective conditions"

"As far as I know, relevant documents should have been issued, which mentioned several requirements and procedures, but they were not very detailed. They were only used for guidance, and the actual selection was not strictly followed."

"Not all hospitals have attending physicians, but only large hospitals. There is no written standard yet"

The interviewees generally said that the current selection and appointment methods of attending physicians were informal and limited. It is mainly based on title, working years and other objective conditions, most consider the treatment ability of candidates (F=9, N=6), and less consider the personal ability of the attending physician such as clinical communication ability (F=2, N=2), management competence (F=3, N=2) and interpersonal competence (F=2, N=2). Some attending physicians need to be recommended by their superiors during the selection or appointment process (Table 3.3).

"If a department has conditions to set up chief physicians, the selection should be mainly based on Professional title and years of service."

"Some conditions will be set, such as vice senior title or above, working for more than 10 years."

"There is a two-way selection process, if there are no colleagues who are willing to be part of the group then they can't form the group, they can't become the group."

Table 3.3 Summary of current basis of attending physicians

Dimension	Category	Indicators	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	Freq.	N
System	Formal selection system	Written procedures	No	No	No	No	No	No	Yes	Yes	Yes	No	**3**	**3**
		Written criteria	No	No	No	No	No	No	No	No	No	No	**0**	**0**
		Standardized tests	No	No	No	No	No	No	No	No	No	No	**0**	**0**
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**3**	**3**
Criteria	Clinical technical competence	Treatment ability	2	1	1	2	2		1				**9**	**6**
		Theoretical_knowledge		1									**1**	**1**
		Total	**2**	**2**	**1**	**2**	**2**		**1**				**10**	**6**
	Clinical	Clinical communication ability	1				1						**2**	**2**
	Non-technical competence	Professional ethics		1									**1**	**1**
		Total	**1**	**1**			**1**						**3**	**3**
	Management competence	Coordinated ability					2						**2**	**1**
		Cooperation ability				1							**1**	**1**
		Total				1	2						**3**	**2**
	Interpersonal competence	Non-clinical communication ability					1					1	**2**	**2**
	Personal traits	Work attitude		1					1				**2**	**2**
	Other conditions	Professional title	1		1	1	1	1	1	1	1	1	**9**	**9**
		Years of working	4	1		1	2		1	1	1	1	**12**	**8**
		Academic Degree	1				2			1			**4**	**3**
		Social relations		1									**1**	**1**
		Superior recommendation		1					1			1	**3**	**3**
		Recognition of colleagues		1			1				2		**4**	**3**
		Total	**6**	**4**	**1**	**2**	**6**	**1**	**3**	**3**	**4**	**3**	**33**	**10**

Freq.: The frequency of this item mentioned.
N: The number of persons mentioned this item.

3.1.5.3. What are the suggested competence indicators for attending physicians?

In the suggested indicators, respondents generally considered multiple aspects of competency. We collected a total of 33 suggestions, including Clinical technical competence, Clinical non-technical competence, management ability, Interpersonal competence, teaching, research and learning ability, personal traits and other conditions. The new recommended indicators still mainly refer to clinical ability (F=25; N=10), of which surgical ability is particularly prominent (F=17; N=7). Surgical competence is considered as the most important among the clinical competence.

"In a department like ours, surgical ability is the hallmark."

"The attending physician can do surgery faster and better than anything."

Many interviewees indicated that clinical communication competence is as important as surgical competence. In addition, respondents generally believe that the attending physician must have management ability (F=35; N=10) and interpersonal competence (F=21; N=5).

"Communication with patients is sometimes more important than a doctor's expertise."

"The attending physician is also a group leader who supervises several people in the group, so has to have some managerial skills."

Another category that emerged is the one concerning teaching, research and learning competencies (F=30; N=10). The majority of interviewees mentioned teaching ability (F=6; N=6) but scientific research ability is most prevalent (F=15; N=10).

"The attending physician shall be responsible for the teaching in the group"

"The department director assigns scientific research tasks to the group, and the main diagnosis group is the specific implementation unit of scientific research."

Respondents mentioned a total of 8 personal traits, among which extroversion was mentioned most frequently (F=8; N=5) and work attitude (F=8; N = 5). (Table 3.4)

"The attending physician should not be introverted, otherwise it is difficult to interact with patients and colleagues."

"Attitude is everything, for the attending physician, for any job."

Table 3.4 Statistical table of suggested indicators

Category	Indicators mentioned	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	F	N
Clinical technical competence	Treatment ability	1	3	3	4	5	1	2	4	1	1	**25**	**10**
	Surgical level	5	1		3		2	1	4	1		**17**	**7**
	First aid ability		1			1		1	1			**4**	**4**
	Theoretical knowledge		1						1	1		**3**	**3**
	total	**6**	**6**	**3**	**7**	**6**	**3**	**4**	**10**	**3**	**1**	**49**	**10**

Category	Indicators mentioned	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	F	N
Clinical non-technical competence	Clinical communication ability	1	5	1	3	1			2		1	**14**	**7**
	Humanistic care			2							1	**3**	**2**
	Professional ethics		2	1	1	1	1					**6**	**5**
	total	**1**	**7**	**4**	**4**	**2**	**1**		**2**		**2**	**23**	**8**
Management ability	Organizing ability		1	1			1	2	2	2	1	**10**	**7**
	Coordinated ability					5	1		1	3	1	**11**	**5**
	Cooperation ability		1			1		1				**3**	**3**
	Leadership	1		1			1		1	1		**5**	**5**
	Healthy sense of competition		1	1	1						3	**6**	**4**
	total	**1**	**3**	**3**	**1**	**6**	**3**	**3**	**4**	**5**	**5**	**35**	**10**
Interpersonal competence	Non-clinical communication ability	3	2	2	3		4	2	2	2	1	**21**	**9**
	Ability to manage relationships	3	2			1			2	1		**9**	**5**
	total	**6**	**4**	**2**	**3**	**1**	**4**	**2**	**4**	**3**	**1**	**30**	**10**
Teaching, research and learning ability	Scientific research ability	1	1	2	5	3		1	2			**15**	**7**
	Teaching ability	1	1		1	1	1	1				**6**	**6**
	Innovation ability		1									**1**	**1**
	Learning ability	1		1	1		1	1	1	2		**8**	**7**
	total	**3**	**3**	**3**	**7**	**4**	**2**	**3**	**3**	**2**		**30**	**9**
Personal traits	Extroversion	2	1	1	1	3						**8**	**5**
	Work attitude	1		3	1	1			2			**8**	**5**
	Friendly			1				1				**2**	**2**
	Aspirant	1		1					1			**3**	**3**
	Mental endurance			2								**2**	**1**
	The right values		1									**1**	**1**
	Positive emotion								1			**1**	**1**
	Patience	2		1								**3**	**2**
	total	**6**	**2**	**9**	**2**	**4**		**1**	**4**			**28**	**7**
Other conditions	Recognition of colleagues		2							2		**4**	**2**
	A healthy body			1			1	1	1			**4**	**4**
	Academic Degree	1										**1**	**1**
	professional title							1				**1**	**1**
	years of working					1						**1**	**1**
	Participated in academic association		1					1				**2**	**2**
	Social relations			1								**1**	**1**
	total	**1**	**3**	**2**		**1**	**1**	**3**	**1**	**2**		**14**	**8**

F: The frequency of this item mentioned.
N: The number of persons mentioned this item.

3.1.5.4. Comparative analysis of observation indicators and suggested indicators

By comparing the frequency of observation indicators and suggested indicators, we found that the largest gap in the level of competence was observable in the clinical technical competence (G=39/4). It was followed by management ability (G=32/8), teaching-researching-learning

ability (G=30/9), interpersonal competence (G=28/7), personal traits (G=26/5), clinical non-technical competence (G=20/5) and other conditions (G=-19/-2). Almost all competency categories have higher recommended times, except for other conditions. At the index level, the main indicators mentioned more frequently than suggested indicators were professional title (G=-8/-8), working years (G=-11/-7), educational background (G=-3/-2) and whether there was a recommendation from the leader (G=-3/-3). The suggested indexes mentioned more frequently than observed indexes were diagnosis and treatment ability (G=16/4), surgical ability (G=17/7), clinical communication ability (G=12/5), non-clinical communication ability (G=19/7), organization and coordination ability (G=10/7) and scientific research ability (G=15/7). Within clinical technical competence, the larger gaps concerned treatment ability and surgical ability. First aid ability and theoretical knowledge were also recommended more frequently. Within clinical non-technical competence, the largest gap concerned clinical communication ability. Humanistic care and professional ethics also had more suggested frequency than observed frequency. For management ability the larger gaps concern organizing and coordinating. Two other indicators deserve attention because their frequency in the observed column is null, which is leadership (G=5) and having healthy sense of competition (G=6). Among other things, social influence and participation in academic organizations were suggested more frequently. (Table 3.5)

"Our current selection mainly considers objective conditions such as Professional title and years of service, and does not give much consideration to individuals' real abilities."

"The current system doesn't take into account things like communication and management, which are really important."

“Now the government is also paying more and more attention to the scientific research ability of doctors, and the scientific research level of hospitals accounts for a large proportion of hospital rankings”

Table 3.5 Comparative statistics

category	Indicators mentioned	Observed criteria	Recommended criteria	Gap (recommended – observed)
Clinical technical competence	Treatment ability	9(6)	25(10)	16(4)
	Surgical level	0	17(7)	17(7)
	First aid ability	0	4(4)	4(4)
	Theoretical knowledge	1(1)	3(3)	2(2)
	total	**10(6)**	**49(10)**	**39(4)**
Clinical non-technical competence	Clinical communication ability	2(2)	14(7)	12(5)
	Humanistic care	0	3(3)	3(3)
	Professional ethics	1(1)	6(5)	5(4)
	total	**3(3)**	**23(8)**	**20(5)**
Management ability	Organizing ability	0	10(7)	10(7)
	Coordinated ability	2(1)	11(5)	9(4)
	Leadership	0	5(5)	5(5)
	Cooperation ability	1(1)	3(3)	2(2)
	Healthy sense of competition	0	6(5)	6(5)
	total	**3(2)**	**35(10)**	**32(8)**
Interpersonal competence	Non-clinical communication ability	2(2)	21(9)	19(7)
	Ability to manage relationships	0	9(5)	9(5)
	total	**2(2)**	**30(9)**	**28(7)**
Teaching, research and learning ability	Scientific research ability	0	15(7)	15(7)
	Teaching ability	0	6(6)	6(6)
	Learning ability	0	8(7)	8(7)
	Innovation ability	0	1(1)	1(1)
	total	**0**	**30(9)**	**30(9)**
Personal traits	Extroversion	0	8(5)	8(5)
	Work attitude	2(2)	8(5)	6(3)
	Friendly	0	2(2)	2(2)
	Aspirant	0	3(3)	3(3)
	Mental endurance	0	2(1)	2(1)
	The right values	0	1(1)	1(1)
	Positive emotion	0	1(1)	1(1)
	Patient	0	3(2)	3(2)
	total	**2(2)**	**28(7)**	**26(5)**

category	Indicators mentioned	Observed criteria	Recommended criteria	Gap (recommended – observed)
Other conditions	Years of working	12 (8)	1 (1)	-11(-7)
	professional title	9 (9)	1 (1)	-8(-8)
	Academic Degree	4 (3)	1 (1)	-3 (-2)
	Superior recommendation	3 (3)	0	-3 (-3)
	Social relations	1(1)	0	-1(-1)
	Recognition of colleagues	4(3)	4(2)	0(-1)
	Social influence	0	1(1)	1(1)
	Participated in authoritative academic association	0	2(2)	2(2)
	A healthy body	0	4(4)	4(4)
	total	**33(10)**	**14(8)**	**-19(-2)**

3.1.6 Discussion and conclusion of Study 1a

In the interview of attending physicians, respondents had a comprehensive understanding of this occupation. They described the work content and responsibility of the attending physician from many aspects. The number of mentions of non-clinical work was almost the same as that of clinical work, indicating that in the eyes of respondents, the non-clinical responsibilities of attending physicians were equally important as the clinical work. In terms of clinical duties, almost all the participants agreed that treating diseases was the primary duty of attending physicians. In addition, six interviewees mentioned follow-up work, which was an important difference between attending physicians and ordinary doctors. In non-clinical work, patient management is the most important, which is also a central difference between attending physicians and ordinary doctors.

The current selection system of attending physicians is mostly characterized by its informal model, which goes counter to recommendations to guarantee objectivity and the equity that such systems must entail to promote their effectiveness in bringing the best possible applicants. What is discussed here is the expectation produced by relying on written or unwritten rules in the major selection system. Despite the possibility that such system has positive and negative features, most interviewees acknowledged that the current model is not really good into selecting the best attending physicians. It is necessary to further perfect or establish a new scientific and reasonable selection system.

The leading categories that emerged from recommended competency indicators highlighted a desired profile of an attending physician should match high competencies in clinical technique, clinical communication, management, and interpersonal relation. One of the reasons that explains this profile is that the attending physician is one of the attending group leader, which is the responsible for the distribution of the group work, for coordinating relationships, and mentoring of members in the group work. Scientific research ability was mentioned frequently (F=15, N=7), mainly because doctors in China need to have certain scientific research achievements to be qualified for promotion.

By comparing observed indicators with recommended indicators, we can infer the tacit judgment about the goodness of the current system. A positive gap suggests a determined indicator should be more valued and made central in the selection system while a negative gap indicates it is currently receiving too much importance and should be either diminished or removed from the selection criteria. The comparison between the observed indicators and the suggested indicators, we found that the main indicators mentioned more frequently than the

suggested indicators are professional title, working years, education background and whether there is a leader's recommendation, indicating that the non-competency conditions of candidates were too much emphasized in the past selection, and these indicators take a large proportion, which should be weakened in the future selection. On the other hand, diagnosis and treatment ability, surgical ability, clinical communication ability, non-clinical communication ability, organizational coordination ability and scientific research ability were mentioned more frequently than observed indexes. These indicators should play a more important role in actual selection. In addition, respondents believed that the selection of attending physicians should be based more on individual abilities rather than objective conditions.

3.2 Study 1b

As stated, this second qualitative study is intended to look for a consensus and more focused list of competencies. To the example of the previous study, we will start by sustaining why Delphi technique is suitable for our purposes and then proceed by showing the methodological aspects as well as findings.

3.2.1 The Delphi technique

The Delphi technique, essentially, is an anonymous inquiry and communication process, widely applied in research for the elicitation for opinions of experts (Brown, 1968). It has been used ever since, together with various modifications and applications in different disciplines. The Delphi is carried out by a series of sequential questionnaires in rounds (Powell, 2003) with several objectives, such as exploration of assumptions that leads to different judgements, collection of information that generates a consensus among respondents, and correlation of judgements on a topic over a wide range of disciplines (Turoff, 1970). The form of the Delphi is based on a principle, which is the decisions from a structured group of individuals are more accurate than those from unstructured groups (Rowe & Wright, 2001).

As mentioned above, the Delphi usually conducted in two or more rounds. According to the guidelines of Hasson (2000), there is usually an initial questionnaire collecting qualitative comments, serving as the foundation for quantitative sections. And given consideration to the quality of the research, a pilot study should precede with a small group of individual respondents. As for the identification of the experts, they should be “informed individuals” or people who are knowledgeable about the subject matter (Lemmer, 1998). Experts are usually people with certain experience and status in the research field. Consequently, when choosing

experts for the Delphi in any research, the researcher should provide a list of criteria for choosing candidates. Additionally, the analysis of the final findings from the Delphi vary in line with the purpose of it, types of tools and number of experts (Powell, 2003).

Besides the choice of experts, the numbers of rounds and the level of consensus among experts should also be decided before the execution of it. Researchers should follow percentages of answer consistency, but determining those percentages is still tricky, suggesting that the stability of the answers are more reliable indicators of consensus. Moreover, in every round of the inquiry process, researchers are able to collect anonymized answers from the experts as well as the reasons they provide such answers. Experts are also encouraged to revise their choices, as it is believed that during the whole process, the range of the answers will be confirmed and mutually agreed (Powell, 2003).

The Delphi has several characteristics, which are reflected from the principles of this research method. Firstly, anonymity of the experts involved. This prevents the influence of authority or personality of some respondents from dominating others. Secondly, iteration with regular feedbacks, i.e. the successive rounds to facilitate the consensus that is considered representative. Finally, the structuring of collecting feedbacks, with successive rounds to provide statistical summaries of the experts' answers (Belton et al., 2019; Goodman, 1987; McPherson et al., 2018; Nasa et al., 2021).

3.2.2 Applications of the Delphi in public healthcare management

The Delphi is becoming increasingly popular in healthcare research, and it has been extensively used for optimisation of management and decision-making. For instance, using Delphi method in nursing education and management (Wilkes, 2015). Then in 2018, a study (Janati et al., 2018)conducted a two-round Delphi survey to explore factors influencing evidence-based management in healthcare organizations so as to improve decision-making . And in 2020, the Delphi is also used in setting priorities for improving primary care access , with eight action-oriented priorities for improving access to primary care in a veteran health administration and other integrated healthcare delivery organizations (Rubenstein et al., 2020). For more previous studies related with healthcare management, the Delphi is in a research aiming to promote a positive work environment for healthcare professionals in hospitals (Maassen et al., 2021). A three-round Delphi study was carried out to establish elements defining positive work environment, and the experts included authors found in literature review, hospital board members, quality officers, HR managers, or head nurses.

Delphi method is a mature research method, which is widely used in many fields. Besides the use of the Delphi in general hospital management, there are also applications of it in building evaluation systems within hospitals and other healthcare organizations, such as a quality evaluation system of managing nurses in fever clinics (X. Yang et al., 2021), and family doctor performance evaluation system in China (Li et al., 2019). In terms of utilizing the Delphi in the evaluation of physicians, there are few research done, neither holistic nor sufficient. A research was done in 2017 exploring the efficiency of physician rating websites and indicators of evaluating good doctors (Rothenfluh & Schulz, 2017). And another one setting up standards for physicians' knowledge of and compliance with guidelines in cardiovascular department in hospitals (Karbach et al., 2011). In China, there is barely research adopting the Delphi method to set up evaluation system for physicians, besides one study in 2005, trying to construct a performance evaluation system for clinic physicians with the Delphi (Zheng et al., 2005).

From literature review of the use of Delphi in healthcare management, it can be concluded that so far, there is no research adopting the Delphi to explore the update of evaluation system for physicians, or more specifically, attending physicians in Chinese hospital after the medical reform.

3.2.3 Applications of the Delphi in building indicators

The most common research objective that could be achieved by the Delphi is to build an indicator or an evaluation system for an organization, especially in management and health care management. The Delphi technique has been widely used for quality-indicator development in healthcare (Boulkedid et al., 2011), for example, the identification of key performance indicators for hospital information systems (Hübner-Bloder & Ammenwerth, 2009), the building of quality indicators for in-hospital management of exacerbation of chronic diseases (Lodewijckx et al., 2013). In China, there are research on exploring the science and technology evaluation system of public hospitals in Shanghai (H. Liang et al., 2017), and research (S. W. Wu et al., 2017) on comprehensive evaluation index system of medical quality based on cross examination of hospital departments.

However, there are few researches adopting the Delphi to set up evaluation system for physicians in hospitals compared with that of the whole organization. In particular, there are few studies that adopt the Delphi method to establish an evaluation system for attending physicians. Delphi method is a mature research method at present. To conclude, it is of great significance to conduct research with utilizing the Delphi method covering a larger scope of

respondents to establish an evaluation system specifically for attending physicians in Chinese hospitals.

In addition to its application in general hospital management, Delphi technique is also widely used in building evaluation systems in hospitals and other medical institutions. In our study 1a, we have had an idea of the nature of the attending physician's work and have determined the basic framework of the attending physicians' competency evaluation index system through interviews supported also by literature review, and this study 1b preliminarily establishes the importance of each index through the Delphi technique.

3.2.4 Method

Research procedures and technical practice reports in Study 1b followed the Delphi research Guidelines of Niederberger and Spranger (2020). The guidelines develop high quality technical procedures and reporting guidelines based on Delphi research literature in the area of health. The guiding questions for the guide are: 1) how the questionnaire and entries for the Delphi study were developed; 2) Which Delphi variables are used; 3) What criteria are used to define and select experts; 4) How to contact experts; 5) Several rounds of Delphi; 6) What is the response rate of experts in the initial and each round; 7) How many experts will participate in each round; 8) How the results of the last round were fed back to each expert; 9) How to define and measure the agreement; 10) How much agreement Delphi finally reached.

3.2.4.1 Developing the questionnaire

Based on the interview results in the early stage, the first Round of Delphi Questionnaire for The Evaluation Indicator System of Attending Physicians' Competence was developed. The questionnaire included 42 items in total, including seven first-level indicators and 35 second-level indicators. The questionnaire includes an expert information table, a first-level indicator importance scoring table, and a second-level indicator importance scoring table. Experts were asked to rate importance on five levels: "1= very unimportant, 2= relatively unimportant, 3= average, 4= relatively important, and 5= very important." In order to help the experts to understand accurately, the questionnaire explains each indicator item.

3.2.4.2 Eligibility criteria

In order to ensure the authoritativeness of Delphi research experts, this study proposed higher-level screening criteria for the invited experts, requiring that the experts participating in the Delphi survey should be senior experts in the management field of domestic attending

physicians or the attending physicians with long working years. They must have authority and experience in the field of attending physicians or hospital management, so that they can make more authoritative suggestions.

Eligibility criteria for invitation are, cumulatively, the following: 1. Sub-senior title or above; 2. More than 10 years of working experience related to this research topic; and 3. Master degree or above. Overall, the sample should be diversified as regards expert background (i.e. domain of specialization).

3.2.4.3 Expert panel

A total of 20 senior experts in the field of attending physicians were invited. The identification of those experts originated from the professional network of the researcher. The list of experts remained unchanged in two rounds. All the experts who participated in the first round of Delphi participated in the second round, including 14 males and six females. The mean age of the experts was 44.2 (±6.4) years old. Among the experts, seven have senior professional titles and 11 have deputy senior professional titles; Among the experts, they are all highly educated, eleven have master's degrees and nine have doctorate degrees. All the experts have more than 10 years of working experience and are familiar with the field of attending physician or hospital management, and 10 experts have more than 15 years of working experience.

From the 20 experts, nine are attending physicians; eight have hospital managerial functions, two are scholars, and one is a senior consultant in the medical consulting industry. For the attending physicians, the panel’s background is diverse as two experts work in oncology, two in Traditional Chinese Medicine, three in surgical, one in gynecology and one in pediatrics. Hospital managers have managerial responsibilities in third tier central hospitals, coming from eight different hospitals located in different provinces in China, and five of them have clinical practice experience. Scholars worked in two large distinct universities, in prestige medical schools. The expert consultant has an academic background and holds senior functions in a prestige medical corporation in China for over 15 years and has had higher expertise responsibilities in HR management in top level hospitals in China. (Table 3.6)

Table 3.6 Basic information of Delphi consulting expert

Index	Statistics
gender	
Male	14
Female	6
Age	44.2±6.4
Professional title	
Senior	7
Sub-Senior	11
Intermediate	2
Academic Degree	
Doctor	9
Master	11
Years of relevant work	
10-14 years	10
≥15 years	10
Familiarity with the subject of the questionnaire	
Familiar	11
Very familiar	9
Expertise background	
Clinical expertise	9
Managerial expertise	5
Mixed clinical and managerial	6
Regional distribution	
Shan Dong province	12
Bei Jing	3
Si Chuan province	2
Chong Qing	1
Fu Jian province	1
Hu Bei province	1

3.2.4.4 Data collection

As stated, in this study, a Delphi questionnaire was distributed online to each expert through Wechat and Questionnaire Star app, and experts were invited to score the importance of each indicator. The first round was deployed in the first week of November 2021 and all 20 invitees participated. The second round was deployed in the last week of November 2021 and the response rate was 100%.

The scoring results were statistically analyzed, and the overall situation of the first round of scoring was fed back to each expert. In the next round, specific questionnaires were formulated according to whether the score of an index of each expert was within the overall score range, and questionnaires were issued again until the scores of all experts were relatively concentrated. If the indicators scored by the experts in the first round are within the overall range, the experts will also be informed.

3.2.4.5 Consensus calculation

The study adopts the mean ±one standard deviation to reflect the concentration of expert scores for each indicator. The expert scores within the range of mean ±standard deviation (rounded) were considered to fall within the overall scoring range. These items were not included in the inquiry conducted to experts in the second round.

Consensus can be calculated based on multiple indices. Amongst the indices used to judge on interrater agreement it is important to identify the suitable index for the levels of measurement of the scale. For ordinal level data, which this study uses, Intraclass Correlation Coefficient (ICC) and Kendall's W are the suitable ones (Gisev et al., 2013) and adding to ICC we opted also to report on Kendall's W due to its simplicity and because it is the most popular (Schmidt, 1997). Kendall's W is calculated based on the sum-of-squares formula (formula 3.1-3.3) where Ri stands for the row sums and n is the number of objects. There is a need to correct for rank ties based on formula 2 where m stands for the number of groups, and k stands for the number of tied ranks. Kendall's W is calculated based on formula 3 where S stands for the sum-of-squares where n is the number of objects judged by p raters and corrected for tied ranks (T).

$$S' = \sum_{i=1}^{n} R_i^2 = SSR \quad \text{.....(3.1)}$$

$$T = \sum_{k=1}^{m} (t_k^3 - t_k) \quad \text{.....(3.2)}$$

$$W = \frac{12S}{p^2(n^3 - n) - pT} \quad \text{.....(3.3)}$$

ICC is calculated based on a formula (Formula 3.4) that considers the Average Mean Squares Between Subjects (MSBS), the Mean Square Error (MSE) for the k observations (Liljequist et al., 2019).

$$ICC(C,1) = \frac{MSBS - MSE}{MSBS + (k-1)MSE} \quad \text{.....(3.4)}$$

ICC is one of the reliability coefficients used to measure and evaluate inter-observer and test-retest reliability. The options made as regards the type of ICC calculation were the following: 1) we adopted a two-way mixed model because we have 20 fixed raters (experts) and each competency is rated by the 20 experts, 2) we calculated absolute agreement because

we are interested in assessing convergence including systematic error and random residual errors by computing the convergence between each expert rating and the average of the evaluation of the 20 raters.

3.2.5 Results

In the first round of consultation, “clinical technical ability” (4.90) and “management ability” (4.55) received the highest score means for the importance of first-level indicators. Clinical non-technical competence (4.15), interpersonal competence (4.05) and personal traits (4.05) had lower scores. The lowest scores were “other conditions” (3.55) and “Teaching, learning and research ability” (3.95). Among the secondary indexes, the highest importance score was “treatment ability” (4.95), “Surgical ability” (4.75) and “first aid ability” (4.70). The lowest scores were “Social network” (2.45), “Participated in authoritative academic association” (3.00), and “Superior recommendation” (3.15). In clinical technical competence, the scores of treatment ability and surgical ability were the highest, but the scores of first-aid ability and theoretical knowledge were not high. The score of clinical non-technical competence is not high, but the score of clinical communication ability, humanistic care and professional ethics is higher than that of clinical non-technical ability. In personal traits, work attitude has a high score (4.75). In other conditions, recognition of colleagues (4.05) and a healthy body (4.20) have a high score.

The overall distribution interval of each indicator was rounded to mean ±standard deviation. In the first round, there were 13 experts (65%) whose scores were not in the overall range, and there were 48 scores (5.71%) of 24 index items (57%) outside the range. Among them, “social network” has the greatest degree of dispersion, with a total of six experts deviating. Four experts rated extraversion outside the range. According to the first round of consistency tests, Kendall's coefficient of concordance (Kendall's W) = 0.455, $p<0.001$, Intra-class correlation coefficient (ICC) = 0.871, $p<0.001$.

In the second round of Delphi consultation, the highest scores of first-level indicators were “clinical technical ability” (5.00) and “management ability” (4.55). Clinical non-technical competence (4.25), interpersonal competence (4.05) and personal traits (4.05) had lower scores. The lowest scores were “Other conditions” (3.50) and “Teaching, learning and research ability” (4.00). Among the subcategory, the highest score was “treatment ability” (5.00), “Surgical ability” (4.80) and “first aid ability” (4.75). The lowest ratings for importance were "social network" (2.70), “Participated in authoritative academic association” (3.10) and “Superior recommendation” (3.15). In clinical technical competence, the scores of treatment ability and surgical ability were the highest, but the scores of first-aid ability and theoretical knowledge

were not high. The score of clinical non-technical competence is not high, but the score of clinical communication ability, humanistic care and professional ethics is higher than that of clinical non-technical ability. In personal traits, work attitude has a high score (4.75). In other conditions, recognition of colleagues (4.05) and a healthy body (4.25) have a high score.

The overall distribution range of each indicator was rounded to mean ± standard deviation, and the scores of all experts in the second round of consultation were all within the overall range. The results of the second round of consistency test showed that Kendall W=0.547, $p<0.001$; ICC was 0.853, $p<0.001$.

The Results are shown in Figure 3.1 and 3.2, and Table 3.7.

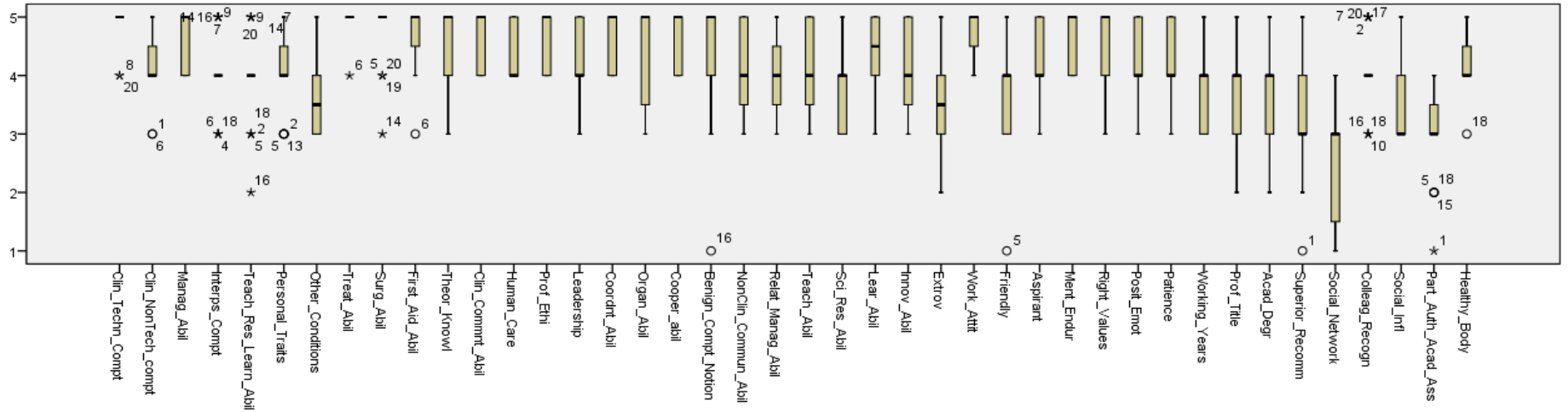

Figure 3.1 Box diagram of 1st round Delphi results

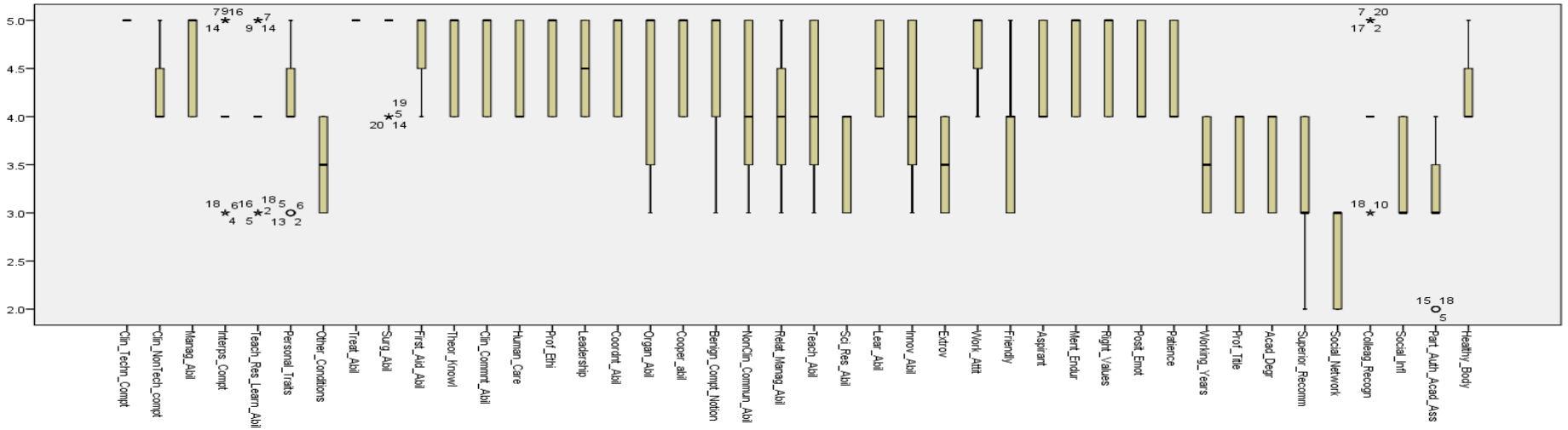

Figure 3.2 Box diagram of 2nd round Delphi results

Table 3.7 Statistical results of two rounds of Delphi expert consultation

Indicator level	indicator	1st round (k=20)		2nd round (k=20)	
		average	rank	average	rank
Clinical technical competence		**4.90**	**32.70**	**5.00**	**34.70**
	Diagnosis and Treatment ability	4.95	33.73	5.00	34.70
	Surgical level	4.75	30.80	4.80	31.28
	First aid ability	4.70	29.65	4.75	30.50
	Theoretical knowledge	4.50	26.83	4.55	27.48
Clinical non-technical competence		**4.15**	**20.88**	**4.25**	**22.23**
	Clinical communication ability	4.65	28.78	4.65	28.83
	Humanistic care	4.40	24.83	4.40	24.78
	Professional ethics	4.65	29.18	4.65	29.20
Management ability		**4.55**	**27.63**	**4.55**	**27.53**
	Leadership	4.40	25.50	4.50	26.58
	Coordinated ability	4.60	25.15	4.60	28.60
	Organizing ability	4.35	29.33	4.35	24.83
	Cooperation ability	4.65	24.93	4.65	29.30
	Notion of benign competition	4.30	19.40	4.45	25.78
Interpersonal competence		**4.05**	**19.05**	**4.05**	**18.90**
	Non-clinical communication ability	4.05	18.73	4.05	19.18
	Ability to manage relationships	4.00	21.03	4.00	18.43
Teaching, research and learning ability		**3.95**	**18.45**	**4.00**	**18.45**
	Teaching ability	4.10	15.80	4.10	20.73
	Scientific research ability	3.80	24.53	3.65	12.73
	Learning ability	4.40	19.60	4.50	26.28
	Innovation ability	4.05	12.95	4.05	19.18
Personal traits		**4.05**	**19.50**	**4.05**	**19.20**
	Extroversion	3.60	30.35	3.50	10.13
	Work attitude	4.75	16.52	4.75	30.43
	Friendly	3.80	22.10	3.90	16.65
	Aspirant	4.20	29.55	4.30	23.35
	Mental endurance	4.65	26.78	4.65	29.45
	Right values	4.50	24.15	4.60	28.38
	Positive emotion	4.30	23.50	4.45	26.03
	Patience	4.30	13.28	4.35	24.18
Other conditions		**3.55**	**11.95**	**3.50**	**10.58**
	Years of working	3.65	11.58	3.50	10.80

Indicator level	indicator	1st round (k=20)		2nd round (k=20)	
		average	rank	average	rank
	Professional title	3.50	12.70	3.55	11.13
	Academic Degree	3.55	9.23	3.60	12.08
	Superior recommendation	3.15	3.48	3.15	8.15
	Social network	2.45	19.88	2.70	3.28
	Recognition of colleagues	4.05	11.48	4.05	19.55
	Social influence	3.50	7.30	3.45	10.10
	Participated in authoritative academic association	3.00	21.60	3.10	7.18
	A healthy body	4.20	28.70	4.25	22.28
Kendall's coefficient of concordance (W)		0.455	$p<0.001$	0.547	$p<0.001$
ICC		0.871	$p<0.001$	0.853	$p<0.001$

3.2.6 Discussion and Conclusion of study 1b

The study was designed to identify, from amongst a set of 42 competencies intended to depict the profile of attending physicians, which ones gather consensus as to its importance in the competency profile. No experts quit in the two rounds of Delphi consultation, and the expert response rate was 100%, indicating that the experts in this Delphi consultation study were highly motivated. According to the study of Gisev (2013), the consistency test indexes of suitable grade data are Kendall's W and ICC. The results of this study showed that Kendall's W=0.455 (p<0.001) and ICC=0.871 p<0.001) of the first Round of Delphi method, but there was a phenomenon that the index was of large dispersion and not in the overall interval, indicating that experts had different views on the importance of this index, so the second round of Delphi survey was conducted. The results of the second round of consistency test showed that Kendall's W=0.547 (p<0.001) and ICC=0.853 (p<0.001), and all indicators were within the overall range. According to Lilhequist's (2019) study, ICC >0.8 indicated high internal consistency of this study. Expert opinion converged after two rounds.

The Delphi expert panel was designed to comprehend diverse profiles of experts. Thus, we have included two experts who have not reached senior professional titles, but have more than 10 years of working experience in research related fields, and have a deep understanding of the field of attending physicians. In addition, all the experts had master's degree or above and a senior professional title, as well as a high degree of familiarity with the field. The set of 20 experts have a profile that makes it difficult to put together and so, we consider this a highly authoritative and professional representative panel, thus offering reliability on the ensuing Delphi findings. Eventually and indication on this was the relative ease with which consensus was found in the Delphi rounds, as well as the high degree of internal consistency.

After two rounds of Delphi expert consultation, in the category of indicators, the highest score was given to “Clinical technical competence” (5.00) with all the experts opting to signal the maximum rating in the scale. Among the subcategory indicators, the highest scores were “treatment ability” (5.00), “surgical ability” (4.80), and “first-aid ability” (4.75). These three indicators all belong to clinical technical ability, and correspond to the results of first-level indicators. The attending physician shall be responsible for a series of medical services such as outpatient service, hospitalization, operation, consultation and follow-up after discharge, as well as the formulation and treatment of diagnosis and treatment decisions for difficult and critical cases in the group (Han, 2018). Therefore, although the ability system of the attending

physician includes all aspects of ability, the clinical technical ability, especially the diagnosis and treatment ability, is still the core ability of an attending physician (Donabedian, 2000).

In diagnosis and treatment ability, surgical ability and first-aid ability become important dimensions to distinguish the level of attending physicians. The level of critical, difficult and major surgery of the patients in the group mainly depends on the surgical ability of the attending physician, which is an important basis for patients to choose the main treatment group. The attending physician must have excellent surgical ability to attract patients into the group and create performance. In the emergency department, the attending physician should be able to respond quickly, carry out first aid, stabilize the patient's condition, and prevent death (Joseph et al., 2018).

In the first level indicators, the importance of management ability (4.55) is second only to clinical technical competence. In the second level indicators, the leadership (4.50), coordinated ability (4.60) and cooperation ability subordinate to management ability (4.65) the importance score exceeds 4.5. The attending physician is the direct manager of the primary treatment group, and shall be responsible for the medical business management within the primary treatment group (Lee, 2010), assess the business technology of the personnel in the group and distribute the performance salary, coordinate and solve the work conflicts among the members of the group, and make the members better cooperate. The attending physician reasonably schedules and distributes human, material and other resources according to the work tasks (Majmudar et al., 2010). In the hospitals interviewed in our study 1, attending physicians were seen as an important reserve talent for the discipline leader and department management of the hospital. The management ability will determine the overall level and harmony level of the attending group. Management skills are an important part of medical education (Myers & Pronovost, 2017).

Clinical non-technical competence refers to the ability that does not belong to medical specialty in the process of clinical diagnosis and treatment, such as clinical communication ability, humanistic care for patients in the process of diagnosis and treatment (Branch Jr et al., 2001), and the ability of medical workers to follow and adhere to professional ethics in medical practice. In the two rounds of Delphi research, the importance of clinical non-technical competence was scored as 4.25, especially the clinical communication ability, which can help the attending physician accurately collect as much disease-related information as possible and correctly diagnose the disease, so as to better treat the disease (Kurtz et al., 2017). Good clinical communication ability can also establish a good medical environment of mutual trust and

mutual support, harmonize the doctor-patient relationship and reduce medical disputes through effective communication between medical workers and patients (Turabian, 2019).

The importance of interpersonal competence was scored as 4.05, with the secondary indicators of “Interpersonal competence”, “Ability to manage relationships” (4.00) and “non-clinical communication ability” (4.05) the importance score is close. In daily work, the attending physician should not only face the patients and carry out clinical diagnosis and treatment activities, but also keep up with the lower level and the same level, report work at any time, convey the hospital requirements to the lower level, and establish a good cooperation mechanism with other departments. For example, in the process of patient referral, non-clinical communication ability will become an important factor affecting the handover effect (Solet et al., 2005). Therefore, interpersonal communication ability is also an important competency of the attending physician which goes in line with.

The importance of teaching, research and learning ability is scored as 4.00. In the secondary indicators, the highest importance score is learning ability (4.50), and the lowest is scientific research ability (3.65). Medicine is a rapidly developing science. With the deepening of people's understanding of diseases, it is very important to understand the technical development of disease action mechanism, molecular and gene levels. At the same time, relevant disease indicators and clinical pathway treatment methods are gradually changing with the progress of technology. Therefore, only with a certain learning ability can we master the latest medical diagnosis and treatment methods that keep up with the development of medicine (Afonso et al., 2014; Ding et al., 2019). The importance of scientific research ability scored the lowest, only 3.65. The attending physician shall be responsible for the scientific research work within the diagnosis and treatment group, determine the professional main direction, select and apply for the project of scientific research and research direction, and be responsible for the development and application of new technologies and new projects. Clinical scientific research work plays an extremely important role. Scientific research atmosphere and scientific research achievements are the most important measure to distinguish the high quality and competitiveness of hospitals, and they are also the key indicators to evaluate the level of doctors. However, at present, in most non-top hospitals, it is generally believed that the main job of doctors is to treat patients and save people, and scientific research is the responsibility of full-time researchers (Zhao et al., 2020). The importance of teaching ability was rated at 4.10. The attending physician group is responsible for diagnosis and treatment of teaching and personnel training work, be responsible for the guidance of junior doctors business technology, help physicians improve the level of professional knowledge and clinical working ability at a lower

level, take an active part in continuing education, completed residency training and gain, intern teaching tasks, guide the medical behavior or criticism (Menachery et al., 2008).

The importance score of personal traits is 4.05. Personality, awareness, attitude and other individual dispositional traits are the implicit parts of the competency iceberg model and are extremely important in the competency model. Among them, work attitude (4.75) is considered to be the most important expressing the evaluation and behavior tendency of work, including seriousness, responsibility, effort (Cook & Wall, 1980). Everyone's subconscious and usual cognition will determine their attitude towards work. A good working attitude includes being serious and responsible, rigorous and meticulous, abiding by rules and regulations, being loyal to their duties. An excellent attending physician should have a serious and responsible working attitude (McManus et al., 2004). An agreeable personality can favor medical treatment, lower the distance between students and patients, contribute to better doctor-patient communication. The attending physician's work pressure is higher than that of ordinary doctors. He is mainly responsible for the medical quality and safety management of patients in the group. He should also frequently deal with the doctor-patient relationship that the family members are not satisfied with the diagnosis and treatment of patients. Therefore, he or she should have good psychological tolerance and good mentality (Yates, 2020).

Among the competencies and characteristics that scored the least, one finds “Social network” (2.70), “Participated in authoritative academic association” (3.10), and “Superior recommendation” (3.15). The importance of professional tenure, expressed as working years (3.50), and technical titles (3.55), which are valued in traditional selection criteria, were also rated lower, which shows that the conditions emphasized in the past selection basis cannot really effectively screen out high-quality attending physicians.

Overall, the list of competencies and characteristics of a highly performant attending physician, organizes around five families (technical clinical; technical non-clinical, management, interpersonal, and technical/researching/learning) and two of a dispositional nature (personality) and personal characteristics. This list gathered much consensus, which indicates its production in the first study was sound. The list also shows that the most central competency families (rated higher than 4.5) are clinical technical and management, followed by all the others rated moderately high (between 4.0 to 4.5) and the personal conditions being the only ones rated below 4. It may strike as a surprise to see management competency rated above clinical non-technical competence (communication with patient, professional ethics) but this only shows the importance of healthcare management to the provision of high quality and effective healthcare services. It is worth noticing that among the competencies listed, in the

second-level indicators, it is the research ability that received the lowest rating, being the only one that averages below 4.

Chapter 4: Study 2 Towards A Competency Evaluation Index for Attending Physicians

4.1 Introduction

Human resource is a special resource that can promote and optimize the allocation of various resources, and is also the primary resource of an organization (Huselid, 1995). With the continuous development of science and technology and the continuous improvement of knowledge and skills, human resources contribute more and more to value creation, and social and economic development relies more and more heavily on human resources. As the main body and core competitiveness of hospital medical service, medical staff is an important and special human resource of hospital (L. Chen et al., 2004).

The attending physician is the leader of the attending physician group in the system of attending in charge. The system of attending in charge is also known as the medical leader responsibility system. It is a new clinical medical management mode in which the main diagnosis group composed of different levels of medical staff acts as an independent unit, and the main diagnosis group is fully responsible for and carries out a series of work such as patient diagnosis, treatment, teaching and scientific research (S. W. Wu et al., 2022). The complexity of the tasks and requirements of attending physicians is increasing due to changes in policies and societal demands. In addition to the medical knowledge and skills learned in school, attending physician also need to master new non-clinical tasks and roles (Westerman et al., 2010). Such as being responsible for the teaching of junior physicians, or leading the main diagnosis group to determine the direction of scientific research, having scientific research achievements and completing scientific research tasks and other scientific research work. At the same time, as the leader of the main group, the attending physician is the direct manager of the main group and has certain management responsibilities.

It is an important issue in the development and management of human resources in hospitals how to select talents scientifically, and how to use high-quality talents to win a place and stand out in the fierce competition in the medical field.

4.1.1 Conjoint analysis

Conjoint analysis is a multivariate statistical analysis method, a measurement technique that quantifies the trade-offs and values of respondents, which can be used to predict buyers' likely reactions to new products/services, identify consumer groups with similar trade-offs/values, and seek product/service profiles to maximize returns (Rao, 2014). Statistical experimental design and parameter estimation are used in this method.

The foundation of conjoint analysis goes back at least to the 1920s. But Luce and Tukey's (1964) seminal paper on the theory of conjoint measurement is generally considered to have formed the foundation of the field of applied conjoint analysis. The development of this field is largely due to the popularity of algorithms for related computation. Conjoint analysis was introduced in 1971 to conduct market research (Green & Rao, 1971). This method can effectively help researchers make correct marketing decisions, such as optimal design of new products, target market selection, new product pricing and consumer choice preference. The conjoint analysis method simulates products with different attribute levels and asks consumers to choose or evaluate their importance. When making a choice, consumers usually weigh among the attributes of products or services, so researchers can collect a large number of respondents' selection results and determine which combination of attributes has the most influence on respondents' choice or decision. The significant advantage of the conjoint analysis method is that it can simulate real products concretively and enable respondents to make judgments, estimate the psychological measures made by respondents when evaluating multiple attributes, and reveal the real or hidden psychological biases, which may not be obvious to respondents themselves.

4.1.2 The applications in health and human resources

Since its inception, conjoint analysis method has been widely used in market research projects, such as optimal design of new products, target market selection, new product pricing and consumer choice preference. These applications include a durable consumer goods, carpet cleaner, lawn chemical (soap), industrial products (copy machine, a portable computer terminal, personal computer design), and other products (car battery, ethical drugs, pesticides), financial services (the branch of the services, car insurance policy, credit card function), transportation (domestic airlines, the electric car design), and other services (hotel design, car rental agency, telephone pricing) (Rao, 2014). This method has helped researchers to solve many kinds of decision problems successfully. Brand and Ruasch (2021) applied the joint analysis method to

explore the compensation effect between consumers' environmental protection and willingness to pay when buying clothes. Ong (2021) used joint analysis to determine the optimal combination of milk tea attributes. This study teased out various attributes such as tapioca pearl size, sugar content, price range, brand, type of milk tea, cream cheese content and ice content.

In addition to making decisions in marketing, economics, electric utilities, energy conservation, transportation and food safety, conjoint analysis is widely used in the health industry and human resources. Conjoint analysis is a useful tool for investigating patients' preferences for treatment of osteoarthritis. Al-Omari (2021) conducted a systematic review aimed at identifying, summarizing, and evaluating the methodological quality of evidence for quantifying patient preferences for treatment of osteoarthritis using combined analytic techniques. It also identifies common approaches and methods and attributes considered to be important in triggering a patient's preference for osteoarthritis treatment. Motta (2021) used conjoint analysis to investigate a representative sample (N = 990) to assess how characteristics of COVID-19 vaccines (e.g., country of manufacture, efficacy, risk of side effects) affect vaccination willingness among US adults.

Conjoint analysis can be used to screen talent and determine which of the respondents' abilities are preferred by the judges. Markham (1999) studied various aspects of patient-physician interaction during medical care, and in this study, conjoint analysis was used to determine the relative importance of these factors to patients. This is expected to help patients and physicians maximize patient satisfaction while minimizing costs. The results found that doctors' perceptual skills were the most important factor, and waiting time at the office was the least important. Biesma (2007) studied employers' perceptions of the relative importance of general and domain specific competencies of public health graduates in the Netherlands. The study used a choice-based conjoint analysis to ask employers to select candidates with different skill levels. The results showed that for master's graduates entering the field of public health, employers valued general competence more than field-specific competence. Ruetzler (2012) examined seven attributes of personal grooming related to interview, including overall physical attractiveness, neatness and grooming, clothing color, conservative versus fashionable clothing, professional versus casual clothing, and body grooming. The simulations were combined into 16 full-color photos so that raters could see clothing color, clothing conservatism and professional attire. The study asked students, faculty and hospitality industry professionals to rank them. Through conjoint analysis, grooming and professional attire were found to be the most important attributes in shaping good perceptions. Ruetzler (2014) again used the conjoint analysis method to compare the importance of technical skills required for successful

management in the hotel industry. The authors identified seven key technical skills: academic achievement (using grade point average as a substitute), social networking, time management, strategic planning, spreadsheet acuity, and written and verbal communication. Eighteen hypothetical student job seekers were simulated through a combination of seven abilities at different levels, written on cards, and 98 respondents were asked to rank the 18 candidates to rate their student characteristics. It is found that teachers attach less importance to applicants' spreadsheet ability and social networking ability than professionals, while teachers attach more importance to applicants' oral expression ability than professionals and students. Popović (2012) used co-analysis to determine employers' preferences for key competencies for corporate executive positions to inform potential candidates about the expectations of various recruiters and to help university faculty design their courses. In a study on graduate recruitment, Mariani (2019) simulated recent graduates with different abilities. Based on the partial value utility of joint analysis, this study used conjoint analysis to determine the resume characteristics of the graduates, and asked the company to select their preferences among the simulated recent graduates.

4.1.3 Summary

Human resource is a special resource that can promote and optimize the allocation of various resources. It is of great significance to construct a human resource management evaluation system that can be used to scientifically select talents within an organization and conform to the characteristics of the organization itself. As the main body and core competitiveness of hospital medical service, medical staff is an important and special human resource of hospital. Conjoint analysis is a multivariate statistical analysis method, which can determine which attribute has the most influence on interviewees' choice or decision. It is generally used for quantitative research on consumers' choice or importance evaluation of products with different attributes. The conjoint analysis method can estimate the psychological measures made by the respondents when evaluating multiple attributes, and reveal the real or hidden psychological biases, which may not be obvious to the respondents themselves. The research fully proves that the conjoint analysis method can be effectively applied to human resource management, screening talents, determining the relative importance of these abilities to candidates, and which abilities of candidates are preferred by judges. In study 2, the relative importance of each indicator was determined by using conjoint analysis method based on the competency indicator system framework of attending physicians determined in the previous study.

4.2 Methods

4.2.1 Questionnaire design

The survey questionnaire is divided into two parts. The first part asks for personal information part, including the age, gender, major, education background, professional title, working years, unit category; the second part is the main part of the questionnaire. In the second part of the questionnaire a brief table with descriptions of high vs. low level of competency was provided asking participants to make decisions for each one as regards their rank preference from the 1st preferred to the last one. The Annex G shows eight profiles of potential attending physicians.

These eight profiles resulted from an orthoplan generation in SPSS based on the 7 competency + attributes described and presented as being high or low. Each simulated attending physician has different ability combinations. For example, some people have higher clinical skills and personal characteristics but lower other abilities, while another person has lower clinical skills and higher interpersonal skills. When faced with this table, which was preceded by a very brief description of each competency/attribute (see Annex G). The requested decision varied according to the status of the respondent. For respondents that have managerial functions we asked to rate each profile (1-10) according to their preferences for hiring. To those that are patients, we asked to rate according to their preference for choosing a specific doctor for themselves. To those that are attending physicians, we asked to rate according to their preference for evaluating as peers. To those that had scholar functions, we asked to rate according to their expected level of competence. To those that were possible subordinates we asked to rate according to their preference for following as a leader. All ratings were made in a 1 (extreme unwillingness to hire / to choose / to be competent / to follow) to 10 (extreme high).

The questionnaire survey mainly takes Shandong as an example, and other regions in the country as a reference to study and evaluate the influencing factors of the competence of attending physicians. Unit category hospital management researchers and others we targeted. The questionnaire was designed through the Wenjuanxing platform, and the questionnaire was distributed to the respondents via WeChat. We surveyed all five categories mentioned above, including scholars, administrators, attending physicians, group members, and patients. A total of 450 questionnaires were distributed in this survey, of which 406 valid questionnaires were recovered thus matching a 90.2% response rate. The specific design of the questionnaire is shown in Annex G.

4.2.2 Survey questionnaire personal information data overview

Among the 406 valid questionnaires, 7.14% were aged ≤30, 44.58% were aged 31-40, 35.96% were aged 41-50, 12.32% were aged ≥51, and those aged 31-40 filled out the questionnaire The number of personnel is the largest; in terms of gender, men account for 41.63%, women account for 58.37%, and the proportion of women is higher than that of men; in terms of regions, Linyi City, Shandong Province accounted for 31.53%, and other cities in Shandong Province accounted for 58.37%, Outside Shandong Province accounted for 10.10%, and the survey area was mainly concentrated in Shandong Province. Linyi City was the most important area for filling out the questionnaire in Shandong Province. At the same time, the scope of the survey covered other cities across the country, which ensured the validity of the data source; in terms of education, junior college and below accounted for Compared with 0.74%, undergraduate students accounted for 49.51%, master students accounted for 44.33%, doctoral students accounted for 5.42%, undergraduate and master students accounted for a higher proportion; in terms of professional title level, positive senior accounted for 7.88%,

Among the 406 valid questionnaires, deputy senior accounted for 34.98%, intermediate accounted for 47.29%, junior accounted for 7.88%, other accounted for 1.97%, intermediate and vice senior accounted for a higher proportion; in terms of working years, 0-5 years accounted for 9.11%, 6-10 years Accounting for 21.18%, accounting for 19.70% in 11-15 years, accounting for 50.00% in ≥ 16 years, and the proportion of working years ≥ 16 years is relatively high; in terms of unit types, 80.79% of top three hospitals, non-tertiary hospitals accounted for 10.34%, Colleges and universities accounted for 3.69%, research institutions accounted for 2.71%, others accounted for 2.46%, and third-class hospitals accounted for a higher proportion; in terms of Identity, researchers in the field of hospital management accounted for 13.30%, attending physicians accounted for 24.14%, hospital managers accounted for 23.15%, members of the attending group accounted for 20.94%, and others (patients) accounted for 18.47%. Except for the small proportion of researchers in the field of hospital management, other Identity were evenly distributed. For details, see Table 4.1.

Table 4.1 Statistical table of basic personal information in the questionnaire

Base variable	Category	Quantity	Proportion
Age	≤30 years old	29	7.14%
	31-40 years old	181	44.58%
	41-50 years old	146	35.96%
	≥51 years old	50	12.32%
Gender	Male	169	41.63%
	Female	237	58.37%
Area	Shandong Linyi	128	31.53%
	Shandong other	237	58.37%
	Outside Shandong Prov.	41	10.10%
Education	Specialist and below	3	0.74%
	Undergraduate	201	49.51%
	Postgraduate	180	44.33%
	PhD student	22	5.42%
Title level	Senior	32	7.88%
	Deputy Senior	142	34.98%
	Intermediate	192	47.29%
	Primary	32	7.88%
	Other	8	1.97%
Working years	0-5 years	37	9.11%
	6-10 years	86	21.18%
	11-15 years	80	19.70%
	≥16 years	203	50.00%
Unit Type	Tertiary hospital	328	80.79%
	Non-tertiary hospitals	42	10.34%
	College	15	3.69%
	Research institute	11	2.71%
	Other	10	2.46%
	Scholars	54	13.30%
	Attending physician	98	24.14%
Identity	Hospital managers	94	23.15%
	Team members	85	20.94%
	Other	75	18.47%

4.2.3 Statistical analysis

A total of 406 questionnaires were collected in this study, In addition, 87 department directors assigned weight to the secondary indicators. SPSS 28.0 was used for conjoint analysis. The collected survey data were collated and then analyzed jointly. This research selects the File-New-Syntax module in the SPSS 28.0 statistical analysis software to analyze the data, and its programming commands are shown in Annex H. Among them, "111.sav" is the orthogonal design generation file, and "222.sav" is the database generated by the 406 questionnaire data after sorting and inputting into the software. "SCORE=x1 to x8" represents the score from the 1st question to the 8th question. We used the conjoint analysis method to determine the weight of the first-level indicators, but because there were too many second-level indicators, it was

difficult to determine the weight through the conjoint analysis method. We used a questionnaire survey and asked the department director to assign the weight of the second-level indicators.

4.3 Results

4.3.1 Analysis of overall attribute survey results

According to the importance value, for the whole sample, the importance of each attribute to the evaluation preference of the attending physician's ability is: Clinical technical competency (33.1%), Clinical nontechnical competencies (13.5%), Teaching, learning and research competency (11.5%) %), Interpersonal competency (11%), Management competency (10.9%), Personal traits (10.1%), Other conditions (9.7%); the importance of clinical technical competency preference far exceeds other preference abilities. The correlation coefficient between the measured preference and estimated preference of the model is 1, and the Kendall rank correlation coefficient is 1. See Table 4.2 for details. In Teaching, learning and research competency, the order of preference is learning ability, teaching ability, and scientific research ability. See Table 4.3 for details.

Table 4.2 Overall attribute conjoint analysis preference importance value table

Attributes	Importance value	Pearson's R		Kendall's tau	
		Value	Sig.	Value	Sig.
Clinical technical competency	33.098				
Clinical nontechnical competencies	13.540				
Management competency	10.962				
Interpersonal competency	11.045	1.000	＜0.001	1.000	＜0.001
Teaching, learning and research competency	11.497				
Personal traits	10.138				
Other conditions	9.721				

Table 4.3 Importance distribution of Teaching, learning and research competency

Teaching, learning and research competency		**Frequency**	**Percentage**
Learning ability	Very important	306	75.4
	Important	50	12.3
	Averagely important	50	12.3
Teaching ability	Very important	73	18.0
	Important	215	53.0
	Averagely important	118	29.1
	Very important	27	6.7
Research ability	Important	141	34.7
	Averagely important	238	58.6

For the overall sample, the most popular physicians were the attending physicians with high Clinical technical competency, high Clinical nontechnical competencies, high Teaching,

learning and research competency, high Management competency, high Interpersonal competency, high Personal traits, and high Other conditions. In addition to Clinical technical competency, there are certain requirements for Clinical nontechnical competencies, Teaching, learning and research competency, and Management competency. See Table 4.4 for details.

Table 4.4 Overall attribute conjoint analysis and evaluation table

Attributes	**Level**	**Utility Estimation**
Clinical technical competency	High	1.631
	Low	-1.631
Clinical nontechnical competencies	High	0.638
	Low	-0.638
Management competency	High	0.47
	Low	-0.47
Interpersonal competency	High	0.461
	Low	-0.461
Teaching, learning and research competency	High	0.499
	Low	-0.499
Personal traits	High	0.396
	Low	-0.396
Other conditions	High	0.376
	Low	-0.376
(constant)	----	5.304

4.3.2 Analysis of the results of different surveyed populations

In this section we will show the analysis per group of stakeholders where all the findings are depicted in Table 4.5 (importance of competencies), Table 4.6 (utility estimation in conjoint analysis) and Table 4.7 for the specific case of teaching-researching-learning ability).

Table 4.5 Preference importance value table of conjoint analysis of stakeholders

Aspect	Importance value				
Stakeholder	Scholars	Managers	Attending physicians	Patients	Team members
Clinical technical competency	33.273	28.940	29.432	46.146	30.371
Clinical nontechnical competencies	15.073	12.703	14.737	12.472	13.192
Management competency	10.146	13.913	10.218	8.144	11.359
Interpersonal competency	11.300	10.881	11.748	9.064	12.048
Teaching, learning and research competency	12.047	12.583	12.723	8.127	11.517
Personal traits	8.636	11.532	10.077	8.675	10.785
Other conditions	9.525	9.448	11.065	7.373	10.729
Pearson’s R			1.000 (p<0.001)		
Kendall’s tau			1.000 (p<0.001)		

Table 4.6 Utility estimation for stakeholders

Attributes		Utility Estimation				
Stakeholder		Scholars	Hospital managers	Attending physicians	Patients	Team members
Clinical technical competency	High	1.547	1.512	1.215	2.396	1.608
	Low	-1.547	-1.512	-1.215	-2.396	-1.608
Clinical nontechnical competencies	high	.651	.644	.599	.650	.658
	Low	-.651	-.644	-.599	-.650	-.658
Management competency	high	.375	.681	.346	.371	.508
	Low	-.375	-.681	-.346	-.371	-.508
Interpersonal competency	high	.438	.464	.376	.449	.577
	Low	-.438	-.464	-.376	-.449	-.577
Teaching, learning and research competency	high	.458	.534	.474	.421	.583
	Low	-.458	-.534	-.474	-.421	-.583
Personal traits	high	.328	.491	.290	.375	.464
	Low	-.328	-.491	-.290	-.375	-.464
Other conditions	high	.266	.375	.390	.368	.433
	Low	-.266	-.375	-.390	-.368	-.433
(constant)		5.708	5.149	5.965	4.914	4.845

Table 4.7 Teaching-Learning-Research competency importance distribution by stakeholder

Teaching, learning and research competency		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Stakeholder	Level	Scholars		Managers		Attending physicians		Patients		Team members	
Learning ability	Very important	33	61.1	73	77.7	74	75.5	72	96.0	54	63.5
	Important	6	11.1	11	11.7	14	14.3	2	2.7	17	20.0
	Avrg Important	15	27.8	10	10.6	10	10.2	1	1.3	14	16.5
Teaching ability	Very important	11	20.4	16	17.0	19	19.4	3	4.0	24	28.2
	Important	17	31.5	54	57.4	58	59.2	60	80.0	26	30.6
	Avrg Important	26	48.1	24	25.5	21	21.4	12	16.0	35	41.2
Research ability	Very important	10	18.5	5	5.3	5	5.1	13	17.3	7	8.2
	Important	31	57.4	29	30.9	26	26.5	62	82.7	42	49.4
	Avrg Important	13	24.1	60	63.8	67	68.4	36	42.4	36	42.4

4.3.2.1 Analysis of the results of the Scholars

It can be seen from the importance value: for scholars, the importance of each attribute to the evaluation preference of the attending physician is: Clinical technical competency (33.273%), Clinical nontechnical competencies (15.073%), Management competency (10.146%), Interpersonal competency (11.300%), Teaching, learning and research competency (12.047%), Personal traits (8.636%), Other conditions (9.525%); Clinical technical competency preference is more important than other preference abilities. See Table 4.5 for details. In Teaching, learning and research competency, the preference levels are learning ability, scientific research ability, and teaching ability in order. See Table 4.7 for details. The correlation coefficient between the measured preference and estimated preference of the model is 1, and the Kendall rank correlation coefficient is 1.

For hospital management groups, the most popular doctors are those with high Clinical technical competency, high Clinical nontechnical competencies, high Teaching, learning and research competency, high Interpersonal competency, high Management competency, high Other conditions, and high Personal traits. In addition to Clinical technical competency, there are certain requirements for Clinical nontechnical competencies, Teaching, learning and research competency, and Interpersonal competency.

4.3.2.2 Analysis of group results of attending physicians

It can be seen from the importance value: for the job attribute of the attending physician group, the importance of each attribute to the attending physician's ability evaluation preference is: Clinical technical competency (29.432%), Clinical nontechnical competencies (14.737%), Management competency (10.218%), Interpersonal competency (11.748%), Teaching, learning and research competency (12.723%), Personal traits (10.077%), Other conditions (11.065%). Clinical technical competency preferences are more important than other preferred competencies. The correlation coefficient between the measured preference and estimated preference of the model is 1, and the Kendall rank correlation coefficient is 1, indicating that the model fitting effect is good and the analysis results are reliable. See Table 8 for details. Teaching, learning and research competency are, in order of preference, learning ability, teaching ability, and research ability. For the group of attending physicians, the most popular physicians are those with high Clinical technical competency, high Clinical nontechnical competencies, high Teaching, learning and research competency, high Other conditions, high Interpersonal competency, high Management competency, and high Personal traits physician. In addition to Clinical technical competency, there are certain requirements for Clinical nontechnical competencies, Teaching, learning and research competency, and Other conditions.

4.3.2.3 Analysis of the group results of hospital managers

From the importance value, it can be seen that for the group of hospital managers, the importance of each attribute to the evaluation preference of the attending physician is: Clinical technical competency (28.9%), Management competency (13.9%), Clinical nontechnical competencies (12.7%), Teaching, learning and research competency (12.6%), Personal traits (11.5%), Interpersonal competency (10.9%), Other conditions (9.4%). Clinical technical competency preferences are more important than other preferred competencies. The correlation coefficient between the measured preference and estimated preference of the model is 1, and the Kendall rank correlation coefficient is 1, indicating that the model fitting effect is good and

the analysis results are reliable. In addition, within the LTR competency, there is a differentiation that gives learning ability the top position, followed by teaching ability and at the last position, the research ability.

4.3.2.4 Analysis of the results of team members

It can be seen from the importance value: for the job attribute of the main clinic group members, the importance of each attribute to the evaluation preference of the attending physician's ability is: Clinical technical competency (30.371%), Clinical nontechnical competencies (13.192%), Management competency (11.359%), Interpersonal competency (12.048%), Teaching, learning and research competency (11.517%), Personal traits (10.785%), Other conditions (10.729%). Clinical technical competency preferences are more important than other preferred competencies. The correlation coefficient between the measured preference and estimated preference of the model is 1, and the Kendall rank correlation coefficient is 1, indicating that the model fitting effect is good and the analysis results are reliable. See Table 14 for details. Teaching, learning and research competency are ranked in order of learning ability, scientific research ability, and teaching ability. For the members of the attending group, the most popular doctors are those with high Clinical technical competency, high Clinical nontechnical competencies, high Teaching, learning and research competency, high Interpersonal competency, high Management competency, high Personal traits, and high Other conditions. In addition to Clinical technical competency, certain clinical nontechnical competencies, Teaching, learning and research competency, and Interpersonal competency are required.

4.3.2.5 Result analysis of patients

According to the importance value, for the patient group, the importance of each attribute to the ability evaluation preference of the attending physician is: Clinical technical competency (46.146%), Clinical nontechnical competencies (12.472%), Management competency (8.144%), Interpersonal competency (9.064%), Teaching, learning and research competency (8.127%), Personal traits (8.675%), Other conditions (7.373%). Clinical technical ability is far more important than other abilities. According to the model, the correlation coefficient between measured preference and estimated preference is 1, Kendall’s W = 1, which shows that the model fitting effect is good and the analysis result is reliable; The order of teaching, learning and research competency is learning ability, teaching ability and scientific research ability. The order is Clinical technical competency High Clinical nontechnical competencies High

Interpersonal competency High Teaching, learning and research competency High Personal traits High Management competency High Other conditions High.

4.3.3 Full competency evaluation index

By crossing data pertaining to the relative importance of competencies and attributes given at 1st and 2nd levels, we can combine all weights into a final weight (expressed as percentage) ascribed to each indicator. Table 4.8 shows the full results that can detail the weights given to every indicator.

Table 4.8 Evaluation index for attending physician

Competence categories		Competence indicators	Points 0-100	Final score
Clinical technical competence 27.1%		Treatment ability	31.8%	8.6%
		Surgical level	24.1%	6.6%
		First aid ability	22.4%	6.1%
		Theoretical knowledge	21.6%	5.9%
Clinical non-technical competence 16.2%		Clinical communication ability	36.8%	6.0%
		Humanistic care	27.3%	4.4%
		Professional ethics	35.9%	5.8%
Management ability 14.9%		Organizing ability	24.9%	3.7%
		Coordinated ability	21.2%	3.2%
		Leadership	19.5%	2.9%
		Cooperation ability	19.6%	2.9%
		notion of benign competition	14.7%	2.2%
Interpersonal competence 12.6%		Non-clinical communication ability	49.7%	6.2%
		Ability to manage relationships	50.3%	6.3%
Teaching, research and learning ability 11.2%		Scientific research ability	27.8%	3.1%
		Teaching ability	23.5%	2.6%
		Learning ability	26.6%	3.0%
		Innovation ability	22.1%	2.5%
Other indicators (dispositions Personality) 10.6%		Extroversion	13.6%	1.5%
		Work attitude	19.6%	2.1%
		Friendly	14.3%	1.5%
		Aspirant	14.7%	1.6%
		Patience	15.7%	1.7%
		The right values	12.1%	1.3%
		Positive emotion	9.9%	1.1%
Other indicators 7.3%	Experience/Qualification	Years of working	2.6%	0.9%
		professional and technical titles		0.9%
		Academic Degree		0.8%
	Social based	Superior recommendation	2.0%	0.4%
		Social network		0.2%
		Recognition of colleagues		0.6%
		Social influence		0.5%
		Participation in authoritative academic associat.		0.3%
	Health	A healthy body	2.7%	1.4%
		Mental endurance		1.3%

4.4 Discussion and conclusion

Overall, the ranking of the importance of attending physicians' competency was clinical technical ability (33.7), clinical non-technical ability (13.7), teaching and research ability (11.4), interpersonal communication ability (11.0), management ability (10.9), personality trait (9.9) and objective qualification (9.5). Clinical technical competence is considered to be the most important competence of the attending physician and far exceeds all other competencies. This is consistent with the Delphi method of study 2, in which experts generally gave the highest scores for clinical competence after two rounds of Delphi counseling. In this study, clinical technical ability refers to the ability to master medical professional knowledge, diagnosis and treatment of diseases and other abilities related to medical professional technology. The primary identity of the attending physician is that of a doctor, and the primary responsibility of a doctor is to cure and save people. Therefore, the clinical technical ability is the most basic and important ability of the attending physician.

Clinical non-technical competence was second in importance. In this study, clinical non-technical ability refers to other abilities that are not subordinate to professional diagnosis and treatment techniques in the process of clinical diagnosis and treatment, such as doctors' ability to communicate with patients and their families on clinical issues (Solet et al., 2005), to manage their own emotions well, and have humanistic care and empathy, respect and care for patients' feelings (Branch Jr et al., 2001) and have professional ethics. In the process of clinical diagnosis and treatment, clinical non-technical ability is an important supplement to clinical technical ability. With the continuous reform of the current medical and health system, clinical medicine model has changed from "disease-centered" to "patient-centered" (Hurwitz & Vass, 2002). In this process, more and more attention has been paid to the humanistic care for patients and communication between doctors and patients.

The importance of teaching research and learning ability ranked third. In this study, this ability includes teaching ability, scientific research ability and learning ability, which refers to the ability to teach junior physicians and students, carry out scientific research activities to produce scientific research results, independent learning, and innovation. Doctors need to keep a strong learning motivation, pay attention to knowledge update and scientific discipline development at any time, and learn actively (Ding et al., 2019). Teaching is an important duty of attending physicians. In order to effectively impart medical knowledge, doctors need to teach group members during clinical practice (Menachery et al., 2008). Spending sufficient time in teaching is also considered important for attending physicians' clinical models. Because of the

centrality of this domain of competencies in this study, the findings pertaining to relative importance rank between teaching, learning, and researching must be discussed.

The results of the survey on teaching, research and learning ability show that among the three abilities, people think learning ability is the most important. Medicine is a rapidly developing science, and medical knowledge and technology are constantly updated. Doctors need to keep learning so as to keep pace with The Times and maintain and improve the level of diagnosis and treatment (Duffy & Holmboe, 2006; Fox & Bennett, 1998). Teaching ability is more important than scientific research ability, and people attach more importance to the teaching responsibility of the attending physician. The results show that the importance of teaching and research ability mainly comes from the learning ability of the attending physicians. It is worth noting that the importance of scientific research ability is higher than teaching ability among scholars, indicating that scholars attach more importance to the work and investment of attending physicians in scientific research. In addition, the importance of teaching ability was significantly higher than that of scientific research ability in the attending physicians and the members of the attending physicians. At present, in most non-top hospitals, it is generally believed that the main work of doctors is to cure and save patients, while scientific research is the responsibility of full-time scientific researchers. Doctors are so busy with clinical diagnosis and treatment that they have no time to do scientific research (L. L. Zhang et al., 2021; Zou et al., 2015), therefore, attending physicians have relatively low requirements for scientific research ability.

The importance of management ability is low, ranking fifth, indicating that people generally think that management is not important in the responsibilities of attending physicians, and the level of management has little impact on the performance of attending physicians. In China, the attending physician is only the leader of a medical team, and generally only performs performance evaluation and distribution of attendance and workload, which might be considered not sufficiently complex to require high management ability. This is consistent with findings from Westerman et al. (2010) that explored the role changes experienced in the transition from residency to attending physician status where management tasks are only marginal which is reinforced by Sanaee et al. (2020) study on transition-to-practice curricula needs.

Objective qualifications ranked lowest in importance. Objective qualifications in this study include qualifications and conditions such as working time, professional title and educational background. This shows that it is generally believed that the quality of the attending physician depends more on the actual ability of the individual than on any limiting conditions. This is

consistent with the findings of the Delphi method in study 2, in which the experts also rated objective qualifications as the lowest importance rating among attending physicians. Also, the standards for medical license certification are formal and regulated (Aftab et al., 2021), which means they are taken as homogeneous within physicians and therefore, not truly distinctive.

Findings reported for specific occupation profiles of participants are also informative. Managers rated the management ability of attending physicians as highly important, second only to clinical technical ability. Managers themselves are engaged in more management work, so they have a deeper understanding of management ability, and attach more importance to the organization and coordination ability and teamwork ability of attending physicians. Similarly, the importance of management skills was rated highly in this group. The attending physician is the direct leader of the group members, and the management ability of the attending physician will directly affect the sense of fairness and work efficiency of the group members (Majmudar et al., 2010). Therefore, the attending physician's leadership, organization and coordination ability are also valued by the attending physician. However, the attending physicians themselves did not attach importance to management ability, ranking only sixth in importance. Attending physicians pay more attention to their colleagues' clinical ability, teaching and research ability and other abilities that are most relevant to daily work. The importance of the attending population to the management ability of the attending physician ranked the lowest. The attending population was more concerned about whether the doctor could cure the disease, and there was less overlap between the management responsibility of the doctor and the attending population.

Objective qualifications ranked the lowest overall, but the importance of objective qualifications ranked the fifth among attending physicians, higher than management ability and personality traits. The results showed that the professional title, working age, educational background, social relationship and other conditions were still more important in the group of attending physicians. It is difficult to accurately quantify the ability of attending physicians, but it is easier to establish screening standards by adopting indicators such as professional title, working age and education background. Therefore, attending physicians still recognize these criteria.

Among the patients, the importance value of clinical technical ability was the highest (42.7). For patients, the ability of the attending physician to cure their disease and recover their health was far more important than other abilities.

Conclusions

This study was designed to gauge the relative importance of several domains of competency concerning attending physicians. It contrasted several relevant domains, namely clinical technical ability, non-clinical technical ability, teaching-learning-researching ability, management ability, objective qualifications, and personality. A special focus is placed upon the teaching-learning-researching competency as the role of research is increasingly gaining relevance to the organs that evaluate the attending physicians' performance. The overall findings show a reality that does not match the importance given by the performance evaluation practice of valuing research ability. In the eyes of the attending physicians, the scholars, the managers, the medical team members, and the patients, research is but a minor domain of competency compared to the clinical technical and non-technical domains. The relatively minor importance given to research is even more visible when comparing the importance of learning teaching and researching, where it is ranked last at a substantial distance from the first position (learning). Therefore, the emerging practice that stem from medical research centers and formal performance appraisal system that gives research a distinctive status to judge any attending physician and "excellent" is not socially validated by the stakeholders.

These findings must be interpreted considering their limitations. Namely, that although the sample came from all over the country and is diversified as regards occupational groups (including scholars, managers, attending physicians, group members) and also includes patients, the absolute number of participants per group (especially scholars) is small. Still, the within-groups opinions are homogeneous as indicated by ICC aggregation indicators, which means there is large convergence and so, albeit small, the sample seems to be sufficiently consistent to anticipate its representativeness and think of the findings as occupational social representations. Another limitation comes from the level of aggregation of the competencies. Because a long list of competencies is not advisable in this sort of research, as participants would experience fatigue and choices would be of poor quality, our findings do not allow a fine-grained look into the competency domains. For example, within the clinical technical competency domain it would be interesting to test specifically the importance of treatment ability, surgical ability, first aid ability, and theoretical knowledge, as the Delphi study does have indication they are not exactly at the same level. This can be indication for future research opportunity.

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Chapter 5: Study 3 Building A Competency-Based Predictive Model of Attending Physician Performance

5.1 Introduction

China's health reform is ongoing. The Chinese government has made various efforts to improve China's medical and health capacity and improve the health level of the Chinese people. The deepening of China's medical and health reform in the sequence of successful policies from the State Council and the Health Commission of China in the last decade created the context for the emergence of a new medical model that created the position of attending physician. The reforms are set to improve the efficiency, accuracy and effectiveness of the diagnosis and treatment (Ren et al., 2021).

The attending physician is the most valuable human resource in the hospital. The quality of the attending physician plays a decisive role in the overall medical level of the hospital. The attending physician is entrusted with being the final decision maker concerning outpatient, hospitalization, surgery, discharge and other duties towards the patient (Ying et al., 2021) which is also matched with being the ultimate responsible for clinical decisions. This gives great responsibility and power, which is accompanied by an expectation that the attending physician holds an excellent level of technical expertise, of interpersonal ability, and team leadership to have a full understanding and guidance to ensure the best possible health care to patients and high scientific research and teaching ability.

The selection of individuals for this position is then critical for the concrete realization of the reforms and very important to improve the medical level of the hospital, but the traditional hospital human resources evaluation in China is mostly focused on qualification (working years, professional title and education background) and not so much on competencies (S. Yang et al., 2022). Therefore, albeit qualifications should be a proxy of competencies, in fact they may not fully translate the real competencies in both clinical and non-clinical domains. So, a competency-based management is the preferred approach in strategically managing human resources (Ribaudo et al., 2021; Young & Dulewicz, 2008), so that the hospital can more accurately select the right attending physician.

There are numerous proposals of competency frameworks for medical occupations which concern healthcare management (Calhoun et al., 2008; Garman & Scribner, 2011; Z. Liang et al., 2018), team training (Salas et al., 2018; Weaver et al., 2014), for general medical practitioners (Frank, 2005; Swing, 2007). However, to the exception of the framework this research has proposed (studies 1 and 2) there is none that directly applies to the attending physician.

This proposed framework gathered the consensus but a given competency framework gather consensus is not sufficient to guarantee its effectiveness. It is necessary to test its ability to predict job performance. By definition, a competency should have a close relationship with job performance (Lucia & Lepsinger, 1999) but we are not yet aware about which attending physician competencies are more correlated (if so) with job performance.

From the literature review we learned that this link is not direct but rather mediated by psychological variables that relate with both the competencies and job performance. These are mediators. When we searched for the most relevant mediator, we found work engagement and we adopt it. Likewise, from the literature review, we know these competency-performance models are sensitive to the context, for example: how much support do workers receive from the organizations, or what work culture exists, etc. We opted to adopt the Perceived Organizational Support because it is something that can be immediately designed by managers to improve the effect competencies can have on performance. So, we ended with a moderated mediation model that puts together, competencies, work engagement, job performance and Perceived Organizational Support."

Therefore, this study is designed to test the predictive validity of the proposed competency framework for attending physicians while exploring the mechanism that links competencies to performance (the choice for work engagement) while testing also boundary conditions (perceived organizational support).

5.2 Literature review

The attending physician is the leader of the attending physician group and the core of the attending physician responsibility system. The complexity of the tasks and requirements of the attending physician position is increasing due to changes in policy and societal needs. Although the exact functions attending physicians exert are not entirely settled, as the main body of medical responsibility, there is a consensus that the attending physician is the person in charge of the whole medical process of outpatient service, admission, diagnosis, treatment, discharge

and follow-up from the patient's enrollment, and his technical level, knowledge and experience are directly related to the treatment effect (Han, 2018). In addition to clinical practice, the attending physicians are responsible for the teaching of junior physicians and graduate students in the attending group, and lead the attending physicians to determine the direction of scientific research, form scientific research achievements and complete scientific research tasks. As the leader of the main group, the attending physician is the direct manager of the main group being entrusted with certain management responsibilities.

The complexity of the attending physicians' duties implies paying greater attention to their recruitment and selection, training and development, career promotion, and performance appraisal, which are key to effectively manage human resources (Mitosis et al., 2021). This is especially important when physicians' density in China average 1.5‰ (while OECD averages 3.1‰, Suzuki et al., 2020) which means that productivity gains have to be achieved also by increasing the professionalism and quality of medical output. One way of achieving this is by focusing on competencies, which gather consensus as the best approach to medical education (J. R. Frank et al., 2010) and to medical practice, under the name of competency-based medical education / practice (Touchie & Ten Cate, 2016).

Current scientific research offers strong evidence, from many fields, of a positive correlation between competence and performance. Korean scholars (Kim, 2016) investigated the influence of self-efficacy, communication ability and critical thinking tendency on clinical performance of nursing students. It was found that there was a significant positive correlation between self-efficacy, communication ability, critical thinking tendency and clinical manifestations. There is a significant positive correlation between teachers' ability level and work performance, especially research ability, teaching ability, industry awareness and work performance (A. Xu & Ye, 2014). In the study of accountants' job performance, general abilities (such as learning new things, innovation ability, and cooperation with others) play a mediating role in the relationship between career success satisfaction and job performance (Trivellas et al., 2015).

Although there are established competency frameworks for physicians (e.g. CanMEDS, J. R. Frank & Danoff, 2007) they are not focused on the attending physician position role. Despite the scarcity of scientific research, akin studies can be used as a reference. Epstein and Hundert (2002) believe that clinician competency refers to the ability to skillfully and accurately use professional academic knowledge, technical means, clinical thinking, communication skills, emotional expression, value orientation and personal experience in daily medical services in order to benefit individuals and groups served. According to the Accreditation Council for

Graduate Medical Education of the United States, the abilities of physicians are patient care, medical knowledge, practiced-based learning and improvement, interpersonal and communication skills and system-based practice (Batalden et al., 2002). Frank (2005) defined seven identities of clinicians: medical expert, communicator, collaborator, health advocate, managers, scholar and professionals. Chinese scholars X. H. Yang and Chen (2013) divided the competency of clinicians into clinical skills and medical services, disease prevention and health promotion, information management ability, medical knowledge and lifelong learning ability, interpersonal communication ability, teamwork ability, scientific research ability, core values and professional quality of doctors.

Hou et al. (2016) explored a set of responsibilities of attending physicians and identified four large domains of routine work: medical practice, teaching, researching and hospital administration duties. According to these authors, some of the competencies residents are expected to learn necessarily relate with the attending physicians' competencies such as the advancement of medical competence within the subordinated team, the ability to communicate, the establishment of good relationship with medical team and patients, the promotion of client-centered learning, the cultivation of a professional attitude, the uphold of medical ethics, and personal qualities conducive to great professionalism.

Literature on medical education use now the acronym CBME (competency-based medical education) as a cornerstone for guaranteeing physicians have the right competencies (i.e. knowledge, skills, and abilities) to exert the profession. Albeit competencies are not taken by some authors as being sufficient to guarantee performance, such as Bacchus (2017) explored also the role of context and Drummond (2021) separated warmth from competence, there is a large consensus on their critical contribute to job performance. With all the literature that stresses the relevance of a competency approach to healthcare both in clinical (Cham & Cochrane, 2020; Gunawan et al., 2019; Sander et al., 2021) or nonclinical functions such as healthcare managers (Leggat et al., 2020), the consensus on their contribute to performance is apparently universal, and we therefore hypothesize that:

Hypothesis 1: Competencies have a positive direct effect on job performance

One of the important objectives for any human resources decision maker is to motivate the workforce so to offer a positive working experience that ultimately – intending or not – translates into higher productivity and added value. A construct that has emerged as established itself as a central aspect in managing people is work engagement (Schaufeli & Salanova, 2007).

Work engagement is a "positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli et al., 2002, p. 74). Professionals believe that

work engagement is an important factor affecting employee performance and organizational management (Simpson, 2009). A growing body of evidence supports the relationship between work engagement and job performance, including those based on performance outcomes (Laschinger & Leiter, 2006; Schaufeli & Bakker, 2004).

In the long list of studies that establish evidence of a positive effect of work engagement, Harter (2002) studied the department-level relationship between employee satisfaction, employee engagement and business outcomes, and the results showed that changes in management practices that improve employee satisfaction and work engagement may increase business outcomes, including profits.

Likewise, in the healthcare sector, Laschinger and Finegan (2005) proposed that six work-life areas that promote employee engagement have a positive relationship with nurses' physical and mental health. Keyko et al. (2016) found work engagement exerted positive effects not only on performance are care outcomes of nurses, but also on their professional and personal outcomes. In a systematic literature review of work engagement directed organizational interventions, Knight et al. (2017) found reports of positive, negative and non-significant effectiveness. Still, most studies do report a positive effect.

It is therefore logic that organizations strive to create conditions that favor high levels of work engagement. To achieve this, human resource management must consider extant resources. These can be resources of a professional nature (training and development, or job autonomy, Schaufeli et al., 2009) but also of a personal nature (self-efficacy or optimist, Xanthopoulou et al., 2007).

Self-efficacy, per definition, refers to the self-perceived ability to control and influence one’s own environment (Bandura, 1997). It is closely linked to how much one sees oneself as being competent, because it is illogical that such a central dimension of work is not critical to formulate a sense of self-efficacy. The relationship is so evident that Haruna and Marthandan (2017) even clarified the nature of self-efficacy referring to the classical components of competency, i.e. knowledge, skills, and abilities. We therefore hypothesize that:

Hypothesis 2: Competencies have a positive direct effect on work engagement

And, likewise, that:

Hypothesis 3: Work engagement has a positive direct effect on job performance

As work engagement is hypothesized as being simultaneously an outcome of having the right competencies to work and is also a predictor of job performance, we reason it plays a pivotal role into bridging competencies with job performance. In line with this, previous research has integrated literature that treats work engagement as either an outcome of personal

resources or management practices (Schaufeli et al., 2009) or an antecedent of performance (Kim, 2017) by conferring it the status of a mediator variable, i.e. a psychological state that helps bridging predictors and outcomes both offering added theoretical value as well as explanatory power. We therefore hypothesize that:

Hypothesis 4: There is a positive indirect effect of competencies on job performance through work engagement.

As stated, the context plays a role in explaining how much competencies can be mobilized into practice so to produce performance. One of the context variables that have gained centrality in organizational and management studies is organizational support, namely, how much it is perceived by employees. This variable is instrumental for human resource managers internationally and in China because it is sensitive to some HR practices such as hiring, training and compensation decisions (Mayes et al., 2017). One set of HR practices, known as KSA-enhancing practices involve precisely recruitment, selection and training and are expected to leverage employee competencies (Aktar & Pangil, 2017).

Organizational support has also been approached by scholars as a way of improving work engagement. For example, Caesens and Stinglhamber (2014) investigated the relationship between perceived organizational support and work engagement. They examined the underlying mechanisms of this relationship and studied the outcomes focusing on employees' job satisfaction, psychological strains and performance. Gokul (2012) examined the impact of perceived organizational support and work engagement on affective commitment of employees treating it as a predictor of work engagement with a direct effect. Perceived organizational support was also treated as a predictor of work engagement but via an indirect effect, i.e. with the mediating influence of flourishing and thriving at work (Imran et al., 2020). Perceived organizational support was also treated as a direct predictor (Darolia et al., 2010) and an indirect predictor (Karatepe & Aga, 2016) of job performance, precisely through work engagement.

Although constructs can be conceived as either mediators (bridging other constructs) or moderators (interacting and modulating effects between other constructs), perceived organizational support – within a study focused on the competency-performance link, is more suitably conceived as a moderator. We reason that when our focus lies on individual professional competencies, the degree the organization supports the employees in doing their work is a feature of the context of those employees. Of course, organizational support is a subjective perception but it is one that is produced based on the overall judgment the employees do about their working context. This theoretical option is shared by previous research (Witt & Carlson, 2006). In detail, Guo (2017) examined whether the relationship between work

engagement and objective task performance is moderated by perceived organizational support. Results of hierarchical regression analysis show that: (1) work engagement is positively related to objective task performance, and (2) the relationship between work engagement and objective task performance is moderated by perceived organizational support, such that the positive relationship is more significant when perceived organizational support higher than lower. Likewise, Côté et al. (2021) took perceived organizational support as a moderator in a mediated model linking presenteeism to job satisfaction via work engagement.

Therefore, we hypothesize that:

Hypothesis 5: Perceived organizational support moderates the direct effect of competencies on job performance in such a way that when perceived organizational support is higher, the effect is stronger.

In line with Guo (2017) findings, a study conducted in the UK by Shantz et al. (2016) reported also a moderating effect of perceived organizational support in the relationship between work engagement and turnover intentions, so that stronger perceived organizational support compensated the negative effects of a lower engagement. Knight et al. (2017) found in a systematic literature review focusing on the effectiveness of work engagement-direct interventions, that some moderators might be operating, such as manager support. This is a clear proxy of the overall organizational support, which entails the possibility that studying the effectiveness of competencies should consider this as a context variable. We therefore hypothesize that:

Hypothesis 6: Perceived organizational support moderates the direct effect of competencies on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.

Because the overall model that brings together Hypotheses 4, 5 and 6 concerns a moderated mediation, we hypothesize that:

Hypothesis 7: Perceived organizational support moderates the indirect effect of competencies on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.

To sum up the above, we draft a conceptual model, which takes competencies as the independent variables, which are expected to leverage work engagement and moderated by perceived organizational support, finally leading to higher job performance.

5.3 Hypotheses

The hypotheses are stated without previewing possible within-construct dimensions. For clarity's and comprehensiveness sake we detail those below.

5.3.1 Direct effects

- H1: Competencies have a positive direct effect on job performance
  - H1a: Competencies (Strict sense) have a positive direct effect on job performance
  - H1b: Personality has a positive direct effect on job performance
  - H1c: Other personal features have a positive direct effect on job performance
- H2: Competencies have a positive direct effect on work engagement
  - H2a: Competencies (Strict sense) have a positive direct effect on work engagement
  - H2b: Personality has a positive direct effect on work engagement
  - H2c: Other personal features have a positive direct effect on work engagement
- H3: Work engagement has a positive direct effect on job performance

5.3.2 Indirect effects

Because work engagement is both expected to be an outcome of competencies and other personal features, as well as a driver of job performance, we hypothesize that:

- H4: There is a positive indirect effect of competencies on job performance through work engagement.
  - H4a: There is a positive indirect effect of competencies (strict sense) on job performance through work engagement
  - H4b: There is a positive indirect effect of personality on job performance through work engagement
  - H4c: There is a positive indirect effect of other personal features on job performance through work engagement

5.3.3 Interaction effects

- H5: Perceived organizational support moderates the direct effect of competencies on job performance in such a way that when perceived organizational support is higher, the effect is stronger.

- H5a: Perceived organizational support moderates the direct effect of competencies (strict sense) on job performance in such a way that when perceived organizational support is higher, the effect is stronger.
- H5b: Perceived organizational support moderates the direct effect of personality on job performance in such a way that when perceived organizational support is higher, the effect is stronger.
- H5c: Perceived organizational support moderates the direct effect of other personal features on job performance in such a way that when perceived organizational support is higher, the effect is stronger.

- H6: Perceived organizational support moderates the direct effect of competencies on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.
  - H6a: Perceived organizational support moderates the direct effect of competencies (strict sense) on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.
  - H6b: Perceived organizational support moderates the direct effect of personality on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.
  - H6c: Perceived organizational support moderates the direct effect of other personal features on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.

5.3.4 Moderated-mediation effects

- H7: Perceived organizational support moderates the indirect effect of competencies on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.
  - H7a: Perceived organizational support moderates the indirect effect of competencies (strict sense) on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.
  - H7b: Perceived organizational support moderates the direct effect of personality on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.

- H7c: Perceived organizational support moderates the direct effect of other personal features on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.

5.3.5 Conceptual model

The integration of all the variables in a comprehensive conceptual model takes competencies as the independent variables, which are expected to leverage work engagement, finally leading to higher job performance. We take age and gender as control variables, and other factors such as professional title and educational background are included in the competency system, so they are not additional control variables (See Figure 5.1).

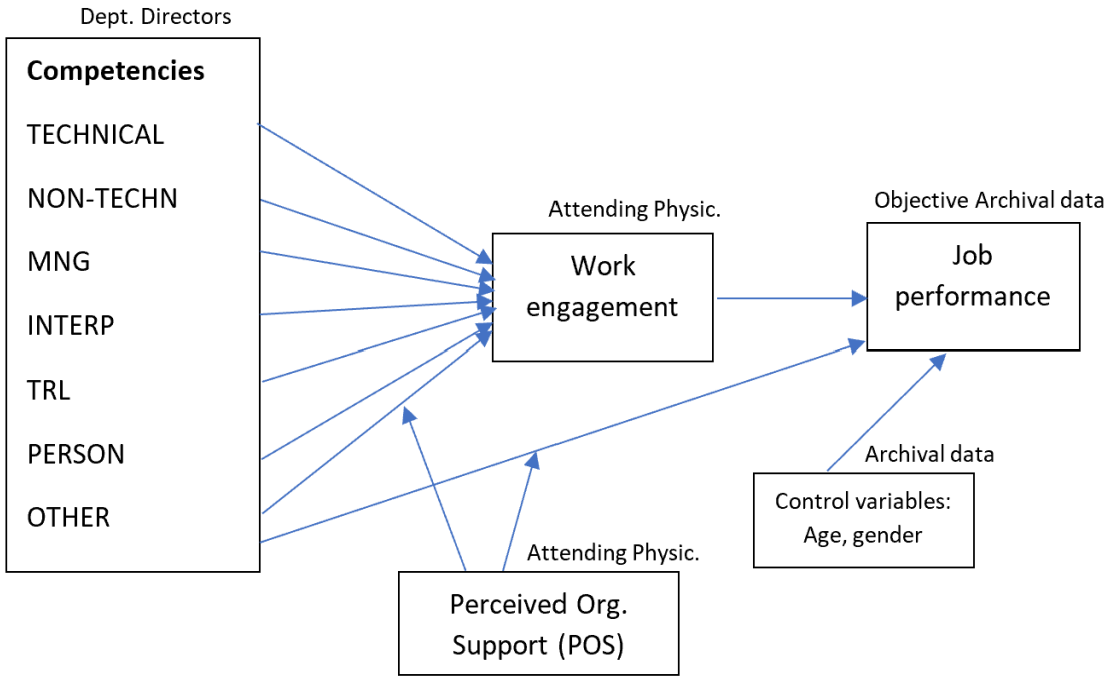

Figure 5.1 Conceptual model

5.4 Method

5.4.1 Sample

The sample comprises 183 matched director-attending physicians. The sample is mostly comprised by male attending physicians (66.1%) and averages 44.1 years-old (sd.=5.9) ranging from 30 years-old to 60 years-old. Because the hospital has created the category of attending physician 4 years ago, all the respondents have such professional tenure.

5.4.2 Procedure

The data collection was firstly prepared by introducing to the hospital departments the information about the study and asking them to cooperate. The department heads were invited to integrate a wechat group and asked to extend that invitation to all the attending physicians working in their department so that could join another wechat group specifically for attending physicians. This brought together 256 directors plus attending physicians in the hospital.

In both wechat groups, an explanation of the study as well as a link to get access to the respective online questionnaire was provided. By April 2nd, Directors were invited to fill in a questionnaire about competencies, namely to classify each of their subordinates as regards their competency level in each of the indicators. Simultaneously, the attending physicians were invited to fill in a brief questionnaire on their work engagement, and perceived organizational support. Guarantees of confidentiality were given to all participants.

Sociodemographic and professional data was collected from archival sources, namely age, gender, and professional tenure. Likewise, we collected data on job performance of each attending physician in the HR department, which combines the post requirements to comprehensively assess and evaluate the work behavior, work attitude, work quality and work effect of the staff. The evaluation contents included: 1) Physician qualification files and authorization, qualification inquiry, assessment, qualification application and dynamic management. 2) Operation workload, discharge workload, operation workload, average hospitalization time, average hospitalization cost, anesthesia table times, anesthesia duration and other workload information management. 3) The management of work quality indicators such as drug proportion, consumption proportion, utilization rate of antibiotics, intensity of antibiotics use, number of unplanned reoperation cases, number of elective surgical complications, and surgical proportion. Both data was matched to build a dyadic database.

5.4.3 Data analysis strategy

Data analysis started by testing the psychometric quality of the measures especially "competency" scale that was entirely new. To achieve this, we have run confirmatory factor analysis which allows to identify latent constructs that plausibly explain the association patterns between the answers to the items. The exploratory factor analysis has indicators of validity which are the KMO (above 0.500), Bartlett's sphericity test that should reject the null hypothesis with $p<0.01$, and the MSAs that should be all above 0.500). Additionally, the compositing items should have all commonalities above 0.500 and the explained variance

should be at least 60%. Each factor must be also reliable which can be gauged by either Cronbach alpha or the Composite Reliability (Joreskog's rho) for which the .70 threshold is used to indicate acceptable levels. Additionally, factors must have acceptable convergent validity which is indicated by the Average Extracted Variance (AVE) reaching at least 0.500 (Fornell & Larcker, 1981). This exploratory technique is mostly suitable for scales that have never been tested before or whose structure is not yet stabilized in a given population. Whenever the factor structure is already known and theoretically sustained a confirmatory factor analysis (CFA) is more suitable. This data analysis technique has fit indices that we should use to judge on its ability to depict the real associations in the data. The fit indices normally used are: chi square, the normed chi-squared (the ratio of the chi-square divided by the degrees of freedom), the comparative fit index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA), and the standardized room mean residual (SRMR). The thresholds for acceptance are: chi-square with a non-significant p value (although this indicator has been discarded when dealing with large samples or complex models), the normed chi-square below 3, CFI and TLI above .90, the RMSEA and the SRMR both below 0.08. The latent constructs must also abide by the same criteria to judge on reliability (CR) and convergent validity (AVE). In case there is more than a single latent construct, the factor solution in the CFA must also have discriminant validity which is indicated by the Heterotrait-Monotrait index (HTMT) falling below 0.85 (for strict) or 0.90 (for liberal) discriminant validity (Henseler et al., 2015).

Once measures are found to be both valid and reliable, they can be used for further analysis namely to generate the descriptive statistics as well as the bivariate statistics. These provide a sense on how strongly the participants experience the variables. After this, hypotheses can be tested which we did with PROCESS Macro (Hayes et al., 2017).

Although this data analysis technique works with composite variables instead of the latent constructs, the sample size does not advise the use of Structural Equations Modelling (Hair et al., 2019) which would be the most recommended approach. Still, as Hayes et al. (2017) demonstrate, both techniques converge as regards results and therefore it is inconsequential to opt for PROCESS. This has the advantage of allowing to run bootstrapping, which is a special strategy that extract randomly selected parts of the sample and runs the model, checking the estimates. Usually 5000 extractions are recommended, which produce a confidence interval of 90% to judge on the variability of the estimates depending on the exact composition of the sample. In case any given estimate has a confidence interval that included value 0 (zero) then we cannot rule out the estimate is non-significant.

Considering our conceptual model, we used Macro PROCESS (Hayes et al., 2017) to test two simultaneous moderations in a simple mediation model.

This model was tested once for each independent variable, i.e. one moderated mediation model tested for clinical competencies, another for non-clinical competencies.

5.4.4 Measures

Competency was measured based on the list of competencies that emerged from the previous studies. We determine the index framework through interview and Delphi, and determine the weight of the index through joint analysis and questionnaire survey. It comprehends seven group of competencies (Clinical technical competency, Clinical nontechnical competency, Management competency, Interpersonal competency, Teaching, learning and research competency) complemented by other aspects that are relevant when profiling an attending physician, namely personal traits, and other conditions.

Clinical technical competency comprises treatment ability, surgical ability, first aid ability and theoretical knowledge on clinical domain. Clinical nontechnical competency comprises clinical communication ability, human care and professional ethics. Management competency comprises leadership, coordinating ability, organizing ability, cooperation, and benign competition. Interpersonal competency comprises non clinical communication ability and relation management ability. Teaching, learning and research competency comprises these three specific domains (teaching colleagues, conducting scientific research, and learning lifelong) as well as the general notion of being able to innovate.

As this is a new proposed measure, we conducted a confirmatory factor analysis on the competencies which showed suboptimal fit indices ($X^2(126)$ =400.872, Normed X^2=3.182, CFI=0.907, TLI=0.888, RMSEA=0.109 CI90 [0.098; 0.122] PClose=0.000; SRMR=0.0462). Due to the closeness to the thresholds, we considered the Lagrange Multipliers, which indicated some optimization was possible by adding some covariances between errors. As these mostly belong to the same factor, we proceed with the adjustments to find a suitable solution with good fit indices ($X^2(121)$ =257.342, Normed X^2=2.127, CFI=0.954, TLI=0.942, RMSEA=0.079 CI90 [0.065; 0.092] PClose=0.000; SRMR=0.0438). However, this solution showed heavy associations between factors and thus there were not enough discriminant validity suggesting a common single 2nd order factor.

We tested this 2nd order factor solution that showed acceptable fit indices ($X^2(126)$ =274.377, Normed X^2=2.178, CFI=0.950, TLI=0.939, RMSEA=0.080 CI90 [0.067; 0.093]

PClose=0.000; SRMR=0.0446) as well as good convergent validity both at the 2nd order (AVE=0.819) and first order factors (AVE ranging from 0.602 to 0.860). The factors are also all reliable with the CR for the 2nd order factor reaching 0.957, and for the 1st order factors ranging from CR=0.856 to CR=0.932. As shown in Figure 5.2.

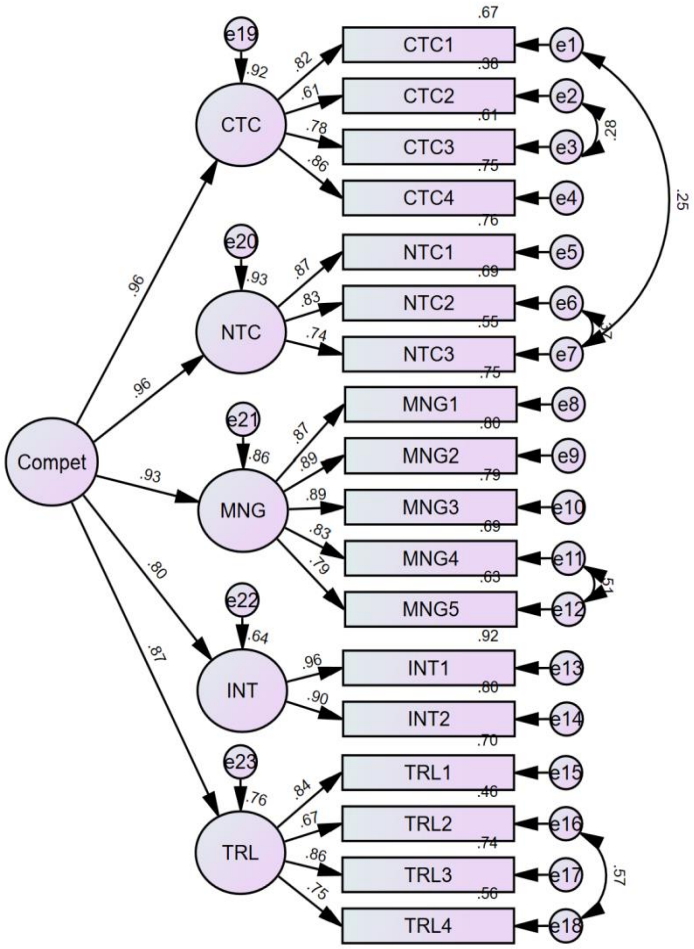

Figure 5.2 CFA for competencies

Personality comprises extroversion (a direct mention to the big-5 extroversion dimension), work attitude (expressed as being positive as regards work challenges and daily task while also taking initiative and being proactive), friendliness (an expression of the big-5 agreeableness), right values (an expression of the big-5 consciousness), positive emotions (an expression of the big5 emotional stability). Although the personality indicators do not exactly match a known framework or extant measure, we reason that such traits are not entirely independent from each other and they emerged from the description of what might be beneficial to be an outstanding attending physician. Therefore, we conducted an exploratory factor analysis which showed a single factor valid solution (KMO=.873, .797<MSA<.936, Bartlett $X^2(28)=1001.830$) with all commonalities above .500, and accounting for 64%. This solution was tested with CFA which,

after adding covariances between some errors (thus indicating the measure is but an approximation to a full measure), also showed acceptable fit indices (X^2(16)=34.622, Normed X^2=2.164, CFI=.981, TLI=.967, RMSEA=.080 CI90 [.043; .117] PClose=.0895; SRMR=.0340). This solution has good reliability (CR=.913) as well as convergent validity (AVE=.568). As shown in Figure 5.3.

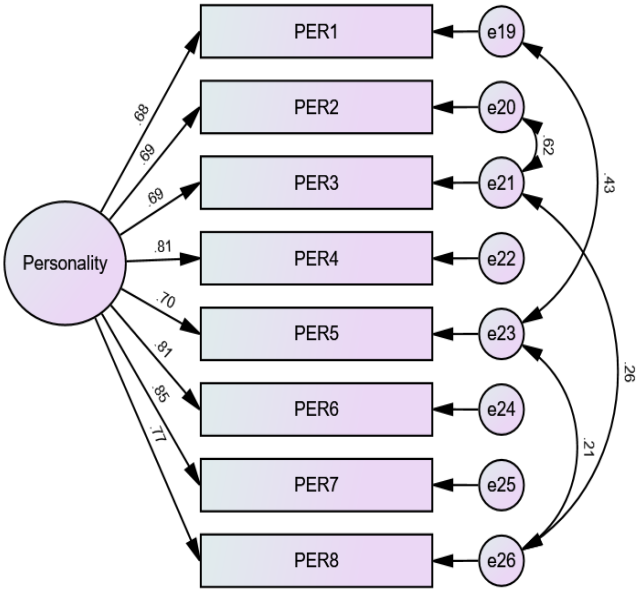

Figure 5.3 CFA for personality

Although there is shared variance that allows for the treatment of personality traits as an aggregate, judging on the discrete nature of traits, we assume there may be advantages into treating them also as separate indicators. Therefore, we regard personality traits as a separate indicator, which may be a little different from the competency indicator system we have established.

Other conditions comprise technical title, academic qualifications, physical health, mental endurance, as well as some social indicators such as the degree of recommendation by the superior, the social network, the recognition received by the colleagues, the degree of social influence, and the participation in academic associations. Other conditions are mainly objective qualifications of attending physicians. Although they have a discreet nature and do not truly share mechanisms that justify aggregating them as a reflective construct, we can produce a formative index so to depict the average favorability of the whole set of conditions that we placed in this category. Thus, these indicators will be treated as an overall formative index. At the same time, since these abilities belong to the competency index system, we did not put them into the control variables.

Work engagement was measured with Schaufeli et al. (2006) Utrecht Work Engagement Scale (UWES) that comprehends three dimensions (vigor, dedication, and absorption), each measured with three items, totaling 9 items as follows. The first dimension, Vigor, was measured with the following items: "1. At my work, I feel bursting with energy", "2. At my job, I feel strong and vigorous", and "3. I am enthusiastic about my job". The second dimension, Dedication, was measured with the following items: "4. My job inspires me", "5. When I get up in the morning, I feel like going to work", and "6. I feel happy when I am working intensely.". And the last dimension, Absorption, was measured with the following items: "7. I am proud of the work that I do", "8. I am immersed in my work", and "9. I get carried away when I'm working". The confirmatory factor analysis of this structure showed unacceptable ft indices (X^2(24)=214.210, Normed X^2=8.925, CFI=0.871, TLI=0.807, RMSEA=0.209 CI90 [0.184; 0.235] PClose=0.000; SRMR=0.0747). Considering the high covariances found between the dimensions, a second order factor structure was tested but some Haywood cases were found, thus indicating its unsuitability. Following recommendation by Brown and Moore (2012) we have conducted an exploratory analysis by using principal component analysis which showed a fusion between dedication and absorption dimensions. This analysis showed valid indicators (KMO=0.889, 0.859<MSA<0.928, Bartlett X^2(36)=1483.916) with all commonalities above .500, and accounting for 79.3% of variance after rotation (Varimax). Table 5.1 shows the loadings and respective reliabilities for both factors indicating high levels of reliability as well as high levels of convergent validity. Additionally, we have computed the discriminant validity indicator HTMT which showed 0.737, thus clearly below the threshold for strict discriminant validity. Considering all the technical data, this scale is usable for future analysis in its current fused form.

Table 5.1 Rotated factor matrix Work Engagement

Items	Absorption-Dedication	Vigor
A2 I am immersed in my work.	**.881**	.299
A3 I get carried away when I'm working.	**.853**	.228
D2 When I get up in the morning, I feel like going to work.	**.793**	.357
D3 I feel happy when I am working intensely.	**.759**	.342
A1 I am proud of the work that I do.	**.694**	.401
D1 My job inspires me.	.318	**.879**
V2 At my job, I feel strong and vigorous.	.333	**.868**
V3 I am enthusiastic about my job.	.328	**.867**
V1 At my work, I feel bursting with energy.	.347	**.829**
Cronbach alpha	.900	.942
Average Extracted Variance (AVE)	.803	.684

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Items	Absorption-Dedication	Vigor

a. Rotation converged in 3 iterations.

Perceived organizational support was measured with Eisenberger (1986) six items chosen by Eisenberger et al. (2001) that measure a single factor: My organization takes pride in my accomplishments at work", "My organization really cares about my well-being", "My organization values my contribution to its well-being", "My organization strongly considers my goals and values", "My organization shows little concern for me", and "Help is available from my organization when I have a problem". The negative worded item was reversed and te confirmatory single factor test showed this item had a very poor loading. After removal of the item, the CFA showed acceptable fit indices ($X^2(5)=7.282$, Normed $X^2=1.456$, CFI=.998, TLI=.996, RMSEA=.050 CI90 [.000; .123] PClose=.423; SRMR=.0112). The solution has high reliability (CR=.948) as well as convergent validity (AVE=.786). As shown in Figure 5.4.

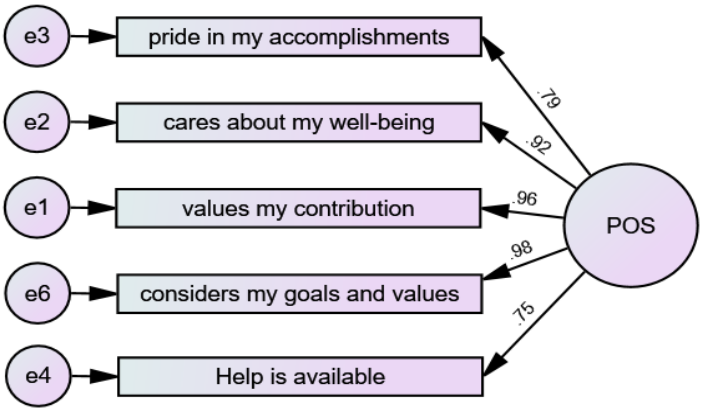

Figure 5.4 CFA for perceived organizational support

Performance was measured with the point system in use by the hospital to rate professional contribution of the attending physicians. The overall performance results from a formal system of evaluation combined the post requirements to comprehensively assess and evaluate the work behavior, work attitude, work quality and work effect of the staff. The evaluation contents included: 1) Physician qualification files and authorization, qualification inquiry, assessment, qualification application and dynamic management. 2) Operation workload, discharge workload, operation workload, average hospitalization time, average hospitalization cost, anesthesia table times, anesthesia duration and other workload information management. 3) The management of work quality indicators such as drug proportion, consumption proportion, utilization rate of antibiotics, intensity of antibiotics uses, number of unplanned reoperation cases, number of elective surgical complications, and surgical proportion.

Control variables comprehended age (measured in continuous variable as the exact age of respondents) and gender (1=male, 2=female). As some of the possible control variables (work

tenure, professional title, education) were included in the conceptual model, they have a different status that precludes them from being treated as control variable.

5.5 Descriptive and Bivariate Statistics

Participants have an overall mean competence of 4.47 (SD=0.47) which places them at a high level as the maximum possible is 5. As this was answered by their direct supervisor meaning the sample is seen as being highly competent and quite homogeneous as regards this professional dimension. When considering its components, clinical technical competence, the values do not distance much from this grand mean. The lowest mean is observable in the TRL (M=4.28, SD=0.59) and the highest in the non-clinical technical competence (M=4.64, SD=.45). The average level of work engagement is also high across the sample (M=5.22, SD=.81 in a 6-point maximum scale). The participants describe their organizations providing a substantial level of support in the means of perceived organizational support (M=4.22, SD=.76).

The ascribed personality traits vary more among participants with the highest falling in work attitude and friendliness and the relatively lowest falling in extroversion and mental endurance. This means the direct supervisors acknowledge strengths in the work attitude as well as in the ability to promote positive friendly relations but also see attending physicians as being relatively more introverted as well as lower mental endurance, i.e. having high coping ability to deal with continuous stress or issues. As regards other domains comprehending features such as physical health, peer recognition, guanxi, or academic degree, the one that stands out is work tenure meaning the sample is experienced, followed by physical health and, mostly important, by peer recognition. The aspect that shows the lowest mean is “guanxi” (M=3.71, SD=1.03) and associative affiliation (M=4.13, SD=.83) both related to relationship.

The overall level of professional performance shows a mean score of 71.8 (SD=8.33) out of a maximum of 100 and the minimum observed in the sample falls down to 54.2 meaning that the sample is mostly taken as highly performing with some cases where the performance level is closer to the midscale and not so to the upper scale.

The bivariate statistics show some minor cases of correlations between age, gender and the variables in the conceptual model. The highest is observable between age and performance, suggesting older attending physicians have higher performance which could be also clarified by the positive correlation observed between work tenure and performance (r=.629, p<.01).

Overall competence shows many correlations, all positive. It is suggestive that the overall competence has strong correlations with work engagement (r=.653, p<.01), personality score

(r=.887, p<.01), with other features (r=.835, *p*<.01) and performance (r=.776, p<.01). Likewise, work engagement is strongly correlated with these variables namely with performance (r=.504, *p*<.01). When analyzing the overall pattern of correlations between performance and all the other variables, it is positive that all of these variables show positive correlation with performance, thus suggesting they all play a role in explaining it. These associations highly encourage the choice of the variables as predictors of performance, and overall it encourages the conceptual model proposed. As shown in Table 5.2.

Table 5.2 Descriptive and bivariate statistics

	Min-Max	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	30-60	44.1	5.8	--													
2. Gender	1-2	1.34	.47	-.103	--												
3. Compt	3.1-5	4.47	.47	.079	-.153*	--											
4. CTC4it	3-5	4.49	.51	.104	-.236**	.876**	--										
5. NTC4it	3-5	4.64	.45	.083	-.145	.881**	.774**	--									
6. MNG5it	3-5	4.49	.52	.089	-.138	.916**	.775**	.806**	--								
7. INT2it	3-5	4.43	.60	.079	-.009	.837**	.594**	.670**	.724**	--							
8. TRL4it	2.7-5	4.28	.59	.002	-.158*	.855**	.714**	.649**	.712**	.623**	--						
9. WEng9it	2.5-6	5.22	.81	.092	-.057	.653**	.545**	.594**	.638**	.561**	.519**	--					
10. AbsDed	1.2-6	5.12	.96	.094	-.061	.567**	.464**	.498**	.559**	.509**	.446**	.950**	--				
11. Vigor	2-6	5.35	.78	.070	-.038	.653**	.560**	.622**	.631**	.526**	.527**	.874**	.678**	--			
12. Pers	3-5	4.54	.45	.058	-.113	.887**	.742**	.800**	.820**	.730**	.780**	.676**	.589**	.673**	--		
13. PER1	2-5	4.20	.76	-.002	-.024	.742**	.576**	.575**	.704**	.691**	.668**	.562**	.516**	.519**	.780**	--	
14. PER2	3-5	4.77	.46	.111	-.080	.620**	.555**	.646**	.527**	.507**	.493**	.459**	.386**	.479**	.735**	.379**	--
15. PER3	3-5	4.73	.48	.143	-.175*	.658**	.567**	.694**	.586**	.529**	.518**	.424**	.345**	.460**	.766**	.443**	.805**
16. PER4	3-5	4.60	.57	.049	-.122	.742**	.658**	.645**	.694**	.553**	.689**	.614**	.542**	.599**	.815**	.554**	.598**
17. PER5	3-5	4.33	.63	-.007	-.105	.714**	.568**	.557**	.648**	.601**	.719**	.505**	.431**	.518**	.800**	.698**	.411**
18. PER6	3-5	4.63	.51	.013	-.076	.707**	.618**	.635**	.666**	.586**	.588**	.487**	.407**	.511**	.821**	.544**	.628**
19. PER7	3-5	4.57	.58	-.005	-.058	.742**	.587**	.687**	.699**	.603**	.665**	.622**	.556**	.598**	.847**	.629**	.535**
20. PER8	3-5	4.54	.56	.118	-.116	.703**	.613**	.717**	.666**	.529**	.572**	.604**	.527**	.601**	.819**	.517**	.556**
21. POS5it	1-5	4.22	.76	.031	-.063	.447**	.333**	.388**	.418**	.412**	.390**	.654**	.673**	.492**	.487**	.458**	.278**
22. OTHER	2.7-5	4.33	.51	.127	-.155*	.835**	.683**	.705**	.770**	.694**	.780**	.620**	.552**	.598**	.796**	.677**	.502**
23. QUA1	3-5	4.62	.55	.197**	-.162*	.651**	.642**	.658**	.622**	.455**	.498**	.492**	.421**	.501**	.609**	.387**	.443**
24. QUA2	3-5	4.41	.63	.164*	-.132	.575**	.501**	.438**	.539**	.450**	.567**	.373**	.322**	.376**	.525**	.435**	.276**
25. QUA3	1-5	4.34	.66	.001	.000	.553**	.379**	.414**	.505**	.509**	.576**	.377**	.327**	.378**	.487**	.500**	.210**
26. QUA4	3-5	4.43	.65	.062	-.002	.646**	.550**	.561**	.601**	.544**	.563**	.405**	.330**	.440**	.589**	.454**	.458**

27. QUA5	1-5	3.71	1.03	-.019	-.128	.478**	.349**	.325**	.392**	.455**	.528**	.425**	.419**	.348**	.457**	.489**	.214**
28. QUA6	3-5	4.56	.57	.072	-.149*	.748**	.647**	.708**	.713**	.572**	.638**	.515**	.456**	.502**	.733**	.552**	.583**
29. QUA7	2-5	4.28	.70	.137	-.137	.702**	.555**	.613**	.665**	.588**	.636**	.501**	.437**	.498**	.680**	.599**	.437**
30. QUA8	1-5	4.13	.83	.156*	-.142	.610**	.452**	.478**	.562**	.503**	.644**	.443**	.415**	.395**	.605**	.568**	.317**
31. QUA9	3-5	4.56	.60	.150*	-.198**	.720**	.642**	.690**	.676**	.590**	.561**	.655**	.568**	.656**	.732**	.507**	.567**
32. Perform.	54-89	71.8	8.33	.202**	-.182*	.776**	.759**	.682**	.716**	.581**	.662**	.504**	.436**	.507**	.643**	.547**	.400**

(Continuous)

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
--																
.568**	--															
.449**	.539**	--														
.623**	.636**	.599**	--													
.523**	.692**	.642**	.690**	--												
.663**	.639**	.636**	.592**	.661**	--											
.279**	.390**	.402**	.347**	.417**	.474**	--										
.572**	.659**	.659**	.597**	.674**	.691**	.480**	--									
.463**	.575**	.421**	.490**	.539**	.601**	.298**	.667**	--								
.311**	.470**	.470**	.396**	.436**	.503**	.284**	.752**	.549**	--							
.306**	.417**	.403**	.336**	.450**	.394**	.271**	.665**	.330**	.616**	--						
.433**	.497**	.450**	.478**	.464**	.532**	.337**	.718**	.483**	.491**	.477**	--					
.298**	.324**	.445**	.305**	.373**	.376**	.458**	.689**	.258**	.378**	.329**	.393**	--				
.649**	.583**	.551**	.567**	.607**	.615**	.322**	.786**	.508**	.554**	.489**	.550**	.369**	--			
.497**	.561**	.563**	.523**	.543**	.573**	.391**	.853**	.501**	.544**	.436**	.547**	.579**	.677**	--		

.412**	.482**	.579**	.386**	.545**	.484**	.322**	.805**	.426**	.526**	.500**	.440**	.544**	.588**	.747**	--	
.572**	.626**	.517**	.637**	.631**	.657**	.466**	.746**	.657**	.491**	.323**	.516**	.391**	.685**	.622**	.476**	--
.486**	.545**	.539**	.474**	.534**	.537**	.238**	.662**	.629**	.484**	.470**	.500**	.307**	.600**	.543**	.487**	.544**

*** $p<.001$; ** $p<.01$; * $p<.05$

5.6 Hypotheses testing

As stated, hypotheses were tested with PROCESS which means we will judge on the estimates on the direct, indirect and interaction effects to conclude about the empirical support given to hypotheses.

As regards the hypotheses pertaining to the direct effects in the conceptual model, we started by testing each of the domains of competency taken separately, namely the clinical technical competencies (CTC), non-clinical technical competencies (NCTC), management competencies (MNG), interpersonal competencies (INT), and Teaching-Researching-Learning competencies (TRL). Findings show significant estimates for the direct effect between all of the domains of competency and job performance. The strongest estimates of job performance were found for CTC, NCTC and MNG, thus rendering support to all hypotheses 1a. A similar scenario was found for personality, which has significant estimates with both job performance, thus supporting H1b, as well as for the other personal features which supports H1c. This gives overall support to Hypothesis 1: Competencies have a positive direct effect on job performance.

Likewise, all the direct effects between competencies and work engagement have also significant estimates thus fully supporting hypothesis 2a. As regards personality and other personal features, the estimates are also positive and significant thus supporting H2b and H2c respectively. This offers overall support to Hypothesis 2: Competencies have a positive direct effect on work engagement.

Closing the direct effects analysis, findings for the relation between work engagement and job performance, show the estimate is always significant and positive (with small variations due to the specific configuration of the estimated model) and this fully supports hypothesis 3: Work engagement has a positive direct effect on job performance.

The indirect effect that has been hypothesized based on the expected positive relationship between competencies and job performance through work engagement, was tested for all the competencies, personality and other personal variables as predictors. In all accounts, the estimates were found to be significant and positive, thus supporting all the sub-hypotheses H4a, H4b and H4c and, therefore, the overall hypothesis 4: There is a positive indirect effect of competencies on job performance through work engagement.

As regards the hypothesized moderator role of perceived organizational support, estimates were firstly computed for the dimensions comprehended within competencies variable. Hypothesis 5 and its respective sub-hypotheses, establish a positive interaction effect in the

direct path linking competencies and job performance. For all the domains of competency, such interaction effect was indeed observed to the exception of TRL (1.95, BootSE=1.06, CI95[-.15; 4.29]). This mostly supports hypothesis H5a to the exception of the case of TRL.

As the interaction effects have all similar moderation graphs, we show – for simplicity's sake – the overall competence average crossed with perceived organizational support figure (Figure 5.5).

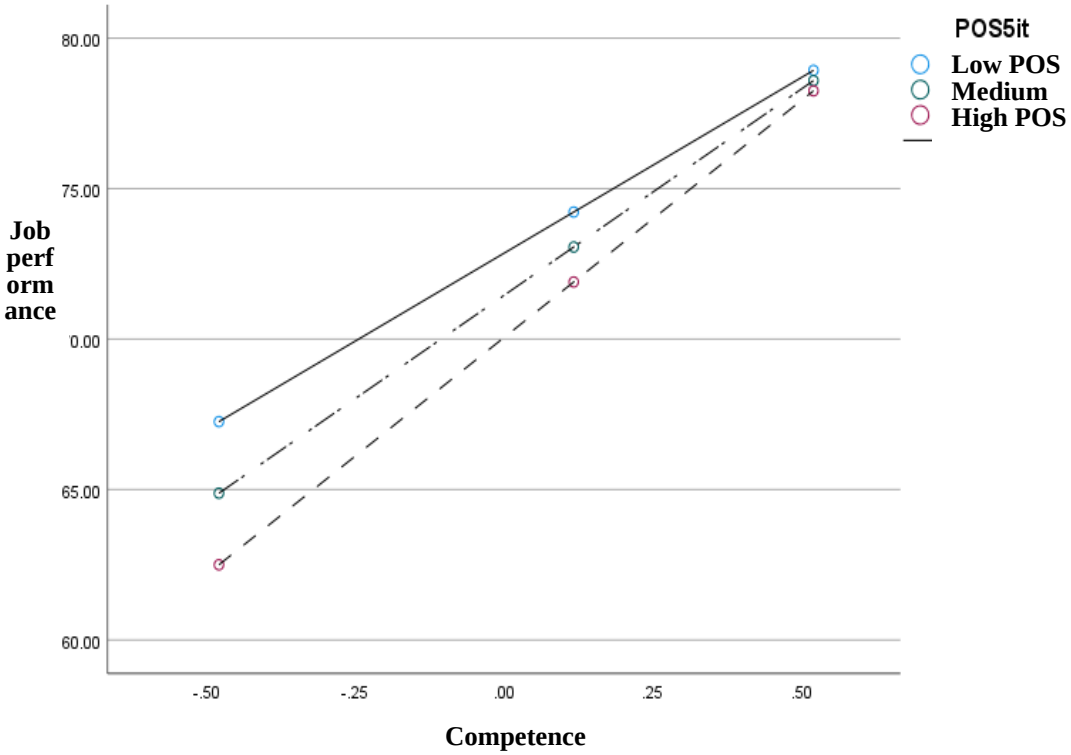

Figure 5.5 Moderation Competencies*POS to explain job perform

As regards the same interaction effect for personality and for other personal variables, estimates show significant and positive which renders support to both Hypotheses 5b and 5c respectively. This partially supports hypothesis 5: Perceived organizational support moderates the direct effect of competencies on job performance in such a way that when perceived organizational support is higher, the effect is stronger.

The other hypothesized moderation effect of perceived organizational support was expected to occur in the path linking competencies to work engagement. This was established in hypothesis 6. For all the domains of competency, such interaction effect was indeed observed which fully supports hypothesis H6a (Figure 5.6).

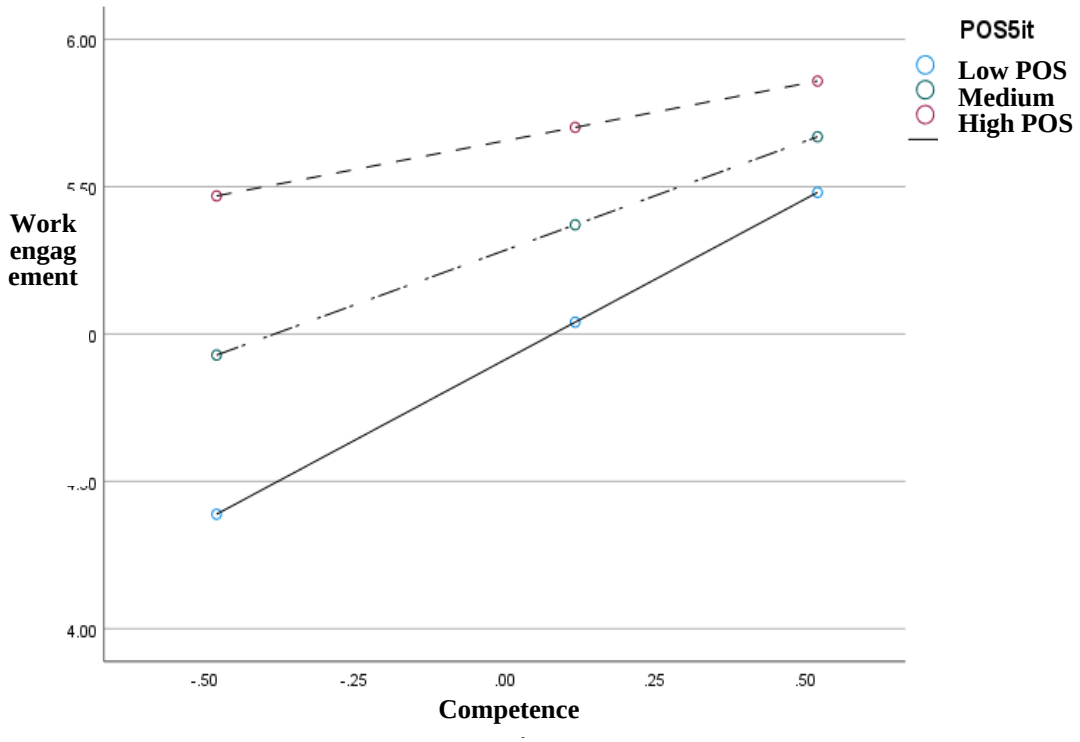

Figure 5.6 Moderation Competencies*POS to explain work engagement

As regards the same interaction effect for personality and for other personal variables, estimates show significant and positive which supports Hypotheses 6b and 6c respectively. This fully supports hypothesis 6: Perceived organizational support moderates the direct effect of competencies on work engagement in such a way that when perceived organizational support is higher, the effect is stronger.

Putting all the hypotheses together, and because there are both mediation effects as well as moderation effects, we proceed to test the moderated mediation effect. Estimates for all the cases, shown in Table 5.3, do show significant as the confidence intervals at 95% never include the zero value. This fully supports hypothesis 7： Perceived organizational support moderates the indirect effect of competencies on job performance in such a way that when perceived organizational support is higher, the indirect effect is stronger.

Table 5.3 Direct, indirect and interaction effects

Dependent variable	Work Engagement					Performance				
	B	SE	t	BootLLCI	BootULCI	B	SE	t	BootLLCI	BootULCI
Direct effects										
Constant	4.96	.33	14.72	4.30	5.63	49.55	4.78	10.34	40.10	59.01
CTC -Clinical Techn. Comp.	.54**	.08	6.38	.37	.71	10.96**	.90	12.14	9.18	12.74
Perceived_Org._Support	.56**	.05	10.09	.45	.67	-1.38*	.66	-2.08	-2.69	-.07
Work_Engagement						2.66**	.71	3.71	1.24	4.08
Interaction effect										
CTC*POS	-.37**	.09	-3.75	-.56	-.17	3.25**	.97	3.34	1.33	5.17
Indirect effect						1.45	.52		.51	2.53
Index moderated mediation						-.98	.49		-2.06	-.13
$\mathbf{R^2}$	59%					64%				
Direct effects										
Constant	5.04	.32	15.34	4.39	5.68	49.39	5.47	9.02	38.59	60.19
NCTC -NonClinTechn. Comp.	.64**	.09	6.85	.45	.82	10.72**	1.14	9.33	8.45	12.99
Perceived_Org._Support	.51**	.05	9.17	.40	.62	-1.42	.73	-1.93	-2.88	.02
Work_Engagement						2.89**	.82	3.51	1.26	4.51
Interaction effect										
NCTC*POS	-.45**	.11	-4.08	-.66	-.23	3.29**	1.25	2.62	.81	5.76
Indirect effect						1.86	.68		.56	3.22
Index moderated mediation						-1.30	.71		-3.03	-.26
$\mathbf{R^2}$	61%					55%				
Direct effects										
Constant	4.92	.31	15.42	4.29	5.55	54.19	5.31	10.19	43.70	64.68
MNG Management Comp.	.63**	.09	7.84	.47	.79	10.22**	1.01	10.03	8.21	12.23
Perceived_Org._Support	.47**	.05	8.52	.36	.58	-1.49*	.71	-2.08	-2.91	-.08
Work_Engagement						2.20**	.82	2.28	.58	3.83
Interaction effect										
MNG*POS	-.37**	.09	-4.16	-.55	-.19	2.27*	1.02	2.22	.25	4.29
Indirect effect						1.39	.59		.30	.2.64
Index moderated mediation						-.82	.44		-1.83	-.13
$\mathbf{R^2}$	63%					57%				
Direct effects										
Constant	5.01	.34	14.48	4.33	5.70	47.19	5.66	8.32	36.01	58.37

Dependent variable	Work Engagement					Performance				
	B	SE	t	BootLLCI	BootULCI	B	SE	t	BootLLCI	BootULCI
INT Interpersonal Comp.	.41**	.07	5.32	.26	.57	6.84**	.93	7.35	5.01	8.68
Perceived_Org._Support	.52**	.05	8.80	.40	.64	-1.79*	.79	-2.26	-3.36	-.23
Work_Engagement						2.20**	.82	2.28	.58	3.83
Interaction effect										
INT*POS	-.23**	.08	-2.92	-.39	-.07	2.40**	.90	2.65	.61	4.19
Indirect effect						1.61	.53		.65	2.79
Index moderated mediation						-.91	.54		-2.33	-.16
$\mathbf{R^2}$	56%					48%				
Direct effects										
Constant	4.79	.35	13.67	4.10	5.48	44.06	5.11	8.60	33.96	54.17
TLR Teach-Learn-Res Comp.	.40**	.07	5.33	.25	.56	7.95**	.83	9.48	6.30	9.61
Perceived_Org._Support	.57**	.05	9.73	.45	.69	-2.07*	.74	-2.79	-3.54	-.06
Work_Engagement						3.47**	.76	4.51	1.95	4.99
Interaction effect										
TLR*POS	-.36**	.10	-3.60	-.56	-.16	1.95	1.06	1.82	-.15	4.29
Indirect effect						1.42	.46		.56	2.40
Index moderated mediation						-1.27	.55		-2.35	-.18
$\mathbf{R^2}$	55%					55%				
Direct effects										
Constant	4.94	.31	15.62	4.31	5.56	48.49	5.66	8.56	37.32	59.66
PER Personality	.72**	.09	7.32	.53	.92	11.04**	1.30	8.44	8.46	13.62
Perceived_Org._Support	.48**	.05	8.53	.37	.59	-2.43**	.77	-3.12	-3.96	-.89
Work_Engagement						2.99**	.87	3.42	1.27	4.72
Interaction effect										
PER*POS	-.44**	.11	-3.60	-.67	-.21	5.00**	1.39	3.58	2.24	7.75
Indirect effect						2.17	.74		.69	3.63
Index moderated mediation						-1.32	.62		-2.66	-.22
$\mathbf{R^2}$	63%					42%				
Direct effects										
Constant	5.09	.34	14.98	4.42	5.77	48.80	5.57	8.92	38.79	60.81
OTH Other	.59**	.08	6.67	.42	.77	9.12**	1.08	8.37	6.97	11.27
Perceived_Org._Support	.49**	.06	8.15	.37	.61	-2.32**	.76	-3.02	-3.83	-.80
Work_Engagement						3.17**	.82	3.86	1.55	4.79

Dependent variable	Work Engagement					Performance				
	B	SE	t	BootLLCI	BootULCI	B	SE	t	BootLLCI	BootULCI
Interaction effect										
OTH*POS	-.34**	.10	-3.34	-.54	-.13	2.37*	1.13	2.09	.13	4.62
Indirect effect						1.90	.68		.68	3.30
Index moderated mediation						-1.08	.53		-2.15	-.06
R^2	58%					52%				

5.7 Discussion and conclusion

This study is designed to test the predictive validity of the proposed attending physicians' competencies framework while also testing an explanatory model that takes work engagement as the mediator mechanism and also perceived organizational support as the context variable i.e. a moderator. For this purpose, several sources of data were mobilized (i.e. the department directors, the attending physicians, and archival job performance data) to build a moderated mediation model). It comprehends seven hypotheses, with the first three stating direct effects between the main variables, and the fourth integrating those by stating an indirect effect. The fifth and sixth hypotheses bring into the model the interaction effect between competencies and perceived organizational support and job performance, and work engagement, respectively. The last hypothesis integrates all the previous one into the overall moderated mediation model.

As regards the hypothesized direct effect between competencies and job performance, findings did support the expected associations and showed a strong correlation. The higher an employee's competence is, the higher their work performance will be. Many studies in other fields have demonstrated a relationship between the two (Khan et al., 2015; Luna Arocas & Morley, 2015; Swanson et al., 2020) and our findings are no exception.

Clinical technical competence, non-clinical technical competence and management competence have the strongest positive correlation with job performance, which is consistent with the results of our previous study 1B, in which we scored the importance of each indicator through Delphi method. Attending physicians are firstly expected to have technical knowledge about the clinical issues they face each day i.e. they are expected to excel in their ability to diagnose correctly and treat, to provide first aid, and in their theoretical clinical knowledge as well as in surgical ability (whenever applicable). Without this, it is utterly impossible that any patient would trust their health to a physician. Therefore, it is rather unsurprising to find that clinical technical competencies have the strongest association with job performance. Although the competence system of the attending physician includes various abilities, the clinical technical ability, especially the diagnosis and treatment ability, is still the most basic and critical ability of an attending physician. The attending physician is the technical representative and authority of the attending group, and the primary factor for patients to choose a certain attending group is the medical skill of the attending physician, which well explains why clinical competence is the most correlated with performance. Similarly, nursing ability, as the core competence of nurses, is closely related to performance (Tzeng, 2004).

Likewise, non-clinical technical competencies comprehend the ability to communicate clinical issues, the humanistic care and the professional ethics, which are also critical to the medical profession. At present, the medical mode is shifting from disease-centered to patient-centered (Hurwitz & Vass, 2002). Doctors should not only care about treating diseases, but they must take strong attention to the communication with patients and their families during treatment. At the same time, the psychological status of patients should also be considered. Humanistic care for patients by doctors is becoming more and more important, which is an important aspect to improve the treatment effect, improve patient satisfaction, reduce doctor-patient disputes, and is closely related to work performance. The nursing profession and community health care practice need to understand a lot about emotional perception, social skills or the ability to manage one's own emotions and the caring ability to communicate others' emotions. Training in this area can effectively improve the clinical performance of nurses (Ramadan et al., 2020).

Lastly, management ability emerged also as an important competency as attending physicians have such responsibilities over their teams. In addition to clinical work, the attending physician is also the direct manager of the attending group, and is responsible for the medical business management of the attending group. The attending physician should evaluate the professional skills of the staff in the group and distribute performance-based salary, coordinate and solve work conflicts among the members of the group, so as to achieve better cooperation among the members. Reasonable scheduling and distribution of human resources, materials and other resources according to work tasks (Ying et al., 2021). Their management ability will greatly determine the number of patients accepted by the attending group, thus affecting the performance of the attending physicians. Still, the importance of management competencies indicates that being able to organize work, to coordinate the work of others, to cooperate fully with the team while having a notion of benign competition, and being able to lead the team is central to be acknowledged as a competent attending physician. This importance is stressed by both the expert consensus findings as well as those resulting for this conceptual model quantitative empirical test.

Another expected effect concerns the exploration of the mechanism that can link competencies to job performance. In our case, the theoretical option targeted work engagement because of its attributed important role in motivating workforce (Schaufeli & Salanova, 2007). Although there are reports of positive, negative and insignificant associations between work engagement and some outcomes (Knight et al., 2017), according to the results of our study, there is a direct positive association between competencies and work engagement, and there is

also a significant positive relationship between work engagement and job performance, suggesting that in addition to the direct relationship, competencies can indirectly affect job performance by acting on work engagement. This finding is in line with a study on the competence and performance of leaders (Wei et al., 2018), that reported the mediating role of work engagement as well as Alessandri (2015) that found that work engagement partially mediated the relationship between positive orientation and job performance. This has been also supported by the systematic literature review authored by Keyko et al. (2016).

As an important variable in HRM (Mayes et al., 2017), organizational support has been chosen as a possible moderator because it can be conceived as so (Côté et al., 2021; Guo et al., 2017) especially because our independent variable as a within-individual nature (i.e. competencies). Our results support such moderating effect of perceived organizational support on the relationship between competencies and job performance although the exact direction of this effect was unexpected. In interpreting the moderation graph we can see that whenever physicians have high competency, the degree of organizational support does not really make much of a difference in their job performance. However, it does a difference when the physicians are reported as having a relatively lower competence. The surprising finding is that the higher levels of performance for such individuals occur when they report lower levels of perceived organizational support. Conversely, those who report higher levels of organizational support have lower performance. A possible explanation lies in what one does when one does not to have strong competency while also counting on organizational resources to compensate for such relative shortage. Intuitively, perceiving stronger support would translate into compensating for lower competency levels but judging from our findings, individuals may rely on the benevolent character of the organization not to push themselves into higher levels of performance. This could be interpreted as an indolence effect also known as social loafing (Simms & Nichols, 2014). Another explanation relies in a professional dynamic where tenured physicians tend to do less surgeries compared to newer physicians and thus this could determine a relative lower performance evaluation point while also not truly giving as much importance to organizational support as the newer physicians, that struggle more to achieve higher performance levels and are more sensitive to perceived organizational support. Still, correlations seem not to offer empirical support to this interpretation although unreported findings that compared means between tenure groups via ANOVA indicate otherwise. Thus, the indolence hypothesis is the apparent explanation for this finding.

As regards the second interaction effect hypothesized, it was also found and follows the expected direction as the higher perceived organizational support is, the stronger the association

between competency and job performance. Likewise, when individuals report having stronger levels of competency, the level of organizational support they received does not change much their job performance. When they are reported as having less competencies, they do benefit from having higher organizational support to build a stronger sense of engagement with their work. We must stress that these findings control for age and gender and thus this phenomenon should be expected independently of gender and age.

The last findings, concerning hypothesis 7, are the ones with the higher importance in this empirical study as they pertain to the overall model. Results from the moderated mediation effects tested for all the competencies and individual features do show a significant coefficient. Being this a negative coefficient, it is interpreted as indicating that individuals that experience higher sense of organizational support will produce higher job performance via a stronger sense of work engagement. The interaction effect is in line with that observed in explaining work engagement and opposite to the one explaining job performance which means that the positive compensating effects of organizational support override the eventual indolence effect.

An interesting finding pertains to the lack of interaction between teaching-researching-learning competency with perceived organizational support into explaining job performance. Apparently, the level of support plays no role into explaining how much this competency fosters performance as if the main effect is so strong that is not subjected to contextual moderation. We must conclude that work engagement is mediating part of the effect of competencies on attending physicians' job performance and that perceived organizational support do makes a difference mostly in those that have relatively lower levels of competency. We must also conclude that the overall set of competencies do not differ much in these relations to the exception of teaching-researching-learning competency that has only the direct and indirect effect upon job performance without being sensible to perceived organizational support.

These findings must be interpreted while considering the study's limitations. We have both theoretic and methodological limitations. The first one concerns the relatively simplistic nature of the model as other important variables can be considered to explain the relationship between competencies and job performance, job satisfaction. Likewise, by using an existing performance appraisal system we cannot ascertain to which extent other tacit dimensions of the attending physician may be taken into consideration in the mind of the evaluator and we must accept the measurement error to reflect some inner implicit conception of competency profile that might not match ours. Because this study is based on a newer competency evaluation index (Study 2) it may be mostly useful for future attending physicians' performance management and they may be selected based on these criteria and thus be more aligned with what is expected

as regards performance. Methodologically, although the data sample is expressing dyads (supervisor-physician) it is quantitatively relatively modest to test interaction effects. Still the model is capable of accounting for a substantial amount of variance of performance.

Future research may benefit from exploring the unexpected possible social loafing effect that may explain the unexpected direction of the first interaction with perceived organizational support in explaining job performance. Future research may also benefit from including other moderators such as hospital organizational culture, and consider important human resource practices such as high-performance work system (Gittell, 2009) or some specific focus on medical career management. Likewise, it would be important to extend this study to other hospital settings to ascertain its universal validity.

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Chapter 6: General Conclusion

This research was designed within the scope of general healthcare service improvement policy in China by targeting an emerging and important healthcare group: attending physicians. These professionals are pivotal into assurance of medical service quality because they are in charge of all the decisions that pertain to the patient's needs, namely outpatients, admission, clinical diagnosis and treatment, surgeries, discharge, and also manage the team to offer guidance and thus, leadership, in the whole process. It is therefore, a complex and critical function for hospitals worldwide.

As in any highly-qualified job, the human resource practices must ensure that the highest level of competencies is developed and acknowledged in selection processes, training decisions, career moves, compensation and performance management. Without this guarantee of competencies there cannot be a streamlined and effective healthcare management. The more complex the positions are, the more demanding their management should be. Therefore, considering the complexity of this attending physician position, there should be an expectation of highly rigorous and scientific approach to their recruitment and selection, performance appraisal, continuous education and other HR responsibilities.

As an emerging professional position in China, it is quite natural that the system is still fine tuning and implementing more professional approaches to their management. Traditionally the choice of such professionals relies in qualifications, which is an obvious criterion. However, it may not suffice as the key-construct in professionals is "competency". This can be taken as a professional currency which links to employability and performance. However, another feature of emerging professional positions is that, at the beginning, there is no reliable competency framework, and attending physicians are not an exception. So, it is imperative that a scientific-based competency framework for attending physicians is developed and made available. This is the main motivator for this research.

The methodological approach to the empirical studies considers Z. Liang et al. (2018) recommendations although there is no gold standard and substantial disarray in developing competency frameworks in healthcare has been reported by Batt et al. (2020).

From the first study we conclude that there are seven competencies at level 1 which comprehend 35 competencies at level 2 that makes a list of 42 total indicators. This gathered

the consensus of 20 experts involved in the Delphi analysis and per se represent already a step towards providing such competency framework to the improvement of the healthcare management system as regards attending physician workforce. Because not all competencies are equally important in the daily job of attending physicians' study 2 was devised, based on a survey on 406 stakeholders to identify how important each level-1 competencies and attributes are for the attending physician functions. This study reports findings from a multistakeholder approach involving hospital managers, attending physicians, scholars, patients and subordinates. These findings highlighted the relative importance of each competency and attribute for several relevant decisions (to hire, to choose as team mate, to choose as personal physician, to anticipate overall competence, to follow as a leader) and it closed the required data to build a final competency evaluation index. These findings are instrumental for anyone that wants to implement a competency-based management for attending physician position, independently of wanting to choose amongst potential applicants, to conduct performance appraisal, to identify training needs, to design and implement continuous medication education programs for these positions, to define the suitable level of compensation according to difficulty and competency profile, to promote among other HR functions.

Still, although this framework gather consensus and is seemingly ready for deployment, it must be tested empirically to ascertain its true ability to predict performance (study 3). This last empirical study offered not only a test of predictive validity as it also contributed to exploring some nomological relationship with possible mediator mechanisms, namely work engagement. It also considered context as possible modulating force, by including in the model perceived organizational support as a moderator. Findings, do corroborate globally the proposed conceptual model, thus showing: 1) that the competency framework is able to predict job performance (and with a high explanatory power, judging from the account variance), 2) that work engagement is indeed a mediator and should be monitored, and 3) that perceived organizational support was mostly instrumental in the cases of lower competency, where it leverages work engagement albeit it has a counterproductive effect in the direct effect with job performance. Still, comparing both divergent effects showed that positive effect prevail in the moderated mediated model. Independently of these details, overall, we can conclude that the proposed framework is robust in depicting the main competencies of attending physicians, that it can be used for managing and increasing the professional level of the entire healthcare system.

This research offers some theoretical and applied contributions which we would like to stress. Firstly, being a relatively recent medical role in China, the attending physician was not yet profiled as regards required competencies. By testing its predictive value of job performance

including a process-like variable such as work engagement, this study adds to extant theory highlighting how work engagement can also be given a functional role in this occupation. The analysis of organizational support also adds to extant knowledge by showing it is mostly important to those that have lower levels of competency and not so relevant for those that have higher competency. The theoretical value of moderated mediated models cannot be understated as they are closer to reality depicting both process and context. Secondly, the applied contribution is quite clear. Future use of this competency evaluation index can capitalize by applying it to select physicians for this position but also develop a performance evaluation system and a systematic monitoring procedure that closes the circle in profiling-monitoring-evaluating for attending physicians, thus optimizing their overall contribute for hospital performance. Likewise, the specific list of competencies in our framework can be rightfully used to guide selection, training needs evaluation and standard training and development programs designed for attending physicians.

A parallel contribution relates with the increasing importance of research in hospitals as this has been paramount both to the performance appraisal as well as to the accreditation of hospitals. Findings show, on the one hand that these are not considered top competencies by the stakeholders but on the other hand that they seem to exert a direct relation with performance without sensitivity to context (perceived organizational support) which may be interpreted as being taken tacitly as so important that everyone should strive to achieve output in this domain. It is thus important that future studies focus on how competencies and their relative importance change with time, how they can be made compatible without tradeoffs (for example, experiencing less pressure for a high clinical competence and higher for research competence) which would translate into failing on the patient high need for healthcare. This balance is very important as both clinical practice and research should be done with the priority of improving service to the patients and society.

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Annex A: The Interview Outline

Firstly, introduce ourselves, and explain the purpose and form of this interview (this interview is up to 40 minutes research on the post competence of attending physicians).

1.The basic information (Name, gender, age, working time, the title of technical post, position, department and role)

2. Your understanding of the post of attending physician (what do you think are the tasks and responsibilities of an attending physician?)

- keep in mind the clinical (treating patients / diagnosing / communicating-advising / monitoring patients / referring patients / supervising
- keep in mind the non-clinical (researching, teaching, bureaucratic-administrative)

3.What do you think about the current selection method for attending physicians? (you know that no system is perfect and so...) What improvements would you suggest?

4. Think about an excellent attending physician. Let's call his/her a talent. How much do you think the performance appraisal system is able to identify and fairly distinguish that excellence level of talents from other normal / average attending physician?

5. What do you think are the competencies or personal characteristics that the performance appraisal system is mostly valuing today?

6. If you would have to design a performance appraisal system as well as a selection system from the zero, what competencies would you recommend to be used as criteria to select / evaluate talented attending physicians? Take full account of personal abilities, external conditions and personal characteristics (personality, attitude, social contacts, relationships). Please list as many as possible in order of importance (clinical, non-clinical).

7. What basic skills or requirements do you think may not be very important, but absolutely cannot be lost?

Annex B: Dictionary of the Attending Physician's Duties in Table 3.2

Category	Definition	Examples
Treatment	Use scientific and reasonable methods to cure various diseases	"The attending physician's primary duty is to cure disease and save lives" "I think the primary job of the attending physician must be treating people"
Diagnose	Observe and inquire about the patient's condition, analyze records, reports, test results, or examination information to diagnose medical condition or disease situation of patient	"The premise of the attending physician is to diagnose the disease" "The attending physician should diagnose the disease according to the description of the patient and his own observation, combined with the examination results"
Follow-up	The hospital or medical care institution has been in the hospital patients by communication or other means, to understand the patient's condition changes and guide the patient's rehabilitation observation method	"The attending physician is responsible for every step from the patient's arrival to discharge and follow-up"
Operation	Surgical excision, suturing, or repair of a patient's body with a medical instrument to improve the functioning of a diseased or injured body part or system	"For a surgeon, surgery is the most important job that occupies the most time"
Intensive care	Careful and continuous attention given to critical patient cases.	"The attending physician should take good care of the critically ill patients in his group"
Referral	Refer patient to medical specialist or other practitioner when necessary.	"Some patients who are not suitable for this group should be transferred to other groups or hospitals according to their condition" "Referral is sometimes made by the attending physician"
Monitor patients' conditions	Monitor patients' conditions and progress and reevaluate treatments as necessary.	"The attending physician should make ward rounds every day, review the data of the patients in the group, and check the results"
Clinical communication	Two-way communication with patients or family members by listening, responding, expressing and explaining to accurately and effectively exchange information, obtain patient history information and needs, explain medical procedures or	"Face the patient on a daily basis, talk to the patient, explain treatment options and their effects and risks, and analyze the situation with the patient"

Category	Definition	Examples
	examination results, and provide health care or treatment advice	
Non-clinical communication	communicate with colleagues and leaders in daily work.	"The attending physician should keep up with subordinates and communicate with them, report work at any time, convey hospital requirements to subordinates, and establish a good cooperation mechanism with other departments"
Humanistic care	On the basis of fully understanding the value of human life, doctors care for, cherish, respect others, Revere life, and are able to put themselves in others' shoes and pay attention to others' feelings, which is reflected in caring consciousness, empathy ability and caring behavior	"The attending physician should always pay attention to the mental health of patients and listen to their demands"
Patient management	comprehensive management of the whole process from patient's visit to admission, discharge and follow-up	"The attending physician should have a comprehensive understanding of the patients in the group and manage the surgical arrangements of the patients as a whole. When can the patients be discharged"
Team task coordination	Distribution of workload (who does what), setting work procedures (how and when to do it), setting task articulation within teams (how to deal with interdependencies).	"The attending physician should reasonably arrange the division of tasks among the group members according to their abilities"
Team relationships coordination	Coordinate internal interpersonal relationship, solve interpersonal conflict within the group, maintain a harmonious and united internal environment	"As a manager, a very important job of the attending physician is to maintain unity within the group, coordinate the interpersonal relationship among the members of the group, and avoid interpersonal conflicts"
Scientific research	Use scientific research means and equipment to conduct a series of activities such as literature research, investigation and experiment	"Under the leadership of the director of the department, specific scientific research work is completed, and the attending physician should also take the initiative to carry out scientific research"
Teaching	Teach group members, trained physicians and interns	"The attending physician shall teach and impart knowledge to junior physicians and interns in the group"
Learning	Always learn cutting-edge diagnosis and treatment technology and medical knowledge	"Medicine is a rapidly developing profession, and the attending physicians should keep abreast of the cutting-edge knowledge and keep pace with The Times"
Performance distribution	Distribute the labor remuneration of the members of the group	"The attending physician is responsible for the secondary

Category	Definition	Examples
		allocation of the bonus awarded by the hospital to this group”

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Annex C: Dictionary of Categories in Table 3.3

Category	Definition	Examples
Formal selection system	Standardized set of procedures, criteria and systematic rules aimed to select the best fitted applicants.	“ At present, there is no formal selection process and standard in the hospital, only a simple appointment process of attending physicians and some objective conditions”
Written procedures	A selection process officially announced in official documents	“ At present, there is no formal selection process and standard in the hospital, only a simple appointment process of attending physicians and some objective conditions”
Written criteria	Selection criteria or basis officially published in official documents	“ At present, there is no formal selection process and standard in the hospital, only a simple appointment process of attending physicians and some objective conditions”
Standardized tests	An official selection examination organized by an official organization	“ The hospital did not organize a selection exam for attending physicians”
treatment ability	The ability to accurately diagnose the disease and use the most effective treatment to solve the health problem	“ The attending physician must have strong professional competence”
theoretical knowledge	Professional theories and knowledge required for diagnosis and treatment	“ The attending physician should have complete professional knowledge”
Clinical communication ability	In the process of communication with patients and their families, doctors can effectively express, explain, listen to and respond to information exchange accurately and effectively and manage their own emotions through language, behavior, manner and text	“ The attending physician must be able to communicate with the patient” “ The attending physician must be able to work with patients” “ Some doctors perform surgeries well, but do not communicate with patients, resulting in low patient satisfaction and more doctor-patient disputes”
Clinical technical competence	Ability of medical profession in clinical diagnosis and treatment	
Clinical non-technical competence	Ability that does not belong to medical profession in clinical diagnosis and treatment	
cooperation ability	Team spirit, obey the overall arrangement of the team, and be able to properly handle the work with team members, cooperate with team members, and promote the achievement of team goals (cooperation between myself and colleagues of the same level)	The attending physician is a member of a team and must be a team player

Category	Definition	Examples
professional ethics	The moral standard and behavior ethics that medical workers should follow in medical practice	The attending physician must have medical ethics Do not do anything against the ethics of a doctor
management competence	As a manager, I have the ability to set team goals, reasonably allocate team resources, coordinate team relations, improve team cohesion, create good conditions and environment for the normal operation of the team, guide and motivate the team to achieve goals, including planning, organization, leadership, control and other elements.	The management of the attending group is an important dimension to reflect the level of the attending physician
Coordinated ability	Ability to coordinate and resolve the relationship and work conflict between team members, so that members can better cooperate	The attending physician must be able to handle conflicts between team members when they arise
Interpersonal competence	In social life, people communicate with others, connect feelings, enhance friendship, thus establishing a wide range of social connections.	“ The attending physician's interpersonal skills are very important”
Non-clinical communication ability	Ability to communicate with colleagues and leaders in daily work	“ The attending physician should be able to deal with leaders and communicate effectively with other colleagues on a daily basis”
Personal traits	The inherent character, qualities, values, etc of a person	“ Some people just do not have the right personality to be a leading physician”
Work attitude	Be conscientious and dedicated to his work and patients	“ The attending physician must have correct working attitude and sense of responsibility”
Superior recommendation	having been formally recommended by his superiors to be the attending physician	In our hospital, the attending physician should be recommended by the head of the department
social relations	Better social resources (such as relatives in high positions) help them become successful in informal ways	Someone from a good family background may easily become an attending physician
Recognition of colleagues	In colleagues have a good reputation, recognized by colleagues	“ There are colleagues who are willing to join him in the attending medical team”
professional titles	A unique Chinese rating system that reflects an individual's professional skill level	In my opinion, under China's unique system, professional title is still an important basis for the selection of attending physicians
years of working	Years of relevant work in the hospital	Older people may be given priority to become the attending physician
Academic Degree	A rating that reflects an individual's level of education	The selection of attending physicians will be based on those with higher education Some people with PHDS are promoted to chief physicians in the first few years

Annex D: Dictionary of Categories in Table 3.4

Category	Definition	Examples
Clinical technical competence	Ability of medical profession in clinical diagnosis and treatment	
Treatment ability	The ability to accurately diagnose the disease and use the most effective treatment to solve the health problem	“ The attending physician must have strong professional competence”
Operation level	Proficiency in cutting, suturing, or repairing a patient's body with a medical instrument to improve the functioning of a diseased or injured body.	The attending physician needs to perform the operation quickly and well
First aid ability	In the event of any accident or acute illness, the ability to carry out temporary and appropriate initial rescue and care of the injured or sick using on-site materials in accordance with the principles of medical care, and then to rush to formal treatment.	The attending physician is sometimes required to have some first aid ability to deal with certain immediate and dangerous situations
Theoretical knowledge	Professional theories and knowledge required for diagnosis and treatment	The attending physician should have complete professional knowledge
Clinical non-technical competence	Ability that does not belong to medical profession in clinical diagnosis and treatment	
Clinical communication ability	In the process of communication with patients and their families, doctors can effectively express, explain, listen to and respond to information exchange accurately and effectively and manage their own emotions through language, behavior, manner and text	“ The attending physician must be able to communicate with the patient” “ The attending physician must be able to work with patients” “ Some doctors perform surgeries well, but do not communicate with patients, resulting in low patient satisfaction and more doctor-patient disputes”
Humanistic care	On the basis of fully understanding the value of human life, doctors care for, cherish, respect others, Revere life, and are able to put themselves in others' shoes and pay attention to others' feelings, which is reflected in caring consciousness, empathy ability and caring behavior	The attending physicians should pay more attention to the psychological needs of patients and learn to care for patients
Professional ethics	The moral standard and behavior ethics that medical workers should follow in medical practice	The attending physician must have medical ethics Do not do anything against the ethics of a doctor
Management competence	As a manager, I have the ability to set team goals, reasonably allocate team resources, coordinate team relations, improve team	The management of the attending group is an important dimension to

Category	Definition	Examples
	cohesion, create good conditions and environment for the normal operation of the team, guide and motivate the team to achieve goals, including planning, organization, leadership, and others.	reflect the level of the attending physician
Organizing ability	It refers to the ability to reasonably schedule and allocate human resources, materials and other resources according to work tasks	Organizational ability is a necessary ability for attending physicians to be managers
Coordinated ability	Ability to coordinate and resolve the relationship and work conflict between team members, so that members can better cooperate	The attending physician must be able to handle conflicts between team members when they arise
Cooperation ability	Team spirit, be able to handle the work with team members, cooperate with team members, and promote the achievement of team goals (cooperation between myself and colleagues of the same level)	"The attending physician is part of a team and must be a team player" "The attending physician shoud be good at inter-department cooperation"
Leadership	As a leader, one person can motivate team members, improve team cohesion, make employees willing to follow and obey orders, and achieve a unified goal together	As the leader of the visiting group, the visiting physician should do a good job of leadership
Healthy sense of competition	A healthy team competition concept will not hinder other groups from engaging in vicious competition for the sake of outstanding performance of this group	A person who would rather send a patient to another hospital than refer the patient to another primary care group in the hospital cannot be a primary care physician Patients should not be forcibly admitted to improve performance rather than transferred to a more suitable primary care group
Interpersonal competence	In social life, people communicate with others, connect feelings, enhance friendship, thus establishing a wide range of social connections.	The attending physician should have strong social skills
Non-clinical communication ability	Ability to communicate with colleagues and leaders in daily work	Be good at daily communication, with peers, superiors and subordinates communication
Ability to manage relationships	Good at dealing with people, good at dealing with all kinds of complex interpersonal relations	Be able to handle relationships with colleagues
Teaching, research and learning ability	The ability of attending physicians in teaching, scientific research and learning	
Teaching ability	Ability to guide residents or interns to learn professional knowledge and skills in a purposeful, planned and organized way	The attending physician will teach group members, residents and interns
Scientific research ability	The ability to carry out a series of activities such as literature research, investigation and experiment.	The attending physician should still have some scientific ability
Learning ability	Physicians have strong learning motivation, pay attention to knowledge update and discipline development, consciously set learning goals and plans, choose learning	The development of medicine is very fast, and the attending physician should be able to learn

Category	Definition	Examples
	strategies, actively study, regulate the learning process, and can self-summarize, evaluate and reflect on the learning results	new technology and new knowledge all the time
Innovation ability	Ability to propose new or improved techniques in diagnosis and treatment based on knowledge, clinical skills and work experience	Some of the attending physicians were able to come up with useful new methods
Personal traits	The inherent character, qualities, values, etc of a person	Although it is difficult to evaluate, the selection of attending physicians should be based on personality factors
Friendly	Friendly and easy-going, will not make people fear and distance	First, the attending physician should be pleasant and not scare the patient
Extroversion	Warm, lively, cheerful, good at communication, strong ability to adapt to the environment	Outgoing people are better suited to attending physician
Patience	Hardly be impatient or bored with work or patients	Sometimes when you have too much to do, you get impatient with your patients
Work attitude	Be conscientious and dedicated to his work and patients	“ The attending physician must have correct working attitude and sense of responsibility”
Aspirant	A state of mind in which individuals are not satisfied with the status quo at work and pursue higher goals unremittingly	The attending physician cannot be complacent because he has the whole team behind him
Mental endurance	The ability of individuals to bear and adjust the psychological pressure and negative emotions caused by adversity	The work of the attending physician is heavy and intense, so it is necessary to have strong anti-pressure ability and good psychological quality
The right values	The individual's psychological tendency system of the importance of objective things and the results of their own behavior is the general view of what is good and should	The attending physician has to have the right values
Positive emotion	Always look at work and things with an optimistic attitude	A good mental attitude can help the attending physician do a better job
Participated in academic association	Participate in some influential societies or associations and assume important positions	professional association indicates that a attending physician is more competent
Superior recommendation	He has been formally recommended by his superiors to be the chief physician	Section director recommendation is still a very important basis
Social influence	Have a certain reputation and respect in the community or related professional field.	You have to have social influence to get more patients
Recognition of colleagues	In colleagues have a good reputation, recognized by colleagues	There are colleagues willing to join him in the attending medical team
A healthy body	To be in good health capable of performing the duties of attending physician	The first thing is to have a healthy body and be able to do the job
professional title	A unique Chinese rating system that reflects an individual's professional skill level	In my opinion, under China's unique system, professional title is still an important basis for the selection of attending physicians

Category	Definition	Examples
Years of working	Years of relevant work in the hospital	Older people may be given priority to become the attending physician
Academic Degree	A rating that reflects an individual's level of education	The selection will be based on those with higher education

Annex E: Delphi Questionnaire of Attending Physicians (1st round)

Dear expert

This questionnaire aims at consulting the importance of each indicator in the competence evaluation indicator system of attending physicians. Please fill in the questionnaire based on your own understanding.

Table 1 asks for expert information and profiles, Table 2 asks for the importance of competency categories, Table 3 asks for the importance of each competency indicator. We divide the importance into five levels, 1=extremely unimportant, 2=unimportant, 3=ordinary, 4=important, and 5=extremely important.

To be an excellent top-level attending physician, how important do you think are each of the following competencies? If you think there are still items that are missed and should be added, please add it in the column of added items with a definition and score.

This round of expert advice will be summarized and fed back to you again in the next round of consultation. Your information and answers will be kept strictly confidential. Thank you for your support!

Table 1 Expert information and profiles

Name		Professional title	□Primary □Intermediate □Sub-Senior □Senior
Gender	□Male □Female	Academic Degree	□Under the undergraduate □Undergraduate □Master □Doctor
Age		Years of relevant work	□＜5 year □5—9 year □10—14 year □≥15 year
Familiarity with the subject of the questionnaire	□Very unFamiliar □unFamiliar □Ordinary □Familiar □Very familiar		

Table 2 the scale of the importance of competency categories

Please signal in the 1 (extremely unimportant) to 5 (extremely important) scale how important are each of the **Competency Categories** listed below. Please consider its definition as stated.

Competency category	**Definition**	**Category importance**				
		1 - -	**2 -**	**3**	**4 +**	**5 ++**
Clinical technical competence	Ability of medical profession in clinical diagnosis and treatment	○	○	○	○	○

Clinical non-technical competence	Ability that does not belong to medical profession in clinical diagnosis and treatment	○	○	○	○	○
Management ability	The ability to set team goals, reasonably allocate team resources, coordinate team relations, improve team cohesion, create good conditions and environment for the normal operation of the team, guide and motivate the team to achieve goals, including planning, organization, leadership, control and other elements.	○	○	○	○	○
Interpersonal competence	In social life, people communicate with others, connect feelings, enhance friendship, thus establishing a wide range of social connections.	○	○	○	○	○
Teaching, research and learning ability	Ability in teaching, research, learning, such as innovation ability	○	○	○	○	○
Personal traits	The inherent character, qualities, values of a person	○	○	○	○	○
Other conditions	Some objective conditions, such as technical title, working years	○	○	○	○	○
Added item:		○	○	○	○	○

Table 3 the scale of the importance of competency indicators

Please signal in the 1 (extremely unimportant) to 5 (extremely important) scale how important are each of the **Competency Indicators** listed below. Please consider its definition as stated.

Competency category	**Competency indicator**	**Definition**	**Indicator Importance**				
			1 - -	**2 -**	**3**	**4 +**	**5 ++**
Clinical technical competence	Treatment ability	The ability to accurately diagnose the disease and use the most effective treatment to solve the health problem	○	○	○	○	○
	Surgical level	Proficiency in cutting, suturing, a patient's body with a medical instrument to improve the functioning of a diseased or injured body.	○	○	○	○	○
	First aid ability	In the event of any accident or acute illness, the ability to carry out temporary and appropriate	○	○	○	○	○

Competency category	**Competency indicator**	**Definition**	**Indicator Importance**				
			1 - -	**2 -**	**3**	**4 +**	**5 ++**
		initial rescue and care of the injured or sick using on-site materials in accordance with the principles of medical care, and then to rush to formal treatment.					
	Theoretical knowledge	Professional theories and knowledge required for diagnosis and treatment	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○
Clinical non-technical competence	Clinical communication ability	In the process of communication with patients and their families, doctors can effectively express, explain, listen to and respond to information exchange accurately and effectively and manage their own emotions through language, behavior, manner and text	○	○	○	○	○
	Humanistic care	On the basis of fully understanding the value of human life, doctors care for, respect others, Revere life, and are able to put themselves in others' shoes and pay attention to others' feelings, which is reflected in caring consciousness, empathy ability and caring behavior.	○	○	○	○	○
	Professional ethics	The moral standard and behavior ethics that medical workers should follow in medical practice	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○
Management ability	Organizing ability	It refers to the ability to reasonably schedule and allocate human resources, materials and	○	○	○	○	○

Competency category	Competency indicator	Definition	Indicator Importance				
			1 - -	2 -	3	4 +	5 ++
		other resources according to work tasks					
	Coordinated ability	Ability to coordinate and resolve the relationship and work conflict between team members, so that members can better cooperate	○	○	○	○	○
	Leadership	As a leader, one person can motivate team members, improve team cohesion, make employees willing to follow and obey orders, and achieve a unified goal together	○	○	○	○	○
	Cooperation ability	Team spirit, be able to properly handle the work with team members , cooperate with team members or other team, and promote the achievement of team goals (cooperation between myself and colleagues of the same level)	○	○	○	○	○
	notion of benign competition	A healthy team competition notion which will not hinder other groups from engaging in vicious competition for the sake of outstanding performance of this group	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○
Interpersonal competence	Non-clinical communication ability	Ability to communicate with colleagues and leaders in daily work	○	○	○	○	○
	Ability to manage relationships	Good at dealing with people, good at dealing with all kinds of complex interpersonal relations	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○

Competency category	**Competency indicator**	**Definition**	**Indicator Importance**				
			1 - -	**2 -**	**3**	**4 +**	**5 ++**
Teaching, research and learning ability	Scientific research ability	The ability to carry out a series of activities such as literature research, investigation and experiment by means of equipment.	○	○	○	○	○
	Teaching ability	Ability to guide residents or interns to learn and master professional knowledge and skills in a purposeful, planned and organized way	○	○	○	○	○
	Learning ability	Physicians have strong learning motivation, pay attention to knowledge update and discipline development, consciously set learning goals and plans, choose learning strategies, actively study, regulate the learning process, and can self-summarize, evaluate and reflect on the learning results	○	○	○	○	○
	Innovation ability	Ability to propose new or improved techniques in diagnosis and treatment based on knowledge, clinical skills and work experience	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○
Personal traits	Extroversion	Warm, lively, cheerful, good at communication, strong ability to adapt to the environment	○	○	○	○	○
	Work attitude	Be conscientious and dedicated to his work and patients	○	○	○	○	○
	Friendly	Friendly and easy-going, will not make people fear and distance	○	○	○	○	○
	Aspirant	A state of mind in which individuals are not satisfied with the status quo at work and	○	○	○	○	○

Competency category	Competency indicator	Definition	Indicator Importance				
			1 - -	2 -	3	4 +	5 ++
		pursue higher goals unremittingly					
	Mental endurance	The ability of individuals to bear and adjust the psychological pressure and negative emotions caused by adversity	○	○	○	○	○
	Right values	The individual's psychological tendency system of the meaning, effect, effect and importance of objective things (including people, things and things) and the results of their own behavior is the general view of what is good and should	○	○	○	○	○
	Positive emotion	Always look at work and things with an optimistic attitude	○	○	○	○	○
	Patience	Hardly be impatient or bored with work or patients	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○
Other conditions	Years of working	Years of relevant work in the hospital	○	○	○	○	○
	Professional title	A unique Chinese rating system that reflects an individual's professional skill level	○	○	○	○	○
	Academic Degree	A rating that reflects an individual's level of education	○	○	○	○	○
	Superior recommendation	One has been formally recommended by his superiors to be the chief physician	○	○	○	○	○
	Social network	One knows powerful people who can help in private	○	○	○	○	○
	Recognition of colleagues	In colleagues have a good reputation, recognized by colleagues	○	○	○	○	○
	Social influence	Have a certain reputation and respect in the community or related professional field.	○	○	○	○	○

Competency category	**Competency indicator**	**Definition**	**Indicator Importance**				
			1 - -	**2 -**	**3**	**4 +**	**5 ++**
	Participated in authoritative academic association	Participate in some influential societies or associations and assume important positions	○	○	○	○	○
	A healthy body	To be healthy enough to work as an attending physician	○	○	○	○	○
	Added item：	Added Definition：	○	○	○	○	○

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Annex F: Delphi Questionnaire of Attending Physicians (2nd round)

(example)

Dear expert _____:

Thank you for having participated in the 1st round of this study. Your answers as an expert were very important. In this 2nd round, our purpose is to share with you the aggregated results for the importance of each indicator in the competence evaluation indicator system of attending physicians.

The following table will show the findings for each indicator together with the common range of answers in the 1st round. This interval is the zone of expert agreement. In case one answer fell outside this interval we will highlight it as ask whether you would want to keep your original answer or, based on aggregated findings of the group of experts, prefer to revise your answer to within the agreement zone. If you prefer to keep your original answer, please explain in the below space the motives for your decision.

The question you answered for each indicator was "To be an excellent top-level attending physician, how important do you think are each of the following competencies?" and the scale used was: 1=extremely unimportant, 2=unimportant, 3=ordinary, 4=important, and 5=extremely important.

Your information and answers will be kept strictly confidential. Thank you for your support!

Table 1 Importance of competency categories

(Please score the indicators marked yellow. Green indicates the concentrated range of all experts' scores in the first round.
You can refer to the overall situation of the first round to adjust, or stick to the original score. Please explain if you insist on the original score)

Competency category	Definition	Original answer					Revised answer				
		1---	2-	3	4+	5++	1---	2-	3	4+	5++
Clinical technical competence	Ability of medical profession in clinical diagnosis and treatment	○	○	○	○	●					
Clinical non-technical competence	Ability that does not belong to medical profession in clinical diagnosis and treatment	○	○	●	○	○	○	○	○	○	○
If you prefer to keep original answer, please explain:											
Management ability	The ability to set team goals, reasonably allocate team resources, coordinate team relations, improve team cohesion, create good conditions and environment for the normal operation of the team, guide and motivate the team to achieve goals, including planning, organization, leadership, control and other elements.	○	○	○	○	●	Your score in the first round of this part of the indicators is in the green range, so there is no need to score again, the same as below.				
Interpersonal competence	In social life, people communicate with others, connect feelings, enhance friendship, thus establishing a wide range of social connections.	○	○	○	●	○					
Teaching, research and learning ability	Ability in teaching, research, learning, such as innovation ability	○	○	○	●	○					
Personal traits	The inherent character, qualities, values of a person	○	○	○	●	○					
Other conditions	Some objective conditions, such as technical title, working years	○	○	●	○	○					

Table 2 the scale of the importance of competency indicators

(Please score the indicators marked yellow. Green indicates the concentrated range of all experts' scores in the first round.
You can refer to the overall situation of the first round to adjust, or stick to the original score. Please explain if you insist on the original score)

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 --	2 -	3	4 +	5 + +
Clinical technical competence	Treatment ability	The ability to accurately diagnose the disease and use the most effective treatment to solve the health problem	○	○	○	○	●					
	Surgical level	Proficiency in cutting, suturing, a patient's body with a medical instrument to improve the functioning of a diseased or injured body.	○	○	○	○	●					
	First aid ability	In the event of any accident or acute illness, the ability to carry out temporary and appropriate initial rescue and care of the injured or sick using on-site materials in accordance with the principles of medical care, and then to	○	○	○	○	●					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
		rush to formal treatment.										
	Theoretical knowledge	Professional theories and knowledge required for diagnosis and treatment	○	○	○	●	○					
Clinical non-technical competence	Clinical communication ability	In the process of communication with patients and their families, doctors can effectively express, explain, listen to and respond to information exchange accurately and effectively and manage their own emotions through language, behavior, manner and text	○	○	○	●	○					
	Humanistic care	On the basis of fully understanding the value of human life, doctors care for, respect others, Revere life, and are able to put themselves in others' shoes	○	○	○	●	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 --	2 -	3	4 +	5 + +
		and pay attention to others' feelings, which is reflected in caring consciousness, empathy ability and caring behavior.										
	Professional ethics	The moral standard and behavior ethics that medical workers should follow in medical practice	○	○	○	●	○					
Management ability	Leadership	As a leader, one person can motivate team members, improve team cohesion, make employees willing to follow and obey orders, and achieve a unified goal together	○	○	○	●	○					
	Coordinated ability	Ability to coordinate and resolve the relationship and work conflict between team	○	○	○	●	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 --	2 -	3	4 +	5 + +
		members, so that members can better cooperate										
	Organizing ability	It refers to the ability to reasonably schedule and allocate human resources, materials and other resources according to work tasks	○	○	○	●	○					
	Cooperation ability	Team spirit, be able to properly handle the work with team members , cooperate with team members or other team, and promote the achievement of team goals (cooperation between myself and colleagues of the same level)	○	○	○	●	○					
	notion of benign competition	A healthy team competition notion which will not hinder other groups from engaging	○	○	○	●	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
		in vicious competition for the sake of outstanding performance of this group										
Interpersonal competence	Non-clinical communication ability	Ability to communicate with colleagues and leaders in daily work	○	○	○	●	○					
	Ability to manage relationships	Good at dealing with people, good at dealing with all kinds of complex interpersonal relations	○	○	○	●	○					
Teaching, research and learning ability	Scientific research ability	The ability to carry out a series of activities such as literature research, investigation and experiment by means of equipment.	○	○	●	○	○					
	Teaching ability	Ability to guide residents or interns to learn and master professional knowledge and skills in a purposeful, planned and organized way	○	○	○	●	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
	Learning ability	Physicians have strong learning motivation, pay attention to knowledge update and discipline development, consciously set learning goals and plans, choose learning strategies, actively study, regulate the learning process, and can self-summarize, evaluate and reflect on the learning results	○	○	○	○	●					
	Innovation ability	Ability to propose new or improved techniques in diagnosis and treatment based on knowledge, clinical skills and work experience	○	○	●	○	○					
Personal traits	Extroversion	Warm, lively, cheerful, good at communication, strong ability to adapt	○	○	●	○	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
		to the environment										
	Work attitude	Be conscientious and dedicated to his work and patients	○	○	○	○	●					
	Friendly	Friendly and easy-going, will not make people fear and distance	○	○	●	○	○					
	Aspirant	A state of mind in which individuals are not satisfied with the status quo at work and pursue higher goals unremittingly	○	○	○	●	○					
	Mental endurance	The ability of individuals to bear and adjust the psychological pressure and negative emotions caused by adversity	○	○	○	●	○					
	The right values	The individual's psychological tendency system of the meaning, effect, effect and importance of objective things	○	○	○	●	○					

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
		(including people, things and things) and the results of their own behavior is the general view of what is good and should										
	Positive emotion	Always look at work and things with an optimistic attitude	○	○	●	○	○	○	○	○	○	○
	If you prefer to keep original answer, please explain:											
	Patience	Hardly be impatient or bored with work or patients	○	○	○	●	○					
Other conditions	Years of working	Years of relevant work in the hospital	○	○	●	○	○					
	professional and technical titles	A unique Chinese rating system that reflects an individual's professional skill level	○	○	●	○	○					
	Academic Degree	A rating that reflects an individual's level of education	○	●	○	○	○	○	○	○	○	○
	If you prefer to keep original answer, please explain:											
	Superior recommendation	One has been formally recommended by his superiors to be	●	○	○	○	○	○	○	○	○	○

Competency category	Competency indicator	Definition	Indicator Importance					Revised answer				
			1 --	2 -	3	4 +	5 + +	1 - -	2 -	3	4 +	5 + +
		the chief physician										
	If you prefer to keep original answer, please explain:											
	Social network	One knows powerful people who can help in private	●	○	○	○	○	○	○	○	○	○
	If you prefer to keep original answer, please explain:											
	Recognition of colleagues	In colleagues have a good reputation, recognized by colleagues	○	○	○	●	○					
	Social influence	Have a certain reputation and respect in the community or related professional field.	○	○	○	●	○					
	Participated in authoritative academic association	Participate in some influential societies or associations and assume important positions	●	○	○	○	○	○	○	○	○	○
	If you prefer to keep original answer, please explain:											
	A healthy body	To be healthy enough to work as an attending physician	○	○	○	●	○					

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Annex G: Questionnaire in Study 2

Every teacher:

Hello everyone! The purpose of this survey is to construct an evaluation index system for attending physicians. You are sincerely invited to fill in the "Evaluation Questionnaire for the Importance of Competence of Attending Physicians" by scoring. This questionnaire is anonymous and takes about 5 minutes. The information provided It is only for academic theoretical research, not for other purposes, please feel free to answer. At the same time, please read the instructions at the front of the book carefully, think carefully, and if you have any questions or suggestions, please report them in time, thank you for your support!

1. Your age: ( ) (fill in the blank)
2. Your gender: ( ) A, male B, female
3. Your highest education: ( )
   A. Specialist and below
   B. Undergraduate
   C. postgraduate students
   D. a doctoral student
4. Your title level: ( )
   A. Positive senior
   B. Deputy senior
   C. Intermediate
   D. primary
   E. Other
5. Your working years: ( ) (fill in the blank)
6. Your work unit category: ( )
   A. Grade 3 hospital
   B. Non-tertiary hospitals
   C. high school
   D. research institutes
   E. Other

7. Your Identity: ( )

A. Researchers in the field of hospital management

B. the attending physician

C. the hospital administrator

D. members of the attending team

E. Other

The second part of the score

Questionnaire (Hospital Manager)(for example)

Dear Expert:

Hello, this questionnaire is designed to evaluate the importance of each competency of the attending physician.

When evaluating the attending physician, it is necessary to comprehensively consider the multiple competencies of the attending physician. Each person has different views on these abilities and characteristics. In this study, we simulated attending physicians with different levels of competence. Would like to know what you think of these attending physicians. Please rate the following 8 attending physicians and how willing you are to select this candidate (1=I would definitely not hire, 10=I would definitely hire).

NO.	Clinical technical competency	Clinical nontechnical competencies	Management competency	Interpersonal competency	Teaching, learning and research competency	Personal traits	Other qualifications	Score
1	High	High	High	High	High	High	High	( )
2	High	Low	Low	Low	High	Low	High	( )
3	High	High	Low	High	Low	Low	Low	( )
4	Low	High	High	Low	Low	Low	High	( )
5	High	Low	High	Low	Low	High	Low	( )
6	Low	High	Low	Low	High	High	Low	( )
7	Low	Low	High	High	High	Low	Low	( )
8	Low	Low	Low	High	Low	High	High	( )

- Clinical technical competency: refers to the ability of doctors related to medical professional technology, such as diagnosis and treatment ability.
- Clinical nontechnical competencies: refers to the ability and professional ethics to communicate with patients on clinical issues.
- Management competency: refers to the ability of leadership, coordination and organization.
- Interpersonal competency: refers to the ability to communicate with others on non clinical topics in a positive way.
- Teaching, research and learning ability: refers to the ability to teach others, conduct research and learning, such as innovation ability.
- Personality traits: refer to psychological endurance, positive attitude and correct personal values.
- Other qualifications: such as professional tenure, professional title and social influence.

The third part of the score

Please evaluate the importance of three abilities in teaching, learning and researching competency:

Index	Commonly	Important	Very important
Teaching ability			
Learing ability			
Researching ability			

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Annex H: Conjoint Analytic Programming

```
CONJOINT
/PLAN='C:\Users\Administrator\Desktop\CONJOINT\111.sav'
/DATA='C:\Users\Administrator\Desktop\CONJOINT\222.sav'
/FACTORS=Clinical technical competency  Clinical nontechnical competencies
Management competency  Interpersonal competency  Teaching, learning and research
competency  Personal traits  Objective qualification
/SUBJECT=ID
/SCORE=x1 to x8
/PLOT=all
```

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Annex I: PROCESS Macro Output for Study 3

Study 3 – Predictive Model
PROCESS Outputs
CTC*POS->WENG->PRODUCTIVITY20

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 8
    Y  : Prdct20
    X  : CTC4it
    M  : WEng9it
    W  : POS5it

Covariates:
 Age        Gender

Sample
Size:  180

**************************************************************************
OUTCOME VARIABLE:
 WEng9it

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      .7673       .5888       .2840     49.8278      5.0000    174.0000       .0000

Model
             coeff         se          t          p       LLCI       ULCI
constant    4.9664      .3372    14.7282      .0000     4.3009     5.6320
CTC4it       .5476      .0858     6.3848      .0000      .3783      .7169
POS5it       .5627      .0557    10.0964      .0000      .4527      .6727
Int_1       -.3713      .0989    -3.7532      .0002     -.5666     -.1761
Age          .0033      .0069     .4748      .6355     -.0103      .0168
Gender       .1273      .0867    1.4682      .1439     -.0438      .2983

Product terms key:
 Int_1      :          CTC4it    x          POS5it

Test(s) of highest order unconditional interaction(s):
        R2-chng           F         df1         df2           p
X*W       .0333     14.0867      1.0000    174.0000       .0002
----------
     Focal predict: CTC4it    (X)
           Mod var: POS5it    (W)

Conditional effects of the focal predictor at values of the moderator(s):

     POS5it      Effect         se          t          p       LLCI       ULCI
    -.7610       .8302      .1052     7.8928      .0000      .6226     1.0378
     .0000       .5476      .0858     6.3848      .0000      .3783      .7169
     .7610       .2650      .1224     2.1647      .0318      .0234      .5066

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:
     POS5it      Effect         se          t          p       LLCI       ULCI
    -3.2378      1.7499      .3188     5.4891      .0000     1.1207     2.3791
    -3.0473      1.6792      .3007     5.5848      .0000     1.0857     2.2726
    -2.8568      1.6084      .2826     5.6908      .0000     1.0506     2.1663
    -2.6663      1.5377      .2647     5.8088      .0000     1.0152     2.0602
    -2.4759      1.4670      .2469     5.9406      .0000      .9796     1.9544
    -2.2854      1.3963      .2293     6.0883      .0000      .9436     1.8489
    -2.0949      1.3255      .2119     6.2543      .0000      .9072     1.7438
    -1.9044      1.2548      .1948     6.4411      .0000      .8703     1.6393
    -1.7140      1.1841      .1780     6.6508      .0000      .8327     1.5354
    -1.5235      1.1133      .1617     6.8848      .0000      .7942     1.4325
```

-1.3330	1.0426	.1460	7.1413	.0000	.7544	1.3307
-1.1425	.9719	.1311	7.4127	.0000	.7131	1.2306
-.9521	.9011	.1174	7.6779	.0000	.6695	1.1328
-.7616	.8304	.1052	7.8923	.0000	.6227	1.0381
-.5711	.7597	.0953	7.9738	.0000	.5716	.9477
-.3806	.6889	.0883	7.8043	.0000	.5147	.8632
-.1902	.6182	.0850	7.2758	.0000	.4505	.7859
.0003	.5475	.0858	6.3831	.0000	.3782	.7168
.1908	.4767	.0906	5.2636	.0000	.2980	.6555
.3813	.4060	.0988	4.1095	.0001	.2110	.6010
.5717	.3353	.1097	3.0570	.0026	.1188	.5517
.7622	.2645	.1225	2.1595	.0322	.0228	.5063

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    CTC4it      POS5it      WEng9it     .
BEGIN DATA.
      -.5144      -.7610      4.4256
       .0000      -.7610      4.8527
       .5028      -.7610      5.2701
      -.5144       .0000      4.9992
       .0000       .0000      5.2809
       .5028       .0000      5.5562
      -.5144       .7610      5.5728
       .0000       .7610      5.7091
       .5028       .7610      5.8424
END DATA.
GRAPH/SCATTERPLOT=
 CTC4it    WITH      WEng9it   BY        POS5it    .
```

****

OUTCOME VARIABLE:
Prdct20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.8006	.6410	25.4944	51.4731	6.0000	173.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	49.5542	4.7886	10.3483	.0000	40.1025	59.0059
CTC4it	10.9641	.9027	12.1454	.0000	9.1823	12.7459
WEng9it	2.6651	.7182	3.7105	.0003	1.2474	4.0827
POS5it	-1.3834	.6649	-2.0805	.0390	-2.6958	-.0710
Int_1	3.2551	.9746	3.3400	.0010	1.3315	5.1787
Age	.1847	.0652	2.8305	.0052	.0559	.3134
Gender	-.2091	.8263	-.2531	.8005	-1.8400	1.4218

Product terms key:
Int_1 : CTC4it x POS5it

Test(s) of X by M interaction:

F	df1	df2	p
.0777	1.0000	172.0000	.7808

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0232	11.1555	1.0000	173.0000	.0010

Focal predict: CTC4it (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	8.4870	1.1613	7.3082	.0000	6.1949	10.7791
.0000	10.9641	.9027	12.1454	.0000	9.1823	12.7459
.7610	13.4413	1.1753	11.4362	.0000	11.1215	15.7611

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-2.0468	1.6667	98.3333

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	.4248	3.2714	.1299	.8968	-6.0323	6.8819
-3.0378	1.0758	3.0846	.3488	.7277	-5.0124	7.1641
-2.8378	1.7269	2.8987	.5957	.5521	-3.9946	7.4483
-2.6378	2.3779	2.7142	.8761	.3822	-2.9793	7.7351
-2.4378	3.0289	2.5312	1.1966	.2331	-1.9671	8.0249
-2.2378	3.6799	2.3501	1.5658	.1192	-.9587	8.3185
-2.0468	4.3017	2.1794	1.9738	.0500	.0000	8.6034
-2.0378	4.3309	2.1715	1.9945	.0477	.0450	8.6169
-1.8378	4.9820	1.9958	2.4962	.0135	1.0427	8.9213
-1.6378	5.6330	1.8241	3.0881	.0023	2.0326	9.2334

-1.4378	6.2840	1.6575	3.7912	.0002	3.0124	9.5556
-1.2378	6.9350	1.4978	4.6301	.0000	3.9787	9.8914
-1.0378	7.5861	1.3474	5.6301	.0000	4.9266	10.2455
-.8378	8.2371	1.2098	6.8088	.0000	5.8493	10.6249
-.6378	8.8881	1.0897	8.1561	.0000	6.7372	11.0390
-.4378	9.5391	.9938	9.5991	.0000	7.5777	11.5006
-.2378	10.1901	.9293	10.9659	.0000	8.3560	12.0243
-.0378	10.8412	.9030	12.0052	.0000	9.0588	12.6236
.1622	11.4922	.9184	12.5135	.0000	9.6795	13.3049
.3622	12.1432	.9733	12.4760	.0000	10.2221	14.0643
.5622	12.7942	1.0617	12.0503	.0000	10.6986	14.8898
.7622	13.4452	1.1761	11.4322	.0000	11.1239	15.7666

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    CTC4it       POS5it       Prdct20      .
BEGIN DATA.
      -.5144       -.7610      68.0495
       .0000       -.7610      72.4156
       .5028       -.7610      76.6827
      -.5144        .0000      65.7224
       .0000        .0000      71.3629
       .5028        .0000      76.8754
      -.5144        .7610      63.3953
       .0000        .7610      70.3101
       .5028        .7610      77.0681
END DATA.
GRAPH/SCATTERPLOT=
 CTC4it    WITH       Prdct20   BY          POS5it    .
```

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Conditional direct effect(s) of X on Y:

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	8.4870	1.1613	7.3082	.0000	6.1949	10.7791
.0000	10.9641	.9027	12.1454	.0000	9.1823	12.7459
.7610	13.4413	1.1753	11.4362	.0000	11.1215	15.7611

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
CTC4it -> WEng9it -> Prdct20

POS5it	Effect	BootSE	BootLLCI	BootULCI
-.7610	2.2125	.8068	.7698	3.8583
.0000	1.4594	.5213	.5137	2.5379
.7610	.7062	.4235	-.0174	1.5959

Index of moderated mediation:

	Index	BootSE	BootLLCI	BootULCI
POS5it	-.9897	.4976	-2.0615	-.1326

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:
95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
POS5it CTC4it

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----

NCTC*POS->WENG->PRODUCTIVITY20

Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2022). www.guilford.com/p/hayes3

****
Model : 8
Y : Prdct20
X : NTC4it
M : WEng9it
W : POS5it

Covariates:
Age Gender

Sample
Size: 180

****
OUTCOME VARIABLE:
WEng9it

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7815	.6107	.2689	54.5906	5.0000	174.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	5.0414	.3285	15.3481	.0000	4.3931	5.6897
NTC4it	.6438	.0939	6.8556	.0000	.4585	.8291
POS5it	.5113	.0557	9.1774	.0000	.4014	.6213
Int_1	-.4514	.1104	-4.0887	.0001	-.6693	-.2335
Age	.0039	.0067	.5889	.5567	-.0092	.0171
Gender	.0578	.0829	.6967	.4869	-.1059	.2214

Product terms key:
Int_1 : NTC4it x POS5it

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0374	16.7177	1.0000	174.0000	.0001

Focal predict: NTC4it (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	.9873	.1136	8.6888	.0000	.7630	1.2116
.0000	.6438	.0939	6.8556	.0000	.4585	.8291
.7610	.3003	.1373	2.1878	.0300	.0294	.5712

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	2.1052	.3521	5.9794	.0000	1.4103	2.8001
-3.0473	2.0193	.3318	6.0852	.0000	1.3643	2.6742
-2.8568	1.9333	.3117	6.2026	.0000	1.3181	2.5485
-2.6663	1.8473	.2917	6.3336	.0000	1.2716	2.4230
-2.4759	1.7613	.2718	6.4802	.0000	1.2249	2.2978
-2.2854	1.6754	.2521	6.6450	.0000	1.1777	2.1730
-2.0949	1.5894	.2327	6.8307	.0000	1.1301	2.0486
-1.9044	1.5034	.2135	7.0404	.0000	1.0819	1.9249
-1.7140	1.4174	.1948	7.2768	.0000	1.0330	1.8019
-1.5235	1.3315	.1765	7.5417	.0000	.9830	1.6799
-1.3330	1.2455	.1590	7.8333	.0000	.9317	1.5593
-1.1425	1.1595	.1424	8.1430	.0000	.8785	1.4405
-.9521	1.0735	.1271	8.4460	.0000	.8227	1.3244
-.7616	.9876	.1137	8.6882	.0000	.7632	1.2119
-.5711	.9016	.1028	8.7699	.0000	.6987	1.1045
-.3806	.8156	.0954	8.5492	.0000	.6273	1.0039
-.1902	.7296	.0923	7.9053	.0000	.5475	.9118
.0003	.6437	.0939	6.8536	.0000	.4583	.8290
.1908	.5577	.1000	5.5752	.0000	.3603	.7551
.3813	.4717	.1099	4.2925	.0000	.2548	.6886
.5717	.3857	.1226	3.1463	.0019	.1438	.6277
.7622	.2998	.1374	2.1822	.0304	.0286	.5709

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    NTC4it       POS5it       WEng9it      .
BEGIN DATA.
      -.4598       -.7610       4.4492
       .0000       -.7610       4.9031
       .3500       -.7610       5.2487
      -.4598        .0000       4.9962
       .0000        .0000       5.2922
       .3500        .0000       5.5176
      -.4598        .7610       5.5433
       .0000        .7610       5.6813
       .3500        .7610       5.7865
END DATA.
GRAPH/SCATTERPLOT=
 NTC4it    WITH        WEng9it   BY          POS5it    .

************************************************************************
OUTCOME VARIABLE:
 Prdct20

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      .7440       .5535     31.7021     35.7480      6.0000    173.0000      .0000

Model
              coeff         se           t           p        LLCI        ULCI
constant    49.3934     5.4720      9.0266      .0000     38.5930     60.1939
NTC4it      10.7265     1.1492      9.3341      .0000      8.4583     12.9947
WEng9it      2.8915      .8232      3.5127      .0006      1.2668      4.5162
POS5it      -1.4272      .7370     -1.9365      .0544     -2.8818      .0275
Int_1        3.2920     1.2549      2.6232      .0095      .8150      5.7690
Age           .1955      .0726      2.6936      .0078      .0523      .3388
Gender      -1.3396      .9015     -1.4859      .1391     -3.1189      .4398

Product terms key:
 Int_1      :          NTC4it     x          POS5it

Test(s) of X by M interaction:
          F         df1          df2           p
     4.3847      1.0000     172.0000       .0377

Test(s) of highest order unconditional interaction(s):
       R2-chng           F         df1          df2           p
X*W       .0178      6.8813      1.0000     173.0000       .0095
----------
    Focal predict: NTC4it     (X)
          Mod var: POS5it     (W)

Conditional effects of the focal predictor at values of the moderator(s):

     POS5it      Effect         se           t           p        LLCI        ULCI
      -.7610      8.2213      1.4774      5.5646      .0000      5.3052     11.1374
       .0000     10.7265      1.1492      9.3341      .0000      8.4583     12.9947
       .7610     13.2317      1.5108      8.7580      .0000     10.2497     16.2137

Moderator value(s) defining Johnson-Neyman significance region(s):
      Value      % below      % above
    -1.7717       2.7778      97.2222

Conditional effect of focal predictor at values of the moderator:
     POS5it      Effect         se           t           p        LLCI        ULCI
    -3.2378       .0678      4.1974       .0161      .9871     -8.2170      8.3525
    -3.0378       .7262      3.9566       .1835      .8546     -7.0833      8.5356
    -2.8378      1.3846      3.7171       .3725      .7100     -5.9522      8.7213
    -2.6378      2.0430      3.4793       .5872      .5579     -4.8244      8.9103
    -2.4378      2.7013      3.2434       .8329      .4061     -3.7005      9.1032
    -2.2378      3.3597      3.0100      1.1162      .2659     -2.5814      9.3009
    -2.0378      4.0181      2.7797      1.4455      .1501     -1.4684      9.5047
    -1.8378      4.6765      2.5533      1.8316      .0687      -.3630      9.7161
    -1.7717      4.8940      2.4795      1.9738      .0500       .0000      9.7880
    -1.6378      5.3349      2.3319      2.2878      .0234       .7324      9.9375
    -1.4378      5.9933      2.1171      2.8310      .0052      1.8147     10.1719
    -1.2378      6.6517      1.9111      3.4806      .0006      2.8796     10.4238
    -1.0378      7.3101      1.7172      4.2571      .0000      3.9208     10.6994
     -.8378      7.9685      1.5398      5.1750      .0000      4.9293     11.0078
     -.6378      8.6269      1.3854      6.2269      .0000      5.8924     11.3614
     -.4378      9.2853      1.2624      7.3551      .0000      6.7936     11.7771
     -.2378      9.9437      1.1807      8.4219      .0000      7.6133     12.2742
     -.0378     10.6021      1.1491      9.2267      .0000      8.3341     12.8701
      .1622     11.2605      1.1716      9.6112      .0000      8.9480     13.5730
      .3622     11.9189      1.2454      9.5705      .0000      9.4608     14.3770
      .5622     12.5773      1.3621      9.2339      .0000      9.8889     15.2658
      .7622     13.2357      1.5118      8.7549      .0000     10.2518     16.2197

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.
```

```
DATA LIST FREE/
    NTC4it       POS5it       Prdct20      .
BEGIN DATA.
      -.4598       -.7610      68.6585
       .0000       -.7610      72.4384
       .3500       -.7610      75.3159
      -.4598        .0000      66.4206
       .0000        .0000      71.3523
       .3500        .0000      75.1066
      -.4598        .7610      64.1827
       .0000        .7610      70.2662
       .3500        .7610      74.8973
END DATA.
GRAPH/SCATTERPLOT=
 NTC4it    WITH       Prdct20   BY          POS5it    .

****************** DIRECT AND INDIRECT EFFECTS OF X ON Y ******************

Conditional direct effect(s) of X on Y:
      POS5it      Effect          se           t           p        LLCI        ULCI
      -.7610      8.2213      1.4774      5.5646      .0000      5.3052     11.1374
       .0000     10.7265      1.1492      9.3341      .0000      8.4583     12.9947
       .7610     13.2317      1.5108      8.7580      .0000     10.2497     16.2137

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
 NTC4it        ->      WEng9it       ->      Prdct20

      POS5it       Effect       BootSE     BootLLCI     BootULCI
      -.7610       2.8547       1.0818       .8507       5.1294
       .0000       1.8615        .6896       .5637       3.2280
       .7610        .8683        .6064      -.4324       2.0004

        Index of moderated mediation:
              Index       BootSE     BootLLCI     BootULCI
POS5it      -1.3051        .7119      -3.0381       -.2642
---

************************ ANALYSIS NOTES AND ERRORS *************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
            POS5it     NTC4it

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----
```

MNG*POS->WENG->PRODUCTIVITY20

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

          Written by Andrew F. Hayes, Ph.D.          www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model   : 8
     Y   : Prdct20
     X   : MNG5it
     M   : WEng9it
     W   : POS5it

Covariates:
 Age         Gender

Sample
Size:   180

**************************************************************************
OUTCOME VARIABLE:
 WEng9it

Model Summary
```

```
          R        R-sq         MSE           F         df1         df2           p
      .7939       .6303       .2554     59.3192      5.0000    174.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.9252      .3172    15.5282      .0000     4.2992     5.5513
MNG5it        .6330      .0807     7.8407      .0000      .4736      .7923
POS5it        .4729      .0555     8.5204      .0000      .3633      .5824
Int_1        -.3746      .0900    -4.1649      .0000     -.5522     -.1971
Age           .0059      .0065     .9059       .3662     -.0069      .0187
Gender        .0829      .0808     1.0263      .3062     -.0765      .2424

Product terms key:
 Int_1     :          MNG5it    x          POS5it

Test(s) of highest order unconditional interaction(s):
          R2-chng           F         df1         df2           p
X*W          .0369     17.3466      1.0000    174.0000       .0000
----------
     Focal predict: MNG5it     (X)
           Mod var: POS5it     (W)

Conditional effects of the focal predictor at values of the moderator(s):

      POS5it      Effect         se          t          p       LLCI       ULCI
      -.7610       .9181       .0979     9.3731      .0000      .7248     1.1114
       .0000       .6330       .0807     7.8407      .0000      .4736      .7923
       .7610       .3479       .1132     3.0734      .0025      .1245      .5713

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:
      POS5it      Effect         se          t          p       LLCI       ULCI
     -3.2378      1.8460       .2907     6.3506      .0000     1.2723     2.4197
     -3.0473      1.7746       .2742     6.4710      .0000     1.2334     2.3159
     -2.8568      1.7033       .2579     6.6043      .0000     1.1942     2.2123
     -2.6663      1.6319       .2417     6.7527      .0000     1.1549     2.1089
     -2.4759      1.5605       .2256     6.9183      .0000     1.1153     2.0057
     -2.2854      1.4892       .2096     7.1038      .0000     1.0754     1.9029
     -2.0949      1.4178       .1939     7.3121      .0000     1.0351     1.8005
     -1.9044      1.3465       .1784     7.5462      .0000      .9943     1.6986
     -1.7140      1.2751       .1633     7.8090      .0000      .9528     1.5974
     -1.5235      1.2037       .1486     8.1017      .0000      .9105     1.4970
     -1.3330      1.1324       .1344     8.4225      .0000      .8670     1.3977
     -1.1425      1.0610       .1211     8.7620      .0000      .8220     1.3000
      -.9521       .9897       .1088     9.0958      .0000      .7749     1.2044
      -.7616       .9183       .0980     9.3724      .0000      .7249     1.1117
      -.5711       .8469       .0892     9.4996      .0000      .6710     1.0229
      -.3806       .7756       .0830     9.3473      .0000      .6118      .9393
      -.1902       .7042       .0800     8.7974      .0000      .5462      .8622
       .0003       .6329       .0807     7.8389      .0000      .4735      .7922
       .1908       .5615       .0849     6.6103      .0000      .3938      .7292
       .3813       .4901       .0922     5.3164      .0000      .3082      .6721
       .5717       .4188       .1018     4.1122      .0001      .2178      .6198
       .7622       .3474       .1133     3.0672      .0025      .1239      .5710

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
    MNG5it       POS5it       WEng9it      .
BEGIN DATA.
      -.5270      -.7610      4.4515
       .0000      -.7610      4.9353
       .4989      -.7610      5.3934
      -.5270       .0000      4.9616
       .0000       .0000      5.2952
       .4989       .0000      5.6110
      -.5270       .7610      5.4717
       .0000       .7610      5.6550
       .4989       .7610      5.8286
END DATA.
GRAPH/SCATTERPLOT=
 MNG5it     WITH       WEng9it   BY          POS5it     .

************************************************************************
OUTCOME VARIABLE:
 Prdct20

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      .7593       .5765     30.0735     39.2453      6.0000    173.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant    54.1957      5.3164    10.1940      .0000    43.7022    64.6891
```

MNG5it	10.2282	1.0191	10.0361	.0000	8.2166	12.2397
WEng9it	2.2078	.8227	2.6837	.0080	.5840	3.8316
POS5it	-1.4962	.7170	-2.0869	.0384	-2.9114	-.0811
Int_1	2.2778	1.0236	2.2252	.0274	.2574	4.2982
Age	.1736	.0705	2.4627	.0148	.0345	.3127
Gender	-1.4914	.8793	-1.6961	.0917	-3.2270	.2442

Product terms key:
Int_1 : MNG5it x POS5it

Test(s) of X by M interaction:

F	df1	df2	p
1.2990	1.0000	172.0000	.2560

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0121	4.9516	1.0000	173.0000	.0274

Focal predict: MNG5it (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	8.4948	1.3039	6.5147	.0000	5.9211	11.0684
.0000	10.2282	1.0191	10.0361	.0000	8.2166	12.2397
.7610	11.9616	1.2612	9.4841	.0000	9.4722	14.4510

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-2.2667	1.1111	98.8889

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	2.8532	3.5009	.8150	.4162	-4.0568	9.7631
-3.0378	3.3087	3.3056	1.0010	.3182	-3.2157	9.8331
-2.8378	3.7643	3.1114	1.2098	.2280	-2.3770	9.9055
-2.6378	4.2198	2.9188	1.4458	.1501	-1.5411	9.9808
-2.4378	4.6754	2.7278	1.7140	.0883	-.7087	10.0595
-2.2667	5.0651	2.5662	1.9738	.0500	.0000	10.1302
-2.2378	5.1310	2.5391	2.0208	.0448	.1194	10.1425
-2.0378	5.5865	2.3530	2.3742	.0187	.9423	10.2308
-1.8378	6.0421	2.1702	2.7841	.0060	1.7586	10.3256
-1.6378	6.4977	1.9918	3.2623	.0013	2.5664	10.4289
-1.4378	6.9532	1.8188	3.8229	.0002	3.3632	10.5432
-1.2378	7.4088	1.6532	4.4814	.0000	4.1457	10.6718
-1.0378	7.8643	1.4973	5.2524	.0000	4.9091	10.8196
-.8378	8.3199	1.3544	6.1429	.0000	5.6466	10.9932
-.6378	8.7755	1.2291	7.1396	.0000	6.3494	11.2015
-.4378	9.2310	1.1274	8.1881	.0000	7.0058	11.4562
-.2378	9.6866	1.0559	9.1735	.0000	7.6024	11.7708
-.0378	10.1421	1.0212	9.9316	.0000	8.1265	12.1578
.1622	10.5977	1.0269	10.3200	.0000	8.5708	12.6246
.3622	11.0533	1.0724	10.3070	.0000	8.9366	13.1699
.5622	11.5088	1.1530	9.9817	.0000	9.2331	13.7846
.7622	11.9644	1.2620	9.4808	.0000	9.4736	14.4552

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    MNG5it       POS5it       Prdct20      .
BEGIN DATA.
      -.5270       -.7610      68.0689
       .0000       -.7610      72.5459
       .4989       -.7610      76.7839
      -.5270        .0000      66.0167
       .0000        .0000      71.4073
       .4989        .0000      76.5100
      -.5270        .7610      63.9645
       .0000        .7610      70.2687
       .4989        .7610      76.2362
END DATA.
GRAPH/SCATTERPLOT=
 MNG5it     WITH       Prdct20   BY          POS5it     .
```

****************** DIRECT AND INDIRECT EFFECTS OF X ON Y ******************

Conditional direct effect(s) of X on Y:

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	8.4948	1.3039	6.5147	.0000	5.9211	11.0684
.0000	10.2282	1.0191	10.0361	.0000	8.2166	12.2397
.7610	11.9616	1.2612	9.4841	.0000	9.4722	14.4510

Conditional indirect effects of X on Y:

INDIRECT EFFECT:

```
 MNG5it       ->     WEng9it      ->     Prdct20

      POS5it      Effect       BootSE     BootLLCI    BootULCI
      -.7610      2.0269       .8633       .4347      3.8104
       .0000      1.3975       .5946       .3059      2.6476
       .7610       .7680       .4363       .0234      1.7128

       Index of moderated mediation:
             Index       BootSE    BootLLCI    BootULCI
POS5it      -.8271       .4443     -1.8343      -.1362
---

************************ ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
            POS5it    MNG5it

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----
```

INT*POS->WENG->PRODUCTIVITY20

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 8
    Y  : Prdct20
    X  : INT2it
    M  : WEng9it
    W  : POS5it

Covariates:
 Age        Gender

Sample
Size:  180

**************************************************************************
OUTCOME VARIABLE:
 WEng9it

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      .7492       .5613       .3030     44.5281      5.0000    174.0000       .0000

Model
              coeff         se          t          p        LLCI        ULCI
constant     5.0172      .3464     14.4822      .0000      4.3335      5.7010
INT2it        .4177      .0784      5.3297      .0000       .2630       .5724
POS5it        .5278      .0599      8.8040      .0000       .4094       .6461
Int_1        -.2355      .0804     -2.9290      .0039      -.3942      -.0768
Age           .0067      .0071       .9522      .3423      -.0072       .0207
Gender       -.0285      .0873      -.3267      .7443      -.2009       .1438

Product terms key:
 Int_1      :        INT2it    x         POS5it

Test(s) of highest order unconditional interaction(s):
       R2-chng           F         df1         df2           p
X*W       .0216      8.5789      1.0000    174.0000       .0039
----------
    Focal predict: INT2it    (X)
          Mod var: POS5it    (W)

Conditional effects of the focal predictor at values of the moderator(s):

      POS5it      Effect         se          t          p        LLCI        ULCI
      -.7610       .5969      .0857     6.9683      .0000       .4278       .7660
       .0000       .4177      .0784     5.3297      .0000       .2630       .5724
       .7610       .2385      .1115     2.1390      .0338       .0184       .4586
```

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	1.1801	.2511	4.6995	.0000	.6845	1.6758
-3.0473	1.1353	.2366	4.7991	.0000	.6684	1.6022
-2.8568	1.0904	.2221	4.9096	.0000	.6521	1.5288
-2.6663	1.0456	.2078	5.0324	.0000	.6355	1.4557
-2.4759	1.0007	.1936	5.1695	.0000	.6187	1.3828
-2.2854	.9559	.1796	5.3227	.0000	.6014	1.3103
-2.0949	.9110	.1658	5.4941	.0000	.5838	1.2383
-1.9044	.8662	.1523	5.6855	.0000	.5655	1.1669
-1.7140	.8213	.1393	5.8979	.0000	.5465	1.0962
-1.5235	.7765	.1267	6.1300	.0000	.5265	1.0265
-1.3330	.7316	.1147	6.3763	.0000	.5052	.9581
-1.1425	.6868	.1037	6.6222	.0000	.4821	.8914
-.9521	.6419	.0939	6.8374	.0000	.4566	.8272
-.7616	.5970	.0857	6.9681	.0000	.4279	.7662
-.5711	.5522	.0796	6.9358	.0000	.3951	.7093
-.3806	.5073	.0762	6.6592	.0000	.3570	.6577
-.1902	.4625	.0758	6.1047	.0000	.3130	.6120
.0003	.4176	.0784	5.3283	.0000	.2629	.5723
.1908	.3728	.0838	4.4504	.0000	.2075	.5381
.3813	.3279	.0914	3.5869	.0004	.1475	.5084
.5717	.2831	.1008	2.8070	.0056	.0840	.4821
.7622	.2382	.1116	2.1350	.0342	.0180	.4584

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
   INT2it      POS5it      WEng9it     .
BEGIN DATA.
      -.5982      -.7610      4.5169
       .0000      -.7610      4.8740
       .5500      -.7610      5.2023
      -.5982       .0000      5.0257
       .0000       .0000      5.2756
       .5500       .0000      5.5053
      -.5982       .7610      5.5345
       .0000       .7610      5.6772
       .5500       .7610      5.8084
END DATA.
GRAPH/SCATTERPLOT=
 INT2it    WITH      WEng9it   BY        POS5it    .
```

****
OUTCOME VARIABLE:
Prdct20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6944	.4822	36.7687	26.8489	6.0000	173.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	47.1922	5.6675	8.3268	.0000	36.0059	58.3786
INT2it	6.8452	.9312	7.3512	.0000	5.0073	8.6831
WEng9it	3.8774	.8351	4.6430	.0000	2.2291	5.5258
POS5it	-1.7980	.7939	-2.2647	.0248	-3.3650	-.2309
Int_1	2.4074	.9072	2.6536	.0087	.6168	4.1980
Age	.1697	.0780	2.1764	.0309	.0158	.3237
Gender	-2.7030	.9624	-2.8087	.0055	-4.6025	-.8035

Product terms key:
 Int_1   :   INT2it   x   POS5it

Test(s) of X by M interaction:

F	df1	df2	p
.0096	1.0000	172.0000	.9220

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0211	7.0416	1.0000	173.0000	.0087

    Focal predict: INT2it   (X)
          Mod var: POS5it   (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	5.0132	1.0672	4.6975	.0000	2.9067	7.1196
.0000	6.8452	.9312	7.3512	.0000	5.0073	8.6831
.7610	8.6772	1.2444	6.9731	.0000	6.2211	11.1334

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-1.5600	2.7778	97.2222

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	-.9494	2.9367	-.3233	.7469	-6.7457	4.8469
-3.0378	-.4679	2.7649	-.1692	.8658	-5.9253	4.9894
-2.8378	.0135	2.5945	.0052	.9958	-5.1074	5.1345
-2.6378	.4950	2.4257	.2041	.8385	-4.2927	5.2828
-2.4378	.9765	2.2588	.4323	.6661	-3.4819	5.4349
-2.2378	1.4580	2.0944	.6961	.4873	-2.6758	5.5918
-2.0378	1.9395	1.9330	1.0033	.3171	-1.8758	5.7548
-1.8378	2.4209	1.7755	1.3635	.1745	-1.0834	5.9253
-1.6378	2.9024	1.6230	1.7883	.0755	-.3009	6.1058
-1.5600	3.0896	1.5653	1.9738	.0500	.0000	6.1793
-1.4378	3.3839	1.4770	2.2910	.0232	.4686	6.2992
-1.2378	3.8654	1.3398	2.8851	.0044	1.2210	6.5098
-1.0378	4.3469	1.2142	3.5801	.0004	1.9504	6.7434
-.8378	4.8283	1.1042	4.3726	.0000	2.6489	7.0078
-.6378	5.3098	1.0150	5.2313	.0000	3.3064	7.3132
-.4378	5.7913	.9524	6.0809	.0000	3.9115	7.6711
-.2378	6.2728	.9217	6.8053	.0000	4.4535	8.0921
-.0378	6.7543	.9263	7.2915	.0000	4.9259	8.5826
.1622	7.2357	.9656	7.4935	.0000	5.3299	9.1416
.3622	7.7172	1.0356	7.4517	.0000	5.6731	9.7613
.5622	8.1987	1.1307	7.2509	.0000	5.9669	10.4305
.7622	8.6802	1.2451	6.9713	.0000	6.2226	11.1378

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    INT2it       POS5it       Prdct20      .
BEGIN DATA.
       -.5982       -.7610      69.7158
        .0000       -.7610      72.7146
        .5500       -.7610      75.4718
       -.5982        .0000      67.2516
        .0000        .0000      71.3463
        .5500        .0000      75.1112
       -.5982        .7610      64.7875
        .0000        .7610      69.9781
        .5500        .7610      74.7505
END DATA.
GRAPH/SCATTERPLOT=
 INT2it    WITH       Prdct20   BY         POS5it    .
```

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Conditional direct effect(s) of X on Y:

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	5.0132	1.0672	4.6975	.0000	2.9067	7.1196
.0000	6.8452	.9312	7.3512	.0000	5.0073	8.6831
.7610	8.6772	1.2444	6.9731	.0000	6.2211	11.1334

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
 INT2it   ->   WEng9it   ->   Prdct20

POS5it	Effect	BootSE	BootLLCI	BootULCI
-.7610	2.3145	.7939	.9761	4.0959
.0000	1.6196	.5335	.6581	2.7681
.7610	.9248	.5359	-.1127	1.9936

Index of moderated mediation:

	Index	BootSE	BootLLCI	BootULCI
POS5it	-.9131	.5483	-2.3399	-.1668

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          POS5it   INT2it

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----

TLR*POS->WENG->PRODUCTIVITY20

Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2022). www.guilford.com/p/hayes3

****
Model : 8
Y : Prdct20
X : TRL4it
M : WEng9it
W : POS5it

Covariates:
Age Gender

Sample
Size: 180

****
OUTCOME VARIABLE:
WEng9it

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7452	.5553	.3072	43.4476	5.0000	174.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	4.7913	.3503	13.6794	.0000	4.1000	5.4826
TRL4it	.4092	.0767	5.3367	.0000	.2579	.5605
POS5it	.5749	.0591	9.7363	.0000	.4584	.6915
Int_1	-.3658	.1016	-3.6018	.0004	-.5662	-.1653
Age	.0095	.0071	1.3380	.1826	-.0045	.0235
Gender	.0636	.0889	.7158	.4750	-.1118	.2390

Product terms key:
Int_1 : TRL4it x POS5it

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0332	12.9728	1.0000	174.0000	.0004

Focal predict: TRL4it (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	.6876	.1034	6.6518	.0000	.4835	.8916
.0000	.4092	.0767	5.3367	.0000	.2579	.5605
.7610	.1308	.1141	1.1465	.2532	-.0944	.3560

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
.5746	65.0000	35.0000

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	1.5935	.3302	4.8259	.0000	.9418	2.2453
-3.0378	1.5204	.3105	4.8969	.0000	.9076	2.1332
-2.8378	1.4472	.2908	4.9761	.0000	.8732	2.0212
-2.6378	1.3741	.2713	5.0650	.0000	.8386	1.9095
-2.4378	1.3009	.2519	5.1652	.0000	.8038	1.7980
-2.2378	1.2278	.2326	5.2788	.0000	.7687	1.6868
-2.0378	1.1546	.2135	5.4080	.0000	.7332	1.5760
-1.8378	1.0814	.1947	5.5554	.0000	.6972	1.4656
-1.6378	1.0083	.1762	5.7237	.0000	.6606	1.3560
-1.4378	.9351	.1581	5.9149	.0000	.6231	1.2472
-1.2378	.8620	.1406	6.1285	.0000	.5844	1.1396
-1.0378	.7888	.1241	6.3575	.0000	.5439	1.0337
-.8378	.7156	.1088	6.5790	.0000	.5009	.9303
-.6378	.6425	.0954	6.7367	.0000	.4543	.8307
-.4378	.5693	.0848	6.7171	.0000	.4020	.7366
-.2378	.4962	.0781	6.3542	.0000	.3421	.6503
-.0378	.4230	.0764	5.5374	.0000	.2722	.5738
.1622	.3499	.0800	4.3734	.0000	.1920	.5077
.3622	.2767	.0883	3.1353	.0020	.1025	.4509
.5622	.2035	.1000	2.0351	.0434	.0061	.4009
.5746	.1990	.1008	1.9737	.0500	.0000	.3980

.7622	.1304	.1142	1.1417	.2552	-.0950	.3558

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    TRL4it       POS5it       WEng9it      .
BEGIN DATA.
      -.5951       -.7610       4.4491
       .0000       -.7610       4.8582
       .5951       -.7610       5.2674
      -.5951        .0000       5.0522
       .0000        .0000       5.2957
       .5951        .0000       5.5392
      -.5951        .7610       5.6554
       .0000        .7610       5.7333
       .5951        .7610       5.8111
END DATA.
GRAPH/SCATTERPLOT=
 TRL4it    WITH       WEng9it   BY         POS5it    .
```

****

OUTCOME VARIABLE:
Prdct20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7448	.5547	31.6181	35.9195	6.0000	173.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	44.0698	5.1194	8.6084	.0000	33.9653	54.1743
TRL4it	7.9577	.8391	9.4830	.0000	6.3014	9.6140
WEng9it	3.4755	.7691	4.5188	.0000	1.9574	4.9936
POS5it	-2.0783	.7446	-2.7911	.0058	-3.5481	-.6086
Int_1	1.9521	1.0681	1.8276	.0693	-.1561	4.0602
Age	.2452	.0724	3.3852	.0009	.1023	.3882
Gender	-1.2094	.9029	-1.3395	.1822	-2.9915	.5727

Product terms key:
Int_1 : TRL4it x POS5it

Test(s) of X by M interaction:

F	df1	df2	p
.1118	1.0000	172.0000	.7385

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0086	3.3402	1.0000	173.0000	.0693

Focal predict: TRL4it (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	6.4722	1.1745	5.5107	.0000	4.1540	8.7903
.0000	7.9577	.8391	9.4830	.0000	6.3014	9.6140
.7610	9.4432	1.1620	8.1266	.0000	7.1496	11.7368

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-1.8739	1.6667	98.3333

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	1.6373	3.5673	.4590	.6468	-5.4036	8.6783
-3.0378	2.0278	3.3600	.6035	.5470	-4.6042	8.6597
-2.8378	2.4182	3.1536	.7668	.4443	-3.8064	8.6427
-2.6378	2.8086	2.9483	.9526	.3421	-3.0106	8.6278
-2.4378	3.1990	2.7441	1.1658	.2453	-2.2173	8.6153
-2.2378	3.5894	2.5416	1.4123	.1597	-1.4271	8.6059
-2.0378	3.9798	2.3410	1.7000	.0909	-.6408	8.6005
-1.8739	4.2998	2.1785	1.9738	.0500	.0000	8.5996
-1.8378	4.3702	2.1430	2.0393	.0429	.1405	8.6000
-1.6378	4.7606	1.9482	2.4436	.0155	.9153	8.6060
-1.4378	5.1511	1.7578	2.9304	.0038	1.6815	8.6206
-1.2378	5.5415	1.5734	3.5219	.0005	2.4359	8.6470
-1.0378	5.9319	1.3974	4.2450	.0000	3.1738	8.6900
-.8378	6.3223	1.2332	5.1265	.0000	3.8881	8.7564
-.6378	6.7127	1.0865	6.1785	.0000	4.5683	8.8571
-.4378	7.1031	.9650	7.3609	.0000	5.1985	9.0078
-.2378	7.4935	.8793	8.5219	.0000	5.7579	9.2291
-.0378	7.8839	.8405	9.3795	.0000	6.2249	9.5430
.1622	8.2743	.8550	9.6772	.0000	6.5867	9.9620
.3622	8.6648	.9203	9.4153	.0000	6.8483	10.4812
.5622	9.0552	1.0267	8.8201	.0000	7.0288	11.0816

```
       .7622       9.4456       1.1629       8.1223        .0000       7.1502      11.7409

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
    TRL4it       POS5it       Prdct20      .
BEGIN DATA.
      -.5951       -.7610      69.1814
       .0000       -.7610      73.0329
       .5951       -.7610      76.8843
      -.5951        .0000      66.7158
       .0000        .0000      71.4512
       .5951        .0000      76.1867
      -.5951        .7610      64.2502
       .0000        .7610      69.8696
       .5951        .7610      75.4891
END DATA.
GRAPH/SCATTERPLOT=
 TRL4it    WITH       Prdct20   BY          POS5it    .

****************** DIRECT AND INDIRECT EFFECTS OF X ON Y ******************

Conditional direct effect(s) of X on Y:
      POS5it      Effect          se           t           p        LLCI        ULCI
      -.7610      6.4722      1.1745      5.5107      .0000      4.1540      8.7903
       .0000      7.9577       .8391      9.4830      .0000      6.3014      9.6140
       .7610      9.4432      1.1620      8.1266      .0000      7.1496     11.7368

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
 TRL4it       ->      WEng9it       ->      Prdct20

      POS5it       Effect       BootSE     BootLLCI     BootULCI
      -.7610       2.3896        .7566        .9536       3.9180
       .0000       1.4221        .4695        .5699       2.4005
       .7610        .4547        .4713       -.3778       1.4799

       Index of moderated mediation:
              Index       BootSE     BootLLCI     BootULCI
POS5it      -1.2713        .5526      -2.3593       -.1828
---

************************ ANALYSIS NOTES AND ERRORS *************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
            POS5it     TRL4it

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----
```

PERS*POS->WENG->PRODUCTIVITY20

```
Run MATRIX procedure:

****************** PROCESS Procedure for SPSS Version 4.0 ******************

            Written by Andrew F. Hayes, Ph.D.           www.afhayes.com
     Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model   : 8
     Y   : Prdct20
     X   : Pers
     M   : WEng9it
     W   : POS5it

Covariates:
 Age         Gender

Sample
Size:   180

**************************************************************************
```

OUTCOME VARIABLE:
WEng9it

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7969	.6350	.2521	60.5408	5.0000	174.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	4.9435	.3164	15.6250	.0000	4.3190	5.5679
Pers	.7255	.0990	7.3279	.0000	.5301	.9209
POS5it	.4823	.0565	8.5306	.0000	.3707	.5938
Int_1	-.4417	.1163	-3.7989	.0002	-.6712	-.2122
Age	.0068	.0064	1.0631	.2892	-.0059	.0195
Gender	.0455	.0800	.5691	.5700	-.1123	.2034

Product terms key:
Int_1 : Pers x POS5it

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0303	14.4319	1.0000	174.0000	.0002

Focal predict: Pers (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	1.0617	.1110	9.5683	.0000	.8427	1.2807
.0000	.7255	.0990	7.3279	.0000	.5301	.9209
.7610	.3894	.1515	2.5703	.0110	.0904	.6884

There are no statistical significance transition points within the observed range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	2.1557	.3590	6.0045	.0000	1.4471	2.8642
-3.0473	2.0715	.3377	6.1345	.0000	1.4050	2.7380
-2.8568	1.9874	.3165	6.2796	.0000	1.3627	2.6120
-2.6663	1.9033	.2954	6.4426	.0000	1.3202	2.4863
-2.4759	1.8191	.2745	6.6266	.0000	1.2773	2.3609
-2.2854	1.7350	.2538	6.8351	.0000	1.2340	2.2360
-2.0949	1.6509	.2334	7.0725	.0000	1.1902	2.1116
-1.9044	1.5667	.2134	7.3434	.0000	1.1456	1.9878
-1.7140	1.4826	.1937	7.6527	.0000	1.1002	1.8650
-1.5235	1.3985	.1747	8.0038	.0000	1.0536	1.7433
-1.3330	1.3143	.1565	8.3961	.0000	1.0054	1.6233
-1.1425	1.2302	.1395	8.8182	.0000	.9548	1.5055
-.9521	1.1461	.1241	9.2352	.0000	.9011	1.3910
-.7616	1.0619	.1110	9.5676	.0000	.8429	1.2810
-.5711	.9778	.1011	9.6724	.0000	.7783	1.1773
-.3806	.8937	.0954	9.3679	.0000	.7054	1.0819
-.1902	.8095	.0947	8.5511	.0000	.6227	.9964
.0003	.7254	.0990	7.3257	.0000	.5300	.9208
.1908	.6413	.1078	5.9465	.0000	.4284	.8541
.3813	.5571	.1201	4.6373	.0000	.3200	.7942
.5717	.4730	.1350	3.5042	.0006	.2066	.7394
.7622	.3889	.1516	2.5648	.0112	.0896	.6881

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
   Pers       POS5it      WEng9it     .
BEGIN DATA.
      -.4570     -.7610     4.4539
       .0000     -.7610     4.9390
       .4465     -.7610     5.4130
      -.4570      .0000     4.9745
       .0000      .0000     5.3060
       .4465      .0000     5.6300
      -.4570      .7610     5.4951
       .0000      .7610     5.6730
       .4465      .7610     5.8469
END DATA.
GRAPH/SCATTERPLOT=
 Pers      WITH      WEng9it   BY        POS5it    .
```

****

OUTCOME VARIABLE:
Prdct20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7260	.5270	33.5828	32.1313	6.0000	173.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	48.4963	5.6607	8.5673	.0000	37.3235	59.6691
Pers	11.0449	1.3072	8.4492	.0000	8.4648	13.6251
WEng9it	2.9988	.8750	3.4273	.0008	1.2718	4.7258
POS5it	-2.4317	.7770	-3.1294	.0021	-3.9654	-.8980
Int_1	5.0016	1.3965	3.5816	.0004	2.2453	7.7580
Age	.2060	.0745	2.7667	.0063	.0591	.3530
Gender	-1.7324	.9239	-1.8752	.0624	-3.5559	.0910

Product terms key:

Int_1	:	Pers	x	POS5it

Test(s) of X by M interaction:

F	df1	df2	p
2.2300	1.0000	172.0000	.1372

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0351	12.8280	1.0000	173.0000	.0004

Focal predict: Pers (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	7.2386	1.5820	4.5755	.0000	4.1161	10.3612
.0000	11.0449	1.3072	8.4492	.0000	8.4648	13.6251
.7610	14.8512	1.7814	8.3366	.0000	11.3350	18.3673

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-1.3539	2.7778	97.2222

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	-5.1493	4.5526	-1.1311	.2596	-14.1350	3.8364
-3.0378	-4.1490	4.2856	-.9681	.3343	-12.6078	4.3098
-2.8378	-3.1486	4.0203	-.7832	.4346	-11.0838	4.7865
-2.6378	-2.1483	3.7570	-.5718	.5682	-9.5639	5.2672
-2.4378	-1.1480	3.4963	-.3283	.7430	-8.0488	5.7528
-2.2378	-.1477	3.2386	-.0456	.9637	-6.5399	6.2446
-2.0378	.8527	2.9848	.2857	.7755	-5.0386	6.7439
-1.8378	1.8530	2.7360	.6773	.4991	-3.5472	7.2532
-1.6378	2.8533	2.4936	1.1443	.2541	-2.0685	7.7751
-1.4378	3.8537	2.2598	1.7053	.0899	-.6066	8.3139
-1.3539	4.2731	2.1649	1.9738	.0500	.0000	8.5462
-1.2378	4.8540	2.0374	2.3824	.0183	.8325	8.8754
-1.0378	5.8543	1.8308	3.1977	.0016	2.2407	9.4679
-.8378	6.8546	1.6457	4.1651	.0000	3.6064	10.1029
-.6378	7.8550	1.4903	5.2707	.0000	4.9134	10.7965
-.4378	8.8553	1.3746	6.4419	.0000	6.1421	11.5685
-.2378	9.8556	1.3093	7.5273	.0000	7.2713	12.4399
-.0378	10.8560	1.3019	8.3385	.0000	8.2863	13.4256
.1622	11.8563	1.3534	8.7606	.0000	9.1850	14.5275
.3622	12.8566	1.4575	8.8210	.0000	9.9799	15.7334
.5622	13.8569	1.6041	8.6387	.0000	10.6909	17.0230
.7622	14.8573	1.7826	8.3346	.0000	11.3388	18.3757

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    Pers        POS5it      Prdct20     .
BEGIN DATA.
      -.4570      -.7610     69.4970
       .0000      -.7610     72.8047
       .4465      -.7610     76.0369
      -.4570       .0000     65.9072
       .0000       .0000     70.9542
       .4465       .0000     75.8860
      -.4570       .7610     62.3174
       .0000       .7610     69.1037
       .4465       .7610     75.7351
END DATA.
GRAPH/SCATTERPLOT=
 Pers       WITH       Prdct20   BY         POS5it    .
```

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Conditional direct effect(s) of X on Y:

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	7.2386	1.5820	4.5755	.0000	4.1161	10.3612
.0000	11.0449	1.3072	8.4492	.0000	8.4648	13.6251
.7610	14.8512	1.7814	8.3366	.0000	11.3350	18.3673

```
Conditional indirect effects of X on Y:

INDIRECT EFFECT:
 Pers          ->      WEng9it       ->      Prdct20

      POS5it      Effect       BootSE     BootLLCI     BootULCI
      -.7610      3.1837       1.0444      1.0866       5.1496
       .0000      2.1757        .7472       .6964       3.6376
       .7610      1.1677        .6964      -.0972       2.6293

        Index of moderated mediation:
              Index        BootSE     BootLLCI     BootULCI
POS5it     -1.3246         .6296      -2.6633       -.2296
---

************************ ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
            POS5it     Pers

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----
```

OTHER*POS->WENG->PRODUCTIVITY20

Other is the average of the sum of scores for each of the 9 composing items (formative construct)

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.0 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 8
    Y  : Prdct20
    X  : Others
    M  : WEng9it
    W  : POS5it

Covariates:
 Age        Gender

Sample
Size:  180

**************************************************************************
OUTCOME VARIABLE:
 WEng9it

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      .7631       .5823       .2885     48.5125      5.0000    174.0000       .0000

Model
              coeff         se          t          p        LLCI        ULCI
constant     5.0985       .3403     14.9839       .0000     4.4269      5.7701
Others        .5993       .0898      6.6779       .0000      .4222       .7765
POS5it        .4915       .0603      8.1553       .0000      .3726       .6105
Int_1        -.3403       .1017     -3.3461       .0010     -.5410      -.1396
Age           .0024       .0069       .3398       .7345     -.0113       .0161
Gender        .0699       .0859       .8132       .4172     -.0997       .2395

Product terms key:
 Int_1     :          Others    x          POS5it

Test(s) of highest order unconditional interaction(s):
       R2-chng           F         df1         df2           p
X*W       .0269     11.1963      1.0000    174.0000       .0010
----------
    Focal predict: Others     (X)
          Mod var: POS5it     (W)
```

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	.8583	.1136	7.5588	.0000	.6342	1.0824
.0000	.5993	.0898	6.6779	.0000	.4222	.7765
.7610	.3404	.1233	2.7610	.0064	.0971	.5837

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	1.7012	.3341	5.0926	.0000	1.0419	2.3605
-3.0473	1.6364	.3154	5.1877	.0000	1.0138	2.2590
-2.8568	1.5716	.2969	5.2931	.0000	.9856	2.1576
-2.6663	1.5067	.2785	5.4103	.0000	.9571	2.0564
-2.4759	1.4419	.2602	5.5410	.0000	.9283	1.9555
-2.2854	1.3771	.2421	5.6876	.0000	.8992	1.8550
-2.0949	1.3123	.2242	5.8522	.0000	.8697	1.7548
-1.9044	1.2475	.2066	6.0375	.0000	.8397	1.6552
-1.7140	1.1826	.1893	6.2461	.0000	.8089	1.5563
-1.5235	1.1178	.1725	6.4798	.0000	.7773	1.4583
-1.3330	1.0530	.1563	6.7384	.0000	.7446	1.3614
-1.1425	.9882	.1408	7.0173	.0000	.7102	1.2661
-.9521	.9233	.1265	7.3018	.0000	.6738	1.1729
-.7616	.8585	.1136	7.5581	.0000	.6343	1.0827
-.5711	.7937	.1028	7.7218	.0000	.5908	.9966
-.3806	.7289	.0948	7.6925	.0000	.5419	.9159
-.1902	.6641	.0902	7.3596	.0000	.4860	.8421
.0003	.5992	.0898	6.6765	.0000	.4221	.7764
.1908	.5344	.0934	5.7228	.0000	.3501	.7187
.3813	.4696	.1007	4.6644	.0000	.2709	.6683
.5717	.4048	.1109	3.6495	.0003	.1859	.6237
.7622	.3400	.1234	2.7557	.0065	.0965	.5834

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    Others       POS5it       WEng9it      .
BEGIN DATA.
      -.5199       -.7610        4.4759
       .0000       -.7610        4.9221
       .5199       -.7610        5.3683
      -.5199        .0000        4.9846
       .0000        .0000        5.2961
       .5199        .0000        5.6077
      -.5199        .7610        5.4932
       .0000        .7610        5.6702
       .5199        .7610        5.8471
END DATA.
GRAPH/SCATTERPLOT=
 Others    WITH       WEng9it   BY         POS5it    .
```

****

OUTCOME VARIABLE:
Prdct20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7233	.5232	33.8594	31.6333	6.0000	173.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	49.8087	5.5787	8.9284	.0000	38.7977	60.8198
Others	9.1259	1.0898	8.3739	.0000	6.9749	11.2769
WEng9it	3.1743	.8213	3.8650	.0002	1.5533	4.7953
POS5it	-2.3202	.7677	-3.0224	.0029	-3.8353	-.8050
Int_1	2.3783	1.1367	2.0923	.0379	.1347	4.6219
Age	.1552	.0752	2.0629	.0406	.0067	.3037
Gender	-1.4334	.9328	-1.5367	.1262	-3.2746	.4077

Product terms key:
Int_1 : Others x POS5it

Test(s) of X by M interaction:

F	df1	df2	p
.3685	1.0000	172.0000	.5446

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0121	4.3777	1.0000	173.0000	.0379

Focal predict: Others (X)
Mod var: POS5it (W)

Conditional effects of the focal predictor at values of the moderator(s):

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	7.3160	1.4178	5.1600	.0000	4.5175	10.1144
.0000	9.1259	1.0898	8.3739	.0000	6.9749	11.2769
.7610	10.9358	1.3644	8.0149	.0000	8.2427	13.6289

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
-1.8446	1.6667	98.3333

Conditional effect of focal predictor at values of the moderator:

POS5it	Effect	se	t	p	LLCI	ULCI
-3.2378	1.4254	3.8793	.3674	.7137	-6.2315	9.0822
-3.0378	1.9010	3.6616	.5192	.6043	-5.3262	9.1283
-2.8378	2.3767	3.4453	.6898	.4912	-4.4234	9.1769
-2.6378	2.8524	3.2304	.8830	.3785	-3.5236	9.2284
-2.4378	3.3280	3.0173	1.1030	.2716	-2.6274	9.2835
-2.2378	3.8037	2.8065	1.3553	.1771	-1.7357	9.3431
-2.0378	4.2794	2.5985	1.6469	.1014	-.8494	9.4081
-1.8446	4.7388	2.4009	1.9738	.0500	.0000	9.4775
-1.8378	4.7550	2.3939	1.9863	.0486	.0299	9.4801
-1.6378	5.2307	2.1939	2.3842	.0182	.9004	9.5610
-1.4378	5.7064	1.9997	2.8535	.0049	1.7593	9.6534
-1.2378	6.1820	1.8133	3.4093	.0008	2.6030	9.7611
-1.0378	6.6577	1.6372	4.0665	.0001	3.4262	9.8892
-.8378	7.1334	1.4752	4.8354	.0000	4.2216	10.0451
-.6378	7.6090	1.3325	5.7105	.0000	4.9790	10.2390
-.4378	8.0847	1.2157	6.6500	.0000	5.6851	10.4843
-.2378	8.5604	1.1331	7.5548	.0000	6.3239	10.7968
-.0378	9.0360	1.0923	8.2722	.0000	6.8800	11.1920
.1622	9.5117	1.0981	8.6619	.0000	7.3443	11.6791
.3622	9.9874	1.1497	8.6868	.0000	7.7181	12.2566
.5622	10.4630	1.2415	8.4280	.0000	8.0127	12.9134
.7622	10.9387	1.3653	8.0121	.0000	8.2440	13.6334

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
    Others       POS5it       Prdct20      .
BEGIN DATA.
      -.5199       -.7610      69.3059
       .0000       -.7610      73.1091
       .5199       -.7610      76.9123
      -.5199        .0000      66.5993
       .0000        .0000      71.3434
       .5199        .0000      76.0876
      -.5199        .7610      63.8928
       .0000        .7610      69.5778
       .5199        .7610      75.2628
END DATA.
GRAPH/SCATTERPLOT=
 Others    WITH       Prdct20   BY         POS5it    .
```

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Conditional direct effect(s) of X on Y:

POS5it	Effect	se	t	p	LLCI	ULCI
-.7610	7.3160	1.4178	5.1600	.0000	4.5175	10.1144
.0000	9.1259	1.0898	8.3739	.0000	6.9749	11.2769
.7610	10.9358	1.3644	8.0149	.0000	8.2427	13.6289

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
Others -> WEng9it -> Prdct20

POS5it	Effect	BootSE	BootLLCI	BootULCI
-.7610	2.7245	.9759	.8995	4.7461
.0000	1.9025	.6828	.6812	3.3082
.7610	1.0804	.5615	.1714	2.3432

Index of moderated mediation:

	Index	BootSE	BootLLCI	BootULCI
POS5it	-1.0802	.5381	-2.1596	-.0627

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:
95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
5000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
POS5it Others

NOTE: Standardized coefficients not available for models with moderators.

------ END MATRIX -----