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Work Engagement Mechanisms of Township Hospitals' Healthcare workers in Guangxi-An Integrated Study Based on the Job Demands-Resources Model

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Doctor of Management

Supervisors:
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Abstract

Grounded in the Job Demands-Resources model, this study examines the work engagement mechanisms of healthcare workers in township hospitals across three counties of Liuzhou, Guangxi. Results show that sense of responsibility significantly enhances challenge appraisal, whereas time pressure significantly reduces it; job autonomy significantly enhances challenge appraisal, and resource inadequacy significantly increases hindrance appraisal. Challenge appraisal promotes work engagement, whereas hindrance appraisal suppresses it, with both mediating the relationship between certain job characteristics and engagement. Social support strengthens the positive effect of challenge appraisal but does not significantly buffer the negative effect of hindrance appraisal. Overall, sense of responsibility and autonomy are main motivators, while resource inadequacy is the main hindrance; improving engagement requires optimizing job design, enhancing autonomy and responsibility, and improving resource allocation and support systems.

Keywords: Work engagement, township hospitals, JD-R Model, cognitive appraisal
JEL: I12, J24

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Resumo

Com base no modelo Exigências-Recursos de Trabalho (JD-R), este estudo analisa os mecanismos de envolvimento no trabalho dos profissionais de saúde de hospitais municipais em três condados de Liuzhou, Guangxi. Os resultados mostram que o sentido de responsabilidade aumenta significativamente a avaliação de desafio, enquanto a pressão de tempo a reduz; a autonomia no trabalho aumenta significativamente a avaliação de desafio, e a insuficiência de recursos aumenta significativamente a avaliação de obstáculo. A avaliação de desafio promove o envolvimento no trabalho, enquanto a avaliação de obstáculo o inibe, mediando ambas a relação entre certas características do trabalho e o envolvimento. O apoio social reforça o efeito positivo da avaliação de desafio, mas não atenua significativamente o efeito negativo da avaliação de obstáculo. No geral, o sentido de responsabilidade e a autonomia são os principais fatores motivadores, enquanto a insuficiência de recursos é o principal obstáculo; melhorar o envolvimento exige otimizar o desenho do trabalho, reforçar a autonomia e a responsabilidade, e melhorar a alocação de recursos e os sistemas de apoio.

Palavras-chave: Envolvimento no trabalho, hospitais concelhios, modelo de exigências e recursos do trabalho, avaliação cognitiva

JEL: I12, J24

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摘 要

本研究基于工作要求—资源（JD-R）模型，调查广西柳州市三县乡镇卫生院医务人员工作投入机制。结果显示，责任感显著提升挑战性评价，时间压力显著降低之；工作自主性显著提升挑战性评价，资源不足显著提高阻碍性评价。挑战性评价促进工作投入，阻碍性评价抑制之，二者在部分工作特征与投入间发挥中介作用。社会支持增强挑战性评价的积极效应，但未显著缓冲阻碍性评价的负效应。总体而言，责任感与自主性是主要激励因素，资源不足是主要阻碍因素；应通过优化岗位设计、强化自主性与责任感及改善资源配置与支持体系以提升工作投入。

关键词：工作投入，乡镇卫生院，工作要求-资源模型，认知评价

JEL: I12, J24

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Three years of doctoral study have flown by in the blink of an eye, leaving me with countless reflections and emotions. Over these three years, I encountered many challenges both in work and life. Yet, it was during my time studying, writing my thesis, and exchanging ideas with professors and classmates that I found solace and peace of mind. I am deeply grateful to Southern Medical University and ISCTE for giving me this invaluable opportunity to learn.

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Chapter1: Introduction

1.1 Research background

Optimization of healthcare resource allocation must be guided by multiple factors, including the accessibility of medical services, the healthcare needs of the population, the availability of healthcare provisions, and the scientific rationality of resource distribution structures. Such an optimization process must align with national economic development levels and social progress, while balancing the principles of efficiency and equity (Li & Fu, 2017).

Township hospitals are pivotal components of China's national healthcare system, playing dual roles in delivering basic medical services and public health programs for rural populations. Cai et al. (2023) emphasized that strengthening primary care at the township level is crucial for controlling healthcare costs and improving healthcare accessibility in rural areas. They further argued that investing in township hospitals can alleviate the overwhelming burden on tertiary hospitals and foster greater equity across healthcare systems. Their empirical findings highlighted that stronger primary care systems correlate with improved health outcomes and lower overall healthcare expenditure.

Official statistics from the National Health Commission indicate that by the end of 2023, there were approximately 35,000 Township hospitals operating across China. Meng et al. (2015) reported that these township hospitals covered over 90% of rural townships, serving as first-contact institutions in China's hierarchical healthcare system. Their responsibilities include disease prevention, health management, and the treatment of common illnesses. Meng et al. (2015) also noted that township hospitals play a central role in bridging the healthcare accessibility gap between rural and urban areas, providing essential services that are otherwise scarce in less developed regions. Township hospitals have become pivotal intermediaries in narrowing urban rural healthcare disparities under China's consolidated social health insurance. By anchoring financing and service delivery locally, they enhance equity and efficiency in three keyways. First, they integrate rural residents into the unified Urban-Rural Resident Basic Medical Insurance (URRBMI), ensuring standardized premiums and benefit packages that reduce out-of-pocket spending and financial barriers at the grassroots level. Second, higher reimbursement rates for care obtained at township facilities incentivize patients to seek

treatment locally, easing pressure on urban tertiary hospitals and diminishing costly cross-regional care. Finally, the pooling of funds from both urban and rural populations bolsters financial sustainability, enabling township hospitals to expand diagnostic capacity and service diversity. This structural alignment strengthens their ability to deliver accessible, affordable primary care and forms the backbone of a more equitable and efficient health system.

Despite these achievements, substantial challenges persist. Township hospitals often suffer from insufficient resource allocation, outdated infrastructure, and inadequate medical equipment, which collectively undermine their healthcare service capacity and long-term sustainability (Yao et al., 2014). From the perspective of health system reforms, township hospitals in China continue to face substantial structural constraints that hinder equitable healthcare delivery. A nationwide cross-sectional study demonstrated that outdated diagnostic infrastructure and irregular funding allocation patterns disproportionately affect rural facilities, especially in western provinces (Zhang et al., 2014). This structural imbalance persists despite major national investment initiatives, often because fiscal decentralization at the county and township levels results in inconsistent prioritization of primary care services (Yuan et al., 2023). Moreover, aging infrastructure remains a pervasive problem. Many township hospitals operate in dilapidated facilities-built decades ago, which not only impairs infection control and clinical safety but also discourages talent retention and public trust (Zhang et al., 2024a). Medical equipment in these settings frequently fails to meet basic diagnostic or treatment needs.

Since the establishment of China's public health infrastructure in the 1950s, substantial progress has been achieved in reducing the incidence and burden of infectious diseases and improving maternal and child health outcomes. Xi et al. (2025) reported that these advances have contributed to significant declines in national mortality rates and remarkable increases in life expectancy across developing nations, including China. Nevertheless, persistent challenges remain, including deficits in healthcare quality, inefficiencies in chronic disease management, and disparities in healthcare delivery efficiency. Yip et al. (2019) examined healthcare reforms implemented over the past decade, specifically from 2009 to 2019. Their findings revealed considerable progress in improving access to healthcare services and financial protection, particularly for socioeconomically disadvantaged populations. Nevertheless, the study highlighted persistent issues in healthcare quality and public satisfaction, indicating that significant disparities remain unresolved. Extensive research has investigated the disparities in healthcare utilization between rural and urban populations. Extensive research confirms pronounced rural urban disparities in China's healthcare utilization. A spatial analysis in Nanjing showed that rural residents comprising 16.5% of the population accounted for only

3.95% of general hospital access, with rural hospital accessibility scores at 0.46 versus 3.11 in urban zones (Du et al., 2024). Simultaneously, a national-level survey revealed that, from 2020 to 2022, rural township hospitals had on average 2.2 fewer institutions, 36 fewer hospital beds, and 10 fewer physicians per 10,000 people compared to national averages (Zhang, 2024b). These pronounced resource shortages substantially limit rural patients' ability to access inpatient and specialized services in a timely manner. Beyond infrastructure, rural areas also lag in healthcare personnel and institutional density. The disparity in healthcare worker distribution doctors, nurses, and technical staff is a recurring finding in recent policy evaluations of primary care access (Zhang, 2024b). Inadequate staffing correlates with lower service uptake, higher out-of-pocket spending, and poorer chronic disease management, even where insurance coverage is near-universal. Consequently, systemic resource deficits including infrastructure, workforce, and institutional capacity continue to undermine equitable healthcare utilization for rural populations, impeding the realization of universal health coverage. Haggerty et al. (2014) found that rural residents consistently exhibit lower levels of healthcare engagement compared to their urban counterparts. Their research attributed this disparity to imbalanced healthcare resource distribution and deficiencies in healthcare infrastructure in rural areas. Furthering this understanding, Farmer et al. (2006) explored the broader social determinants of healthcare access, highlighting that geographic isolation and socioeconomic deprivation contribute significantly to reduced healthcare utilization in rural regions. These structural barriers exacerbate health inequities and hinder efforts to achieve nationwide healthcare equity.

The hukou system, China's household registration mechanism, adds another layer of complexity to the rural-urban divide in healthcare access. Established in the 1950s, the hukou system classifies individuals as either rural or urban residents, granting them varying degrees of access to public services, including healthcare. This institutional framework has historically restricted rural residents' mobility and access to urban resources, thereby entrenching disparities in healthcare utilization and outcomes (Shen et al., 2021).

Research indicates that individuals with rural hukou status face significant barriers to accessing healthcare services in urban areas. For instance, Yao et al. (2020) found that rural hukou holders are less likely to utilize urban healthcare facilities due to limited portability of health insurance and lack of local medical records, even when residing in urban settings. This limitation results in the underutilization of available healthcare services among rural migrants.

Moreover, the hukou system contributes to health stratification across the life course. Individuals with rural hukou status experience cumulative disadvantages in health outcomes,

including higher rates of chronic diseases and mental health issues. These disparities are attributed to lower socioeconomic status and reduced access to quality healthcare services, which are often concentrated in urban areas (Song & Smith, 2019).

Li et al. (2018) analyzed health service utilization patterns between urban and rural residents over a nearly two-decade period and found that the hukou system entrenched systemic disparities by restricting access to healthcare resources for rural populations. This restriction operates through several institutional pathways. One critical mechanism involves rural residents' ineligibility to participate in urban health insurance programs, which substantially increases their out-of-pocket expenses for advanced medical care (Yang et al., 2025). Moreover, urban healthcare systems often allocate limited specialist appointments and advanced procedures preferentially to urban hukou holders, leaving rural residents with restricted access to high-quality services (Yang & Yu, 2023). In addition, fragmented medical record systems undermine continuity of care for rural patients, particularly in managing chronic diseases (Song & Smith, 2019). The unequal distribution of healthcare infrastructure and qualified personnel further amplifies these disparities, as rural areas often face shortages of advanced facilities and medical professionals (Chen et al., 2022a).

Despite policy relaxations since the 1980s, rural residents continue to face substantial obstacles in obtaining equitable healthcare services, perpetuating significant gaps in healthcare utilization and outcomes. Treiman (2012) emphasized that although reforms have weakened some of the hukou system's rigidities, such as allowing rural residents to temporarily migrate for employment without fully transferring their household registration and expanding access to basic public health insurance schemes, these adjustments have not fundamentally eliminated institutionalized access barriers to high-quality healthcare services (Yao et al., 2020). Persistent inequalities in resource distribution, including healthcare services, remain prevalent. This is particularly evident in the concentration of specialized medical resources, advanced equipment, and experienced healthcare professionals in urban centers, while rural regions continue to suffer from limited medical infrastructure and shortages of qualified providers (Du et al., 2024). This entrenched inequity further marginalizes rural populations, restricting their access to critical public services such as preventive care, chronic disease management, and maternal-child health interventions (Liu et al., 2017).

China's healthcare insurance system mirrors these societal divides. Lei and Lin (2009) analyzed the New Cooperative Medical System (NCMS), a community-based health insurance scheme for rural residents. They pointed out that while enrollment rates have improved, the NCMS provides less comprehensive coverage and involves more complicated reimbursement

procedures compared to urban insurance schemes. Liu et al. (2002) evaluated urban health insurance reforms and noted that urban residents enjoy more extensive and efficient healthcare coverage. In contrast, rural insurance schemes remain less favorable, creating significant barriers to affordable and reliable healthcare access for rural populations.

Despite ongoing healthcare reforms, rural populations in China continue to experience substantial challenges in accessing healthcare services. Xu et al. (2024) conducted an extensive analysis of spatial accessibility in Zhejiang Province and revealed significant inequities between rural and urban areas. Their findings underscore the enduring disparities in healthcare resource allocation and emphasize the urgent need for more targeted and effective policy interventions to bridge the rural-urban healthcare divide and promote equitable access.

China's rural healthcare system continues to confront profound structural challenges, particularly concerning the availability and distribution of qualified healthcare personnel. Wang et al. (2019) found that although initiatives such as rural-oriented medical education programs have made some progress, sustaining a robust rural healthcare workforce remains an ongoing issue. Shortages are particularly severe in remote areas, where recruitment and retention of healthcare workers are hampered by limited career development opportunities and harsh working conditions (Zhou, 2025a).

Between 2017 and 2018, substantial reductions were observed, with approximately 62,000 village doctors lost and 5,101 rural clinics closed (Yang et al., 2019). This contraction left 1,022 administrative villages without healthcare facilities and led to 6,903 clinics facing acute shortages of qualified personnel, thereby exacerbating vulnerabilities in rural healthcare service delivery. In response, China's healthcare reforms have aimed to restructure primary healthcare systems by promoting tiered diagnosis and treatment pathways, reallocating high quality medical resources to grassroots institutions, and enhancing the availability of essential medications for chronic and common diseases (Zhu et al., 2019). These efforts seek to strengthen healthcare delivery infrastructure and mitigate the service provision gap between urban and rural populations.

Moreover, township hospitals have assumed broader responsibilities beyond traditional clinical services, functioning as central hubs for public health initiatives. These include leading roles in health education programs, chronic disease management, and epidemic prevention and control efforts. Wang et al. (2024a) emphasized the strategic significance of the rural three-tier healthcare system, wherein township hospitals are positioned as pivotal operational centers supporting the continuity and sustainability of rural healthcare frameworks. Their central role in the three-tier model has been instrumental in enhancing healthcare access and improving

population health outcomes in underserved rural regions of China.

Township hospitals also assume a broader role beyond clinical services, serving as hubs for public health functions including health education, chronic disease management, and epidemic prevention and control. Cai et al. (2023) highlighted the strategic importance of consolidating the rural three-tier healthcare network, identifying township hospitals as critical operational centers supporting rural healthcare delivery systems. Despite their essential roles, township hospitals' healthcare workerss face significant occupational challenges. Xu et al. (2020a) reported that rural healthcare workers often experience emotional exhaustion and burnout due to prolonged exposure to high work demands and resource-constrained environments. Such as rural healthcare workers often experience emotional exhaustion and burnout due to prolonged exposure to high work demands and resource-constrained environments, such as long working hours, high patient volumes, insufficient medical equipment, limited opportunities for professional development, and inadequate financial compensation.

Similarly, Cao et al. (2022) found that adverse working conditions, low salary levels, and limited career advancement opportunities exacerbate occupational stress among rural healthcare workers, emphasizing the cumulative negative impact on job satisfaction and psychological well-being. Further compounding these issues, Dong et al. (2023) explored the psychological consequences of occupational stress during the COVID-19 pandemic, revealing that heightened stress levels were associated with increased depression and reduced job satisfaction among healthcare workers.

Moreover, Que et al. (2020) specifically examined the psychological impact of the COVID-19 pandemic on healthcare workers, documenting increased prevalence of anxiety, depression, and insomnia. These mental health challenges pose a serious threat to the sustainability and quality of rural healthcare services. Collectively, these studies underscore the urgent need for targeted interventions to alleviate occupational stress, enhance professional development opportunities, and improve the working conditions of township hospitals' healthcare workerss to ensure the sustainability and effectiveness of rural healthcare delivery systems.

1.2 Research purpose

Based on the JD-R theory, this study aims to systematically examine the current status and influencing mechanisms of work engagement among healthcare workers in township hospitals in three counties of Liuzhou City, Guangxi province. The township hospitals in Liucheng, Sanjiang, and Rongshui counties of Liuzhou City exhibit considerable representativeness in

terms of primary healthcare system structure, variations in economic development levels, allocation of medical resources, and the work-related stress profiles of healthcare personnel. These characteristics provide a typical and empirically valuable sample for examining the mechanisms of work engagement among township hospital healthcare workers based on the JD-R theoretical framework. In addition, as these township hospitals are administratively managed by my hospital's affiliated institution, the research was able to coordinate the survey efficiently, ensuring the comprehensiveness, authenticity, and high response rate of the data collection. The management structure also facilitated access to comprehensive staff rosters and administrative records, thereby improving the efficiency and accuracy of sample selection and questionnaire administration.

This study systematically analyzes the mechanisms by which job demands, and job resources influence work engagement among township hospital healthcare workers. In accordance with the transactional theory of stress and the JD-R model, job demands are divided into challenge demands and Hindrance demands. Challenge demands include workload, time pressure, task complexity, and responsibility. Hindrance demands comprise administrative hassles, role conflict, role ambiguity, resource inadequacy, interpersonal conflict, and organizational politics (Cavanaugh et al., 2000).

Simultaneously, job resources are categorized into two dimensions. Job control encompasses decision authority and task discretion (Gonzalez Mulé & Cockburn, 2017), while job autonomy refers to employees' freedom in determining work methods and task execution (Flatten et al., 2011).

The examination of these variables is particularly relevant because township hospitals' healthcare workerss are chronically exposed to high job demands and severe resource constraints, making them an ideal population for testing JD-R theoretical predictions (Hou et al., 2020). By surveying healthcare workers from township hospitals in Liucheng, Sanjiang, and Rongshui counties of Liuzhou City, the study captures actual working conditions under varied resource availability and demand pressures, providing empirical evidence for theoretical refinement and managerial practice (Yao et al., 2020).

It is noteworthy that job demands are not inherently detrimental; their effects largely depend on healthcare workers' cognitive appraisal. When job demands are appraised as challenges, they can stimulate intrinsic motivation and promote professional development (Lepine et al., 2016). In contrast, when appraised as hindrances, they tend to evoke negative emotions and lead to job burnout (Adnan et al., 2022). Thus, cognitive appraisal serves as a core mediating mechanism between job demands and work engagement (van der Heijden et al.,

2019). In resource-limited township hospital environments, positive cognitive appraisals enable healthcare workers to reinterpret work stress as manageable challenges, thereby enhancing vigor, dedication, and absorption.

While township hospitals represent a critical backbone of China's rural healthcare system, the application of the JD-R model within these settings remains methodologically and contextually underdeveloped. Existing research has disproportionately focused on tertiary or urban healthcare institutions, often neglecting the distinct organizational, cultural, and socio-economic realities of rural healthcare providers (Liu et al., 2021). Township hospitals' healthcare workerss routinely engage in complex multitasking, balancing clinical care, public health services, and administrative responsibilities within highly decentralized systems that differ markedly from the centralized structures of urban hospitals (Xu et al., 2020a). These unique demands underscore the limitations of directly transplanting conventional JD-R frameworks without contextual adaptation.

Cultural and regional diversity within China's rural healthcare landscape further complicates model generalizability. Ethnic heterogeneity, linguistic barriers, and divergent community health expectations substantially influence both job demands and perceived resources among healthcare workers (Zhang et al., 2018). Failing to incorporate these culturally embedded dynamics may obscure critical variance in how rural providers experience and appraise occupational stressors. As regional disparities in healthcare delivery persist, model calibration that neglects sociocultural nuances risks limiting both explanatory and predictive validity (Li et al., 2020).

In addition, although personal resources are increasingly acknowledged within the JD-R framework (Xanthopoulou et al., 2007), longitudinal investigations capturing their dynamic interaction with job demands and job resources remain scarce in rural contexts. Emerging evidence suggests that personal resources may initiate gain spirals that promote sustained engagement, yet most studies in this domain rely heavily on cross-sectional data that preclude causal inferences (Tian et al., 2023).

Policy reforms further complicate model application. Reorganization efforts, such as county-level medical alliances and hierarchical administrative restructuring, have fundamentally altered working conditions in township hospitals (Li et al., 2024). However, most empirical applications of the JD-R model fail to integrate these institutional transitions, leading to incomplete depictions of evolving motivational pathways among township hospitals' healthcare workerss.

Finally, methodological constraints continue to restrict knowledge advancement.

Standardized instruments like the Utrecht Work Engagement Scale (UWES), widely adopted in Western research, often exhibit limited factorial validity and cultural equivalence when deployed in rural Chinese samples (Fong & Ng, 2012).

In summary, this study employs a structural equation modeling approach based on the JD-R theory, using data from township hospitals in three counties of Liuzhou City. The research model incorporates independent variables (challenge demands, Hindrance demands, job control, job autonomy), a mediating variable (cognitive appraisal), a moderating variable (social support), and a dependent variable (work engagement), aiming to provide theoretical foundations and practical guidance for optimizing human resource management and psychological support in primary healthcare settings.

1.3 Research dilemma

Although the JD-R model has been widely utilized in occupational health research, its empirical application remains insufficient within township-level healthcare institutions in rural China (Chenevert et al., 2021).

Rural healthcare providers frequently encounter high work demands compounded by resource scarcity, limited promotion opportunities, and chronic understaffing, which create distinctive occupational stress profiles not fully captured (Xu et al., 2020a).

Most prior research has focused predominantly on urban tertiary hospitals, where healthcare infrastructure, staffing, and professional development pathways substantially differ from township hospitals, limiting the external validity of these findings for rural healthcare contexts (Luo et al., 2021).

While the theoretical distinction between challenge and Hindrance demands has been extensively discussed, empirical differentiation and mechanism testing within rural healthcare workforces remain scarce (Bao et al., 2024).

Moreover, cognitive appraisal how individuals interpret work demands as either opportunities for growth or barriers has received limited empirical validation as a mediating mechanism in township hospital settings under resource-constrained conditions (Fu et al., 2025). This gap is particularly relevant given that the same job demand (e.g., workload) may elicit vastly different motivational outcomes depending on whether it is cognitively framed as a challenge or hindrance. As township healthcare workers often operate under high-pressure yet low-control conditions, their subjective appraisal of stressors is likely to play a critical role in determining engagement outcomes. Therefore, examining cognitive appraisal not only

addresses a theoretical gap in the JD-R model but also offers practical insights into promoting adaptive engagement in under-resourced primary care systems.

Although social support has been widely acknowledged as a crucial buffer against occupational stress, its moderating role within township healthcare institutions has not been systematically investigated, particularly under chronic resource shortages and career limitations (Lu et al., 2023)

While the present study also employs a cross-sectional design, it addresses prior limitations by advancing theoretical depth and contextual relevance. Specifically, it targets an underexamined group healthcare professional in Chinese township hospitals who face unique work conditions marked by resource scarcity and institutional constraints. By applying a differentiated stressor framework that distinguishes challenge and hindrance demands, and by incorporating cognitive appraisal and perceived organizational support as key mediating and moderating mechanisms, this study extends the JD-R model to better explain work engagement in township-level healthcare systems. Rather than altering research temporality, the contribution lies in contextualizing established theoretical constructs within a critical yet understudied segment of China's healthcare system (Zhou & Zheng, 2022).

1.4 Research questions

Work engagement is a critical indicator of employee well-being and organizational performance, particularly in healthcare settings where service quality and patient outcomes are directly influenced by staff motivation and sustained psychological investment in work. In resource-constrained township hospitals, work engagement characterized by vigor, dedication, and absorption (Schaufeli et al., 2002) plays a vital role in maintaining effective healthcare delivery. Engaged healthcare professionals sustain high levels of focus during complex clinical interactions, persist through workload pressures, and are more likely to adhere to safety protocols and patient-centered practices (Galanis et al., 2024). The vigor component, in particular, reflects the physical and emotional energy that staff bring to their roles, enabling them to actively manage chronic demands and respond effectively to unpredictable care situations common in rural primary care environments.

In environments such as township hospitals, where staff frequently encounter overlapping clinical, public health, and administrative roles, maintaining stable energy reserves becomes vital for sustaining work engagement (Zhang et al., 2021a). Repeated exposure to emotionally charged situations such as dealing with critically ill patients, resource scarcity, and community

expectations places extraordinary psychological demands on rural healthcare workers (van Bogaert et al., 2017). Without sufficient personal and organizational resources, chronic energy depletion may lead to emotional exhaustion and impaired clinical judgment, ultimately compromising patient safety and organizational performance (Poghosyan et al., 2010). Conversely, high staff commitment and energy function as protective mechanisms, buffering against burnout and facilitating adaptive coping strategies that sustain long-term engagement under adversity (Hakanen et al., 2006).

However, the factors contributing to work engagement among healthcare workers in rural environments, such as township hospitals in China, remain underexplored (Xu et al., 2020a).

The JD-R theory has become a dominant framework in occupational health psychology for explaining how job characteristics influence work engagement and burnout. Bakker et al. (2017) underscored that job demands can be either challenge demands, which have the potential to motivate employees and foster growth, or Hindrance demands, which often impede performance and well-being. Differentiating between these two types of demands provides a more nuanced understanding of their distinct impacts on work engagement.

Empirical evidence further supports this differentiation. For instance, Crawford et al. (2010) found that challenge demands such as task complexity are positively associated with work engagement, whereas Hindrance demands like role conflict and organizational constraints are negatively correlated. This dichotomy underscores the necessity of examining the specific effects of challenge and Hindrance demands on the work engagement of healthcare workers in resource-constrained township environments.

Empirical evidence further supports this differentiation. For instance, Crawford et al. (2010) demonstrated that challenge demands such as task complexity are positively associated with work engagement, whereas Hindrance demands like role conflict and organizational constraints exhibit a negative relationship. Within healthcare populations, this dichotomy has been consistently validated. For example, in a cross-sectional study of Chinese nurses, (Zhang et al. (2014) found that workload and task variety (representing challenge demands) were significantly linked to higher engagement levels, while administrative burden and interpersonal conflict (representing Hindrance demands) predicted emotional exhaustion and disengagement. Similarly, Li et al. (2021) observed among rural healthcare workers that the positive effects of challenge demand on engagement were contingent on adequate job resources, while hindrance demands consistently predicted burnout regardless of available resources. These findings emphasize the necessity of dissecting stressor types when analyzing work engagement in resource-constrained township healthcare settings, where staff often face both stimulating and

obstructive job characteristics simultaneously.

Job resources also play an essential role. Xanthopoulou et al. (2007) emphasized that resources such as job control and job autonomy serve as motivators that can enhance work engagement by satisfying basic psychological needs for competence, autonomy, and relatedness. Yet, the extent to which these resources buffer the negative effects of high demands in under-resourced rural healthcare settings remains unclear.

In addition to the structural aspects of job demands and resources, psychological processes are crucial in shaping work engagement. Cognitive appraisal theory posits that individuals' subjective evaluations of stressors whether perceived as challenges or hindrances—mediate their emotional and behavioral responses. Sinclair et al. (2020) emphasized that positive cognitive appraisal is significantly associated with higher work engagement and suggests that appraisal may serve as a critical psychological mechanism linking job demands to engagement outcomes. Cognitive appraisal serves as a core psychological mechanism that explains how healthcare workers respond to job demands. According to Ganster et al. (2018), individuals evaluate stressors as either challenges, which offer opportunities for growth, or hindrances, which obstruct goal achievement. This evaluative process determines whether job demands stimulate engagement or contribute to strain. Positive appraisal of complex tasks and high workload enhances vigor and dedication, fostering greater work engagement (Sinclair et al., 2020), whereas appraisal of bureaucratic barriers and role conflict as hindrances is associated with emotional exhaustion and disengagement (Lepine et al., 2016). Chun et al. (2023) confirmed that positive cognitive appraisal strengthens resilience and sustains engagement even under resource constraints.

Social support is another pivotal factor influencing how individuals cope with work stressors. According to Van der Heijden et al. (2019), social support from colleagues and supervisors can buffer the adverse effects of job demands on psychological health, thereby enhancing work engagement. This buffering hypothesis is particularly relevant in rural Chinese township healthcare settings where job resources especially organizational support is often underdeveloped, as outlined in the JD-R framework.

Moloney et al. (2018) further argued that robust social support systems improve psychological resilience and job satisfaction among healthcare workers, which are integral to sustaining engagement and reducing turnover, especially in underserved regions.

Guided by the JD-R model and supported by emerging empirical evidence, it is evident that the interaction between job demands, job resources, cognitive appraisal, and social support constitute a complex mechanism influencing work engagement. However, limited research has

addressed how these dynamics function in the unique socio-cultural and organizational contexts of rural China, characterized by resource scarcity, hierarchical organizational structures, and distinct cultural expectations regarding work and collectivism.

Therefore, this study aims to address the following research questions:

(1) How do job demand (including challenge demands and Hindrance demands) influence cognitive appraisal (challenge appraisal and hindrance appraisal) among township hospitals' healthcare workers?

(2) How do job resources (decision authority, task discretion, and job autonomy) influence challenge appraisal among township hospitals' healthcare workers?

(3) How do cognitive appraisals (challenge appraisal and hindrance appraisal) influence work engagement?

(4) Does cognitive appraisal mediate the relationships between job demands, job resources, and work engagement?

(5) Does social support moderate the relationship between cognitive appraisals and work engagement?

1.5 Significance of the study

1.5.1 Theoretical significance

The present study seeks to advance theoretical understanding of the JD-R model by extending its application to primary healthcare workers in rural township hospitals in China. Although the JD-R model has been extensively validated across diverse occupational contexts, such as corporate organizations (Bakker et al., 2007), educational institutions (Hakanen et al., 2006), urban healthcare systems (Schaufeli & Bakker, 2004), and public administration sectors (Xanthopoulou et al., 2007) its applicability within rural healthcare settings remains significantly underexplored.. By analyzing how job demands, job resources, and personal cognitive appraisal mechanisms interact to influence work engagement among township hospitals' healthcare workerss, this study aims to enhance the model's generalizability.

Schaufeli (2017) emphasized that the JD-R framework is highly flexible and can accommodate sector-specific adaptations. However, the scarcity of empirical research from rural healthcare settings restricts its global applicability. By embedding cognitive appraisal as a mediating mechanism and social support as a moderating resource within the JD-R model, this study substantially advances the model's explanatory precision. Cognitive appraisal

introduces an individual-level psychological process that interprets job demands as either motivating challenges or obstructive hindrances, thereby determining whether demands trigger adaptive engagement or maladaptive strain (Ganster et al., 2018). This appraisal process is particularly critical in rural healthcare settings, where healthcare workers confront complex, overlapping, and often conflicting demands that require continuous subjective evaluation (Xie et al., 2021). Simultaneously, the inclusion of social support captures contextual buffering dynamics by recognizing that interpersonal resources such as peer assistance, supervisory guidance, and community solidarity can amplify the beneficial effects of challenge appraisals while attenuating the detrimental impact of hindrance appraisals (Halbesleben, 2006). Together, these mechanisms enrich the JD-R framework by integrating both internal psychological filters and external environmental moderators, offering a more dynamic and context-sensitive understanding of how work engagement is sustained under persistent resource constraints and occupational adversity (van der Heijden et al., 2019).

Additionally, Lepine et al. (2016) proposed a critical differentiation between challenge demands and Hindrance demands, acknowledging that not all job demands have uniform effects on occupational outcomes. On occupational outcomes, this means that while certain job demands can stimulate motivation, engagement, and professional growth when perceived as challenges (Crawford et al., 2010), others may deplete energy, induce psychological strain, and hinder performance when appraised as hindrances (Lepine et al., 2016). Challenge demands, such as task complexity, responsibility, and time pressure, often foster a sense of accomplishment and competence, thereby enhancing work engagement and resilience (Xanthopoulou et al., 2007). In contrast, Hindrance demands, including role conflict, administrative hassles, and organizational politics, obstruct goal attainment, trigger frustration, and increase emotional exhaustion, ultimately undermining engagement (Zhang et al., 2020). This distinction underscores the heterogeneous nature of job demands and highlights the necessity of differentiating their distinct psychological processes when analyzing work engagement, particularly in complex occupational settings such as rural healthcare (Xu et al., 2020a). By systematically integrating this differentiation into the JD-R model, the present study refines its predictive capacity and offers a more nuanced theoretical framework to guide both empirical investigations and practical interventions (Bakker et al., 2017).

Integrating this distinction into the JD-R model enables the differentiation between positive and negative aspects of job demands, providing a nuanced perspective on their influence on healthcare workers' engagement and resilience. In doing so, the study contributes to refining the JD-R framework, offering new pathways for future theoretical and empirical research in

occupational health psychology.

1.5.2 Practical significance

From a practical perspective, the findings of this study are expected to yield actionable insights for human resource management in rural healthcare institutions. Township hospitals staff are vital for the delivery of primary healthcare services in rural China, yet they often endure heavy workloads, limited professional development opportunities, and insufficient organizational support (Liu et al., 2019). Xu et al. (2020a) demonstrated that such unfavorable working conditions are linked to high levels of occupational stress and mental health issues, threatening both individual well-being and organizational stability.

Understanding the differential effects of challenge and Hindrance demands will enable healthcare administrators to design targeted interventions aimed at optimizing workload management and enhancing professional development pathways. By distinguishing between these two forms of stressors, the study offers practical strategies for fostering a work environment that encourages growth and minimizes occupational fatigue.

Moreover, Van der Heijden et al. (2019) stressed the importance of social support as a vital job resource in buffering against psychological distress and promoting work engagement. This study's focus on the moderating effect of social support offers valuable guidance for developing supportive workplace policies, such as fostering peer support networks, enhancing supervisory relationships, and instituting organizational wellness programs, particularly critical in resource-constrained township healthcare settings.

Moloney et al. (2018) further emphasized that psychological resilience and mental health interventions are crucial for retaining healthcare workers, especially in underserved regions. These recommendations will be directly aligned with broader public health goals aimed at improving healthcare access and service quality in rural China, contributing to the sustainability and effectiveness of grassroots healthcare systems

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Chapter2: Literature Review

2.1 The JD-R Model

The JD-R model provides a parsimonious yet highly comprehensive framework for explaining employee well-being and performance across occupational contexts (Bakker et al., 2007). At its core, the JD-R model posits that all job characteristics, regardless of industry or role specificity, can be classified into two overarching categories: job demands and job resources (Demerouti et al., 2001). Job demands refer to those physical, psychological, social, or organizational aspects of work that require sustained effort and are associated with certain physiological or psychological costs. In contrast, job resources are those aspects that facilitate goal achievement, stimulate personal growth, and buffer the negative effects of job demands (Bakker & Demerouti, 2007).

Critically, the JD-R model delineates two relatively independent but interrelated psychological processes through which these job characteristics influence employee outcomes. The first is the health impairment process, whereby excessive job demands particularly when unbuffered lead to chronic strain, emotional exhaustion, and eventual burnout (Bakker et al., 2003). The second is the motivational process, wherein job resources directly promote work engagement by fulfilling fundamental psychological needs such as autonomy, competence, and relatedness, ultimately enhancing performance and organizational commitment (Schaufeli et al., 2002).

Importantly, job resources serve not only as direct facilitators of motivation but also as critical buffering agents that mitigate the deleterious effects of high job demands on employee well-being (Bakker et al., 2005). For example, when healthcare workers face intense emotional labor or heavy clinical responsibilities, the presence of supportive leadership, adequate autonomy, and opportunities for professional development can significantly attenuate the adverse consequences typically associated with such demands (Xanthopoulou et al., 2007). This buffering effect underscores the dynamic interplay between job demands and resources, whereby adequate resources transform potentially overwhelming demands into challenges that foster growth and engagement (Bakker & Demerouti, 2017).

Furthermore, longitudinal studies have demonstrated that the JD-R model operates not only

at the individual level but also across organizational units, suggesting that aggregated job resources contribute to overall team resilience and institutional performance (Bakker & Demerouti, 2024). This multilevel applicability reinforces the JD-R model's utility for both theoretical advancement and practical interventions aimed at enhancing workforce sustainability, particularly in resource-constrained healthcare systems such as township hospitals.

2.1.1 Theoretical foundations

The JD-R model, first introduced by Demerouti et al. (2001), provides a comprehensive and flexible framework to understand the complex interplay between work environments and employee well-being, motivation, and performance.

It was developed as a response to the limitations of earlier occupational stress models. Karasek's Demand-Control (DC) model, one of the foundational frameworks in occupational health psychology, posited that job strain results from the combination of high job demands and low decision latitude. However, its focus on a limited set of job characteristics and its assumption of uniform effects across occupations have been criticized for lacking contextual adaptability and comprehensiveness (Formazin et al., 2025). These constraints restricted its application across diverse work environments and increasingly complex job settings.

In contrast, the JD-R model proposed a broader and more flexible classification system. It postulates that the vast array of job characteristics encountered across different occupations can be categorized into two overarching domains: job demands and job resources. Job demands are those physical, psychological, social, or organizational aspects of work that require sustained effort and are associated with certain physiological and psychological costs, whereas job resources facilitate goal achievement, reduce job demands, and stimulate personal growth and development (Bakker & Demerouti, 2017). This categorization allows the JD-R model to be applied universally across occupational contexts, enhancing its relevance and adaptability in modern organizational research.

Moreover, the JD-R model offers a dynamic dual-pathway framework that simultaneously explains both the motivational benefits of job resources and the strain-inducing consequences of excessive job demands (Bakker et al., 2007). Specifically, job resources such as autonomy, decision authority, task discretion, and social support activate a motivational process, promoting work engagement and enhancing organizational commitment. Conversely, high job demands—particularly when chronic and unbuffered by sufficient resources can initiate a

health impairment process, leading to strain, emotional exhaustion, and ultimately burnout (Bakker et al., 2014).

Importantly, the JD-R model accommodates the integration of personal and contextual variables that interact with job demands and resources, allowing for more individualized and context-sensitive predictions of employee outcomes. This adaptability has facilitated its application across a wide array of occupational settings, including healthcare, where complex demands and resource constraints often coexist (Mazzetti et al., 2023).

In healthcare environments especially in primary care systems such as township hospitals in rural China—this theoretical flexibility of the JD-R model becomes particularly relevant. Healthcare workers in these settings face not only high job demands in the form of excessive workloads, complex patient cases, and emotional labor, but also encounter persistent shortages in material resources, staffing, and career advancement opportunities (Dong et al., 2023). The dual-pathway structure of the JD-R model allows for a nuanced understanding of how these simultaneous pressures can lead to either maladaptive outcomes such as burnout or positive outcomes such as work engagement, depending on the availability of job resources and individual coping mechanisms (Bakker et al., 2014).

Particularly crucial in this study is the focus on work engagement as the ultimate motivational outcome of the JD-R framework. Unlike many prior studies that emphasize burnout or strain, this research highlights work engagement because it captures healthcare workers' proactive energy, professional dedication, and immersive involvement in their duties (Schaufeli et al., 2009). Given the chronic adversity township hospital staff face, understanding the mechanisms that foster and sustain engagement may offer more actionable solutions for improving healthcare workforce resilience and service quality than simply addressing burnout symptoms after they have emerged (van Bogaert et al., 2013).

Moreover, the JD-R model's structure accommodates the inclusion of cognitive appraisal as a key mediating mechanism that explains how healthcare workers subjectively evaluate and interpret job demands (Ganster & Rosen, 2013). Depending on how demands are appraised—as either challenges that promote professional growth or hindrances that obstruct goal attainment the same objective workload may lead to divergent psychological and behavioral outcomes (Crawford et al., 2010). This cognitive appraisal mechanism is particularly important in township hospital contexts where job characteristics are highly heterogeneous and resource scarcity is common.

At the same time, social support serves as an essential external moderator in this extended

JD-R model, influencing how healthcare workers cope with and appraise their work demands. Support from supervisors, colleagues, and professional networks may strengthen positive appraisals of challenging tasks, buffer the negative impacts of Hindrance demands, and directly foster greater work engagement (Moloney et al., 2018). In the often-isolated working conditions of township hospitals, robust social support systems are critical for sustaining healthcare workers' motivation, well-being, and long-term professional commitment (Dong et al., 2023).

In this study, the JD-R framework is extended to analyze not only the direct effects of job demands and job resources on work engagement but also the critical psychological and contextual mechanisms through which these relationships operate. Specifically, cognitive appraisal is incorporated as a mediating process that explains how healthcare workers subjectively evaluate and interpret job demands as either challenges or hindrances, while social support functions as a moderating factor that buffers the negative effects of job demands and strengthens positive motivational processes. This integrated model offers a theoretically grounded and context-sensitive approach for understanding the dynamic interplay of stressors, resources, and psychological mechanisms that shape work engagement among healthcare workers in township hospitals.

2.1.2 Job demands

Job demands refer to the physical, psychological, social, or organizational aspects of a job that require sustained physical or mental effort and are therefore associated with specific physiological and psychological costs. Typical examples include high workload, time pressure, emotional demands, and role conflict, all of which are prevalent in healthcare settings. Importantly, job demands are not inherently detrimental; their impact largely depends on the interaction with available job resources and an individual's coping capacity. According to the JD-R model, sustained exposure to high demands without adequate recovery or support mechanisms leads to energy depletion, resulting in emotional exhaustion and ultimately burnout (Demerouti et al., 2001).

Recent empirical research emphasizes that the qualitative nature of job demands also matters. For example, demands perceived as challenges such as complex patient cases can foster motivation and professional development, while hindrance demands such as administrative overload are more likely to elicit frustration and disengagement (Fernandez De Henestrosa et al., 2023a). Moreover, emotional demands, including managing patient emotions and dealing with suffering or death, have been shown to exert a particularly heavy psychological toll on healthcare workers, exacerbating the risk of burnout and mental health disorders if not properly

managed (Freimann & Merisalu, 2015).

In healthcare environments characterized by chronic understaffing and high patient volumes, such as township hospitals in rural China, these job demands are often intensified. Without sufficient organizational support and personal coping strategies, the cumulative burden of high demands accelerates emotional exhaustion, a core component of burnout syndrome (Mazzetti et al., 2022). Therefore, a nuanced understanding of job demands differentiating between challenge and hindrance types and recognizing their complex interactions with resources is critical for developing targeted interventions to mitigate their adverse impacts on healthcare workers' well-being and performance.

Building on this distinction, Cavanaugh et al. (2000) introduced the challenge–hindrance demand framework into the JD-R model, offering a more refined classification of job demands based on employees' cognitive appraisal. Challenge demands, such as workload, time pressure, task complexity, and responsibility, are perceived as growth-promoting and motivating because they provide opportunities for learning and achievement. In contrast, Hindrance demands—including role conflict, role ambiguity, administrative hassles, interpersonal conflict, and organizational politics are appraised as obstacles that impede goal attainment, induce frustration, and contribute to emotional exhaustion (Lepine et al., 2005).

This dichotomous conceptualization has significantly advanced the explanatory capacity of the JD-R model, particularly in high-demand professions like healthcare, where employees simultaneously encounter both challenge and hindrance demand. When challenge demands are supported by adequate job resources, they can enhance work engagement by fostering mastery and competence. However, the accumulation of hindrance demands without corresponding resources leads to chronic strain, elevating the risk of burnout and compromising both worker well-being and patient care outcomes (Bakker & Demerouti, 2007). Therefore, differentiating between these two categories of job demands is essential for accurately predicting employee outcomes and designing targeted interventions within healthcare contexts.

This distinction is particularly relevant for healthcare professionals working in resource-constrained environments such as township hospitals in rural China. In these settings, healthcare workers simultaneously encounter multiple, overlapping job demands that require constant cognitive, emotional, and physical adaptation (Xu et al., 2024). Without proper classification of these demands into challenge and hindrance categories, both theoretical understanding and practical interventions may overlook the nuanced ways in which certain demands can either motivate or undermine healthcare workers' engagement.

Challenge demands such as complex diagnostic tasks, high clinical responsibility, and intensive patient care often stimulate learning, promote skill development, and contribute to a heightened sense of professional accomplishment (Crawford et al., 2010). These demands activate employees' intrinsic motivation, fostering a sense of competence and mastery that directly enhances work engagement (Bakker et al., 2007). Particularly for healthcare workers who derive meaning and purpose from patient outcomes and community service, successfully managing challenge demands can strengthen personal efficacy and reinforce their dedication to professional roles (Xanthopoulou et al., 2007).

In contrast, hindrance demands such as administrative burden, ambiguous role expectations, bureaucratic obstacles, and persistent resource inadequacies—are generally perceived as unnecessary barriers that obstruct goal attainment (Zhang et al., 2021b). These demands impose strain by consuming limited personal and organizational resources without offering corresponding opportunities for growth or professional fulfillment. In township hospitals, hindrance demands are often exacerbated by systemic factors such as outdated infrastructure, insufficient medical supplies, limited career advancement opportunities, and institutional instability (Cao et al., 2023). Persistent exposure to these hindrance demands heightens emotional exhaustion and cynicism, undermining both work engagement and organizational commitment over time (Bakker et al., 2014).

Furthermore, empirical studies have demonstrated that the impact of challenge and hindrance demands on work engagement is not uniform but depends heavily on the availability of job resources and individual coping capacities. When sufficient job resources—such as autonomy, decision authority, and supervisory support—are present, employees are more likely to interpret challenge demands as opportunities for growth and mastery, thereby sustaining higher engagement levels (Hu et al., 2017a). Conversely, in contexts where job resources are lacking, even challenge demands may become overwhelming and eventually transform into sources of strain, emphasizing the importance of resource sufficiency in maintaining adaptive responses to demands (Bakker & Demerouti, 2017).

Additionally, in high-pressure healthcare contexts, challenge and hindrance demands often coexist, interact, and fluctuate dynamically over time. For township hospital staff who balance clinical duties, public health responsibilities, and administrative functions simultaneously, the cumulative burden of both types of demands requires continuous psychological adaptation (Schaufeli & Bakker, 2004). Therefore, understanding not only the isolated effects of challenge and hindrance demands but also their interactive and cumulative consequences is vital for designing effective interventions that target the distinct pathways through which demands

influence engagement and well-being.

Finally, the differential effects of job demand in the JD-R framework highlight the necessity of incorporating employees' cognitive appraisal into any comprehensive analysis of work engagement. The same objective demand may elicit either engagement or strain depending on how it is appraised by the healthcare worker, underscoring the importance of psychological processes in determining occupational outcomes (Sinclair et al., 2020). Therefore, by distinguishing between challenge and hindrance demands and recognizing the mediating role of cognitive appraisal, this study offers a more refined understanding of how job demands operate within township healthcare environments characterized by chronic resource limitations and fluctuating organizational pressures.

2.1.3 Job resources

Job resources are defined as the physical, psychological, social, or organizational aspects of a job that assist employees in achieving work goals, reduce job demands and their associated physiological and psychological costs, and promote personal growth, learning, and development. Key examples include autonomy, social support, performance feedback, opportunities for professional development, and the perceived significance of work tasks. According to the JD-R model, job resources play a crucial dual role: they not only buffer the adverse effects of high job demands but also independently foster work engagement by fulfilling basic psychological needs such as competence, relatedness, and autonomy (Bakker & Demerouti, 2007).

The theoretical foundation of the JD-R model aligns closely with the Conservation of Resources (COR) theory, which asserts that individuals strive to acquire, retain, and protect their valued resources. Stress is hypothesized to arise when there is a threat to these resources, an actual loss, or a lack of expected resource gain following substantial investment (Hobfoll, 1989). Within this framework, job demands are conceptualized as resource drains, whereas job resources act as protective and enriching factors that bolster resilience and foster well-being.

A key strength of the JD-R model is its wide applicability across different occupations. Unlike earlier stress models like Karasek's Demand-Control model, which focused primarily on industrial work settings, the JD-R model is designed to be occupation-independent. Its flexible structure has made it a powerful tool for investigating job characteristics and employee well-being across a variety of sectors, including healthcare, education, and public administration (Bakker & Demerouti, 2017). This broad adaptability underscores its relevance in modern organizational research.

Empirical studies have consistently validated the assumptions of the JD-R framework. Schaufeli and Bakker (2004) provided robust evidence that job demands primarily predict burnout, whereas job resources are strong predictors of work engagement. Their multi-sample study demonstrated consistent relationships across different industries and cultural contexts, highlighting the model's generalizability and cross context robustness.

Beyond the binary job characteristics framework, the JD-R model has evolved to incorporate personal resources such as self-efficacy, resilience, and optimism. These personal characteristics are seen to interact with job resources to enhance their motivational potential, buffer the negative effects of job demands, and promote higher levels of work engagement (Xanthopoulou et al., 2007). Integrating personal and job resources provides a more holistic understanding of how individual and contextual factors jointly influence occupational health outcomes.

For instance, Hu et al. (2017a) conducted a longitudinal analysis among Chinese nurses and police officers, finding that fluctuations in job demands and resources were strongly linked to changes in burnout and work engagement levels over time, thus reinforcing the model's predictive validity in diverse occupational and cultural contexts.

Within the JD-R framework, specific job resources such as decision authority, task discretion, and job autonomy have been identified as particularly salient for healthcare workers, especially in resource-constrained environments like township hospitals. Decision authority empowers employees to influence work processes and outcomes, fostering a greater sense of control and mastery over their tasks (Gonzalez Mulé & Cockburn, 2017). Task discretion allows healthcare professionals to exercise clinical judgment and adapt procedures based on patient needs, thereby enhancing perceived competence and professional fulfillment. Job autonomy, defined as the extent to which individuals experience freedom and independence in scheduling and executing their work, has consistently been associated with elevated work engagement, particularly under conditions of high job demands (Bakker & Demerouti, 2007).

These core job resources not only directly promote motivational processes but also interact with employees' cognitive appraisal mechanisms. When adequate resources are present, healthcare workers are more likely to appraise demanding situations as challenges rather than hindrances, thereby reinforcing adaptive coping responses and sustaining engagement (Crawford et al., 2010). Conversely, resource depletion increases vulnerability to strain and disengagement, underscoring the critical role of resource accumulation and preservation within the JD-R model's motivational pathway.

In healthcare environments, particularly within the resource-constrained township hospitals

of rural China, the preservation and accumulation of job resources are especially crucial for sustaining healthcare workers' engagement and preventing burnout. Unlike job demands, which consume employees' physical and psychological energy, job resources serve a protective and motivational function by fulfilling fundamental psychological needs and enabling healthcare workers to meet the complex and often conflicting demands of their roles (Bakker et al., 2007).

Among the various job resources, decision authority, task discretion, and job autonomy have been identified as particularly salient for healthcare professionals. Decision authority empowers healthcare workers to exercise control over clinical decisions, treatment protocols, and patient care planning, fostering a stronger sense of responsibility and competence (Gonzalez Mulé & Cockburn, 2017). Task discretion allows healthcare workers to adapt procedures based on patient needs and clinical judgment, thus increasing their perceived professional efficacy and flexibility (Hu et al., 2017a). Similarly, job autonomy provides the latitude to organize work schedules, prioritize tasks, and implement individualized care approaches, which is particularly important in rural township hospitals where unexpected situations and diverse patient needs frequently arise (Bakker et al., 2007).

Beyond these structural job resources, social support both supervisory and collegial—functions as a critical environmental resource that enhances employees' resilience, buffers against the negative impact of job demands, and reinforces positive work attitudes (van der Heijden et al., 2017). In township hospitals, where medical personnel often work in relative isolation and face limited access to advanced medical technology and expertise, the psychological reassurance and collaborative problem-solving afforded by supportive colleagues and leaders are instrumental in maintaining motivation and emotional stability (Dong et al., 2020).

The JD-R model also posits that job resources not only buffer the detrimental effects of excessive job demands but also directly foster work engagement through the satisfaction of three core psychological needs outlined in self-determination theory: autonomy, competence, and relatedness (Bakker & Demerouti, 2024). Autonomy enables healthcare workers to feel in control of their work processes; competence ensures they perceive themselves as effective and capable in their roles; and relatedness fosters a sense of belonging within the professional community. When these needs are met, intrinsic motivation is enhanced, promoting sustained levels of vigor, dedication, and absorption, even under persistently demanding work conditions (Schaufeli, 2017).

Importantly, the beneficial effects of job resources can also interact with employees' cognitive appraisals of job demands. When sufficient resources are present, healthcare staff are

more likely to perceive job demands as challenges rather than hindrances, thereby activating motivational pathways that lead to higher engagement (Lepine et al., 2005). Conversely, in the absence of adequate resources, even demands that might otherwise serve as developmental opportunities may be appraised negatively, increasing the likelihood of disengagement and emotional exhaustion (Bakker et al., 2014). This interplay emphasizes the dual role of job resources in both moderating the adverse effects of job demands and enhancing the positive appraisal of challenges.

In sum, job resources serve as a critical leverage point within the JD-R framework, particularly in healthcare systems like township hospitals that are characterized by high demands and limited organizational support structures. By directly enhancing work engagement and indirectly shaping how job demands are appraised, job resources play a central role in promoting sustainable professional functioning, psychological well-being, and service quality among rural healthcare workers.

2.1.4 Dual processes of the JD-R model

A fundamental contribution of the JD-R model is its conceptualization of two distinct yet interrelated pathways: the health impairment process and the motivational process. These pathways offer a comprehensive explanation of how job characteristics influence employees' well-being and performance over time, providing critical insights for occupational health psychology (Bakker & Demerouti, 2007).

Health Impairment Process. The health impairment process elucidates how excessive and prolonged exposure to job demands gradually depletes employees' mental and physical resources. Job demands such as high work pressure, emotional labor, and role ambiguity require continuous effort and cognitive control, which, when unmatched by recovery periods or coping resources, precipitate adverse outcomes including burnout, psychological distress, and physical health deterioration (Tesi, 2021). Burnout, characterized by emotional exhaustion, cynicism, and reduced professional efficacy, is strongly linked to high job demands. Longitudinal studies have substantiated that persistent job demands are predictive of escalating mental health issues and absenteeism over time, particularly in high-stress fields such as healthcare and social work.

Motivational Process. Conversely, the motivational process focuses on the energizing role of job resources. According to the JD-R model, job resources—such as autonomy, social support, performance feedback, and learning opportunities—are crucial in fostering work engagement, defined as a positive, fulfilling, work-related state characterized by vigor, dedication, and absorption. Rooted in Self-Determination theory, job resources satisfy basic

psychological needs for autonomy, competence, and relatedness, thereby promoting intrinsic motivation (Schaufeli & Bakker, 2004). Furthermore, job resources serve a buffering function, mitigating the detrimental effects of job demands on well-being. The incorporation of personal resources like resilience, optimism, and self-efficacy has expanded the JD-R model's scope, showing that personal strengths amplify the positive effects of job resources on engagement and well-being.

Reciprocal and Dynamic Relationships. Recent longitudinal and diary-based research has advanced the JD-R framework, revealing that these processes are reciprocal and dynamic rather than unidirectional. For instance, high levels of work engagement not only predict better job performance but also facilitate the accumulation of additional job and personal resources over time, forming a gain spiral. Conversely, burnout is associated with resource depletion and disengagement, initiating a loss spiral (Hakanen et al., 2006). The interaction between job demands and resources is also situationally contingent; in high-pressure environments like healthcare, the presence of robust job resources is critical to sustaining psychological resilience and maintaining engagement levels.

Implications for practice. The dual-process framework of the JD-R model yields significant implications for organizational practices aimed at improving employee well-being. Effective interventions should focus on both reducing excessive job demands and enhancing job resources. Practical strategies include increasing employees' decision-making autonomy, providing constructive feedback and recognition, fortifying social support networks, and expanding professional development opportunities (van Wingerden et al., 2017). These approaches are especially vital in resource-limited settings, such as township hospitals in rural China, where healthcare workers encounter high job demands amid constrained support systems.

In addition to these dual pathways, the JD-R model has increasingly emphasized the role of individual appraisal mechanisms in shaping how job demands and resources are perceived and processed. Specifically, cognitive appraisal functions as a psychological filter through which employees evaluate whether specific job demands are interpreted as challenges that stimulate growth or hindrances that obstruct goal attainment (Crawford et al., 2010). This appraisal process significantly influences which pathway health impairment or motivational becomes activated. For instance, high workload may be appraised as a motivating challenge when adequate resources and personal competencies are present but may shift toward hindrance when resources are lacking or demands become excessive.

Moreover, the interactive effects of job demands and resources are not static but vary across

individuals and situations. In high-strain occupational contexts such as rural healthcare, social support emerges as a critical external resource that moderates these relationships by strengthening adaptive appraisals and buffering stress responses (Bakker et al., 2003). This highlights the importance of simultaneously considering both environmental conditions and individual psychological processes when applying the JD-R model to complex real-world settings.

Collectively, these refinements have enhanced the JD-R model's explanatory precision, making it highly applicable for investigating the mechanisms underlying work engagement and burnout across diverse occupational and cultural contexts, including township healthcare systems in China.

2.1.5 Application of the JD-R model in healthcare

The JD-R model has matured into one of the most influential frameworks for comprehending occupational health and performance, especially in the healthcare sector. Healthcare environments are distinguished by their exceptionally high job demands, encompassing emotional labor, overwhelming patient loads, time pressures, administrative burdens, and recurrent exposure to traumatic clinical events. These factors significantly elevate the risks of burnout and occupational stress among healthcare professionals (Shanafelt et al., 2020). The persistent strain not only impairs personal well-being but also compromises the quality of patient care, manifesting in reduced patient satisfaction and higher medical errors.

Burnout, a syndrome characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment, has been firmly linked to elevated job demands and prolonged occupational stress (Dall Ora et al., 2020). In healthcare, burnout prevalence rates consistently exceed those observed in other professional sectors, particularly in high-intensity fields like critical care and emergency medicine. This underlines the acute vulnerability of healthcare workers to both physical and psychological deterioration.

Moreover, healthcare workers often contend with systemic resource deficiencies, including chronic understaffing, inadequate organizational support, and limited opportunities for career progression. These resource constraints exacerbate the adverse effects of job demands, diminishing healthcare workers' resilience and enhancing their susceptibility to occupational burnout (Aiken et al., 1997). In rural and underserved areas, such as township hospitals in China, these challenges are further amplified by infrastructural inadequacies and limited professional support systems, making the application of the JD-R model particularly relevant in such contexts.

A critical feature of the JD-R model is its assertion that job resources can buffer the negative impacts of job demands. Resources such as collegial support, job autonomy, performance feedback, and professional development opportunities have been empirically validated as protective factors against burnout and as facilitators of work engagement (West et al., 2018). Longitudinal investigations reveal that when job resources are adequately supplied, they not only mitigate the adverse effects of job demands but also sustain employees' intrinsic motivation and psychological resilience over time (Thapa et al., 2022). In healthcare settings, the presence of job resources has been linked to improved mental health outcomes among nursing professionals, reduced burnout prevalence, and enhanced organizational commitment. These findings highlight that fostering a resource-rich environment is essential for promoting sustainable work engagement among healthcare workers who routinely face high-intensity stressors.

Evidence from recent multi-wave studies suggests that a synergistic approach—targeting both aspects results in significantly better outcomes in terms of reduced burnout, higher work engagement, and improved job satisfaction (Brafford et al., 2024). Particularly in resource-constrained environments such as township hospitals, where healthcare workers confront chronic understaffing and limited infrastructure, bolstering job resources can function as a critical buffer against occupational stress and mental health deterioration.

Empirical studies have provided robust support for these mechanisms within healthcare populations. For instance, in a longitudinal study among hospital nurses, Boamah and Laschinger (2016) demonstrated that higher levels of structural empowerment a proxy for job resources such as autonomy and access to information were significantly associated with increased work engagement and reduced burnout over time. Similarly, a multi-center investigation conducted by Van Bogaert et al. (2017) found that nursing work environments characterized by strong leadership support, teamwork, and adequate staffing levels predicted higher engagement scores and lower emotional exhaustion among frontline care providers.

Moreover, recent cross-cultural research has reinforced the relevance of the JD-R framework in diverse healthcare settings. In a multinational sample of physicians, Montgomery et al. (2019) reported that job resources such as professional autonomy and colleague support not only buffered the adverse effects of high emotional demands but also directly enhanced work engagement. These findings emphasize the cross-contextual applicability of the JD-R model and illustrate that even under high-pressure clinical conditions, sufficient job resources can foster resilience and maintain psychological well-being.

More broadly, the JD-R model has been extensively applied across a wide range of

healthcare systems worldwide to explain how specific job characteristics influence professional functioning and patient care outcomes. Across various clinical settings including tertiary hospitals, outpatient services, and long-term care facilities empirical studies consistently demonstrate that high job demands such as emotional labor, cognitive overload, and time pressure are strong predictors of burnout when not counterbalanced by adequate job resources (Bakker et al., 2014). In contrast, the availability of job resources like decision authority, supervisor support, teamwork, and professional development opportunities directly contributes to higher levels of work engagement and improved patient safety outcomes (van Bogaert et al., 2017).

Moreover, the JD-R model's motivational pathway has been validated in various healthcare professions, including nursing, emergency medicine, intensive care, and mental health services. In these occupations, healthcare workers frequently operate under volatile, uncertain, and emotionally charged conditions that elevate both cognitive and emotional job demands (Hakanen et al., 2008). Under such circumstances, employees' access to supportive leadership, clear communication channels, participative decision-making, and opportunities for professional growth are consistently associated with increased resilience, stronger work engagement, and better team performance (Schaufeli et al., 2009).

Importantly, the model's dual pathway allows healthcare organizations to move beyond solely reducing job demands and instead focus on enhancing resources that foster proactive, positive coping. Interventions such as leadership development, resilience training, and team-based resource-sharing have been shown to strengthen workers' ability to cognitively reappraise stressors as opportunities for growth, thus activating the motivational process and preventing emotional exhaustion (Sinclair et al., 2020).

In sum, extensive empirical evidence across diverse healthcare contexts confirms the JD-R model's broad applicability and its central proposition that, while certain job demands in healthcare are unavoidable, their negative effects can be effectively counterbalanced through the accumulation of robust job resources.

The model underscores the necessity for a dual-focused intervention strategy that not only seeks to reduce excessive job demands but also actively enhances job resources such as autonomy, decision authority, and social support. Such resource-enhancement efforts not only protect healthcare workers' well-being but also strengthen their capacity for positive cognitive appraisal, thereby sustaining work engagement even in high-demand environments like township hospitals in rural China. This global evidence provides a solid theoretical foundation for adapting and applying the JD-R framework to the unique operational realities of China's

primary healthcare system, as examined in the following section.

2.1.6 Application of the JD-R model in China's primary healthcare system

The JD-R model has increasingly been applied within China's healthcare research to analyze employee well-being, job satisfaction, and organizational performance. However, its implementation in the primary healthcare sector, particularly among township hospitals' healthcare workers, remains relatively underdeveloped compared to tertiary care institutions. Township hospitals, serving as the fundamental units of China's rural healthcare network, operate under challenging conditions characterized by high job demands and limited job resources, rendering the JD-R model particularly pertinent.

In township healthcare settings, job demands are persistently multifaceted and elevated. Healthcare workers are often responsible for both clinical services and public health duties, leading to overwhelming workloads exacerbated by understaffing and logistical challenges inherent to rural regions (Shah et al., 2021).

Emotional labor is another salient demand; maintaining positive relationships with patients in tight-knit rural communities necessitates high levels of emotional regulation and interpersonal sensitivity. These demands are compounded by administrative overloads, such as mandatory public health reporting and compliance with chronic disease management programs, which have intensified following recent healthcare reforms like the county medical community strategy (Zhao et al., 2025a). These cumulative stressors correspond to the health impairment pathway of the JD-R model, wherein excessive job demands progressively deplete physical and psychological resources, culminating in emotional exhaustion, reduced job satisfaction, and heightened turnover intentions (Dall Ora et al., 2020).

Despite resource scarcity, several key job resources play a critical role in mitigating adverse occupational outcomes and enhancing work engagement among rural healthcare workers. Social support, encompassing emotional, instrumental, and informational assistance from colleagues and supervisors, is a well-documented protective factor against work-related stress and burnout (Xie et al., 2021).

Professional autonomy in clinical decision-making, though variably present across rural Chinese healthcare settings, offers practitioners enhanced control over their clinical practices. Recent studies highlight that a greater sense of autonomy and self-determination significantly improves job satisfaction and professional commitment among primary health workers in rural China (Wang et al., 2020). By empowering healthcare workers to exercise discretion in patient care, autonomy fosters both intrinsic motivation and resilience, which are critical for sustaining

engagement in resource-constrained environments.

Furthermore, recent policy initiatives have introduced continuing education and skill development programs for rural healthcare providers, contributing to increased professional capacity and perceived career advancement opportunities, although regional disparities in access remain prevalent (Hu et al., 2020). Additionally, cultural capital, characterized by healthcare workers' familiarity with local dialects, customs, and social networks, facilitates stronger patient-provider relationships, fostering trust and enhancing the efficacy of healthcare delivery in community settings.

In addition to job resources, personal resources have been recognized as essential elements within the JD-R framework. Attributes such as self-efficacy, resilience, optimism, and organizational-based self-esteem influence how individuals perceive and respond to job demands. Research suggests that healthcare workers with higher levels of personal resources are more capable of framing stressors as manageable challenges rather than insurmountable threats, thus maintaining better mental health and higher work engagement (Xanthopoulou et al., 2009). For instance, individuals with strong self-efficacy demonstrate greater persistence in confronting occupational adversity, whereas those with high resilience are better equipped to recover from work-related stressors, ensuring sustained professional performance and reduced burnout symptoms (Xu et al., 2020a).

Empirical evidence from Chinese rural healthcare settings reinforces the applicability of the JD-R model. A recent study by Liu et al. (2024) highlighted that excessive job demands, particularly emotional labor and administrative burdens, were significantly associated with higher turnover intentions among healthcare workers in township hospitals. Similarly, recent empirical investigations have highlighted the pivotal role of job resources in enhancing work engagement among rural healthcare professionals. For instance, Zhang et al. (2020) demonstrated that resilience and work engagement substantially mediated the relationship between job satisfaction and turnover intentions among village doctors in rural China. Their findings underscore the necessity of fostering intrinsic job resources to improve workforce retention and psychological well-being. Further, Zhang et al. (2021a) examined the combined influence of personality traits, alexithymia, and work engagement on burnout among village doctors, revealing that higher levels of work engagement significantly buffered against burnout risk. These results confirm the protective function of work engagement, consistent with the motivational process proposed by the JD-R model.

Moreover, longitudinal evidence has begun to reveal how fluctuations in job demands and resources over time contribute to dynamic changes in engagement and burnout levels among

township hospitals' healthcare workers. For example, Jiang et al. (2022) conducted a two-wave panel study in rural hospitals and found that increases in job autonomy and social support were significantly associated with subsequent improvements in work engagement, while rising administrative burdens predicted elevated emotional exhaustion. Their findings illustrate the gain and loss spiral processes embedded within the JD-R model and highlight the necessity of continuous resource investment to sustain engagement under shifting work conditions.

In addition, appraisal mechanisms have been empirically validated as critical mediators in these relationships. Bao et al. (2024) demonstrated that healthcare workers who appraised high job demands as challenges, rather than hindrances, reported significantly higher levels of engagement and lower burnout symptoms.

These results underscore the importance of not only reducing job demands but also actively fostering positive cognitive appraisal patterns through supportive organizational climates and targeted psychological interventions.

Collectively, these empirical insights further solidify the JD-R model's applicability in China's primary healthcare sector by confirming that optimizing both structural job characteristics and individual cognitive evaluations is central to promoting sustainable work engagement. Given the ongoing systemic reforms and the resource constraints characterizing rural healthcare institutions, tailoring interventions to strengthen job resources, develop personal capacities, and cultivate adaptive appraisal processes remains a strategic priority for enhancing workforce stability and healthcare service quality.

Together, these findings reinforce the applicability of the JD-R framework in rural China by highlighting the dynamic interactions between job resources, personal characteristics, and engagement outcomes, offering practical insights for designing evidence-based interventions to sustain healthcare workforce well-being.

2.2 Extension of the JD-R model: cognitive appraisal and social support in township hospitals' healthcare workers

Building on the foundational JD-R framework, this study introduces two critical extensions—cognitive appraisal and social support to enhance its applicability within the township healthcare context in China. These additions recognize that employees' subjective evaluations and environmental support systems jointly shape their responses to job demands, ultimately influencing work engagement outcomes.

Beyond its foundational role in stress appraisal theory (Ganster & Rosen, 2013), cognitive appraisal has been increasingly validated in healthcare research as a pivotal determinant of work engagement. In clinical settings, where complex medical judgments, time pressures, and emotional demands converge, healthcare professionals' appraisal of these demands fundamentally shapes whether they experience adaptive engagement or maladaptive exhaustion (Baig et al., 2022). Particularly in resource-constrained township hospitals, the frequent exposure to ambiguous protocols, limited treatment options, and unpredictable patient volumes renders positive appraisal essential for sustaining psychological resilience. Empirical evidence suggests that individuals who appraise complex demands as challenges demonstrate stronger affective commitment, higher levels of vigor, and greater absorptive capacity at work (Sinclair et al., 2020).

2.2.1 Cognitive appraisal: differentiating challenge and hindrance demands

Cognitive appraisal, as conceptualized in contemporary occupational stress models, suggests that individuals actively evaluate environmental demands, interpreting them as either challenges or hindrances based on perceived opportunities for personal growth or threats to goal attainment (Ganster et al., 2018).Integrated into the JD-R model, this perspective provides a psychological filter through which job demands exert either motivational or impairing effects (Cavanaugh et al., 2000).

Several empirical studies have validated the mediating role of cognitive appraisal in healthcare settings. For instance, Liu et al. (2021) found that among rural Chinese healthcare workers, administrative burdens and resource inadequacy were predominantly appraised as hindrances, directly contributing to emotional exhaustion and diminished work engagement. Conversely, high workload and responsibility, when perceived as challenges, were associated with enhanced professional efficacy and greater engagement levels. These findings highlight that appraisal patterns critically determine whether job demands activate the JD-R model's motivational or health impairment pathways (Lepine et al., 2005).

Notably, appraisal processes may be particularly salient in rural township healthcare, where complex administrative reforms, community expectations, and multitasking responsibilities create highly individualized stress profiles (Zhao et al., 2025a). Workers capable of positively framing complex demands are better positioned to sustain engagement even under significant occupational strain.

The theoretical underpinnings of cognitive appraisal stem from the transactional model of stress and coping, pioneered by Lazarus and Folkman (1984). This model emphasizes that stress

is not a direct consequence of external demands but rather a function of how individuals evaluate these demands in relation to their personal resources and goals. Primary appraisal involves judging whether an event is relevant to well-being and categorizing it as a threat, harm, or challenge, whereas secondary appraisal concerns the perceived capacity to manage or control the situation. This dual appraisal process has profound implications for occupational settings, where identical job demands may elicit vastly different psychological responses depending on these subjective evaluations.

Building upon this foundation, the challenge–hindrance stressor framework (Cavanaugh et al., 2000; Crawford et al., 2010) refined the understanding of occupational stress by differentiating between demands that foster growth (e.g., workload, responsibility) and those that obstruct goal attainment (e.g., administrative hassles, role conflict). Integrated into the JD-R model, cognitive appraisal functions as a psychological filter that translates job characteristics into either motivational or strain pathways. Specifically, when demands are appraised as challenges, they activate the motivational route of the JD-R model, satisfying psychological needs for competence and mastery, thereby enhancing vigor, dedication, and absorption. Conversely, hindrance appraisals trigger the health-impairment route, intensifying emotional exhaustion and reducing engagement.

Recent meta-analytic evidence (Sinclair et al., 2020) further validates this bifurcation, showing that challenge appraisals correlate positively with engagement and performance, while hindrance appraisals predict withdrawal and burnout across occupations. Ganster and Rosen (2013) underscore that appraisal processes bridge environmental stressors and individual outcomes, offering a mechanism through which context-specific factors—such as cultural values, resource scarcity, and institutional constraints—shape occupational well-being. This theoretical perspective is especially pertinent in rural township hospitals in China, where chronic resource shortages and overlapping clinical–administrative roles heighten the salience of appraisal mechanisms. By reinterpreting demanding conditions as manageable challenges rather than insurmountable obstacles, healthcare workers may sustain psychological resilience and professional commitment even under persistent strain.

2.2.2 Social support as a contextual moderator

In addition to appraisal mechanisms, social support serves as a key external moderator within the JD-R model, particularly in resource-constrained healthcare environments. Defined as emotional, instrumental, and informational assistance provided by supervisors, colleagues, and communities, social support directly enhances employees' coping capacity (Bakker et al., 2005).

Empirical research in rural Chinese healthcare consistently demonstrates this buffering role. A multi-center study by Xu et al. (2020a) revealed that township hospitals' healthcare workerss reporting higher levels of peer and supervisory support experienced significantly greater work engagement, even when exposed to elevated job demands. Similarly, Jiang et al. (2022) found that social support moderated the adverse effects of administrative overload, preserving engagement levels despite high work pressure. These findings suggest that in contexts of limited institutional resources, informal social networks become vital protective factors that sustain motivation and mitigate burnout risk.

Moreover, the moderating role of social support extends to cognitive appraisal processes. Chen et al. (2022a) demonstrated that healthcare workers receiving greater supervisor support were more likely to appraise high demands as challenges rather than hindrances, thereby enhancing engagement and reducing emotional exhaustion. This interaction highlights how supportive work environments foster adaptive appraisal styles, promoting positive engagement outcomes even under chronic work intensification.

In township hospitals, where systemic resources are often lacking, social support fulfills not only emotional buffering but also informational and instrumental functions critical for healthcare delivery (Halbesleben, 2006). Leadership support offers validation and resource access, collegial support fosters peer consultation and workload sharing, while family support helps stabilize personal well-being during prolonged occupational stress (Wang et al., 2024b). The collectivist orientation in rural Chinese culture further amplifies the protective value of close interpersonal networks, making social support a culturally embedded coping mechanism that directly facilitates positive cognitive appraisal and enhances work engagement.

2.2.3 Contextual adaptation to township healthcare

The integration of cognitive appraisal and social support is particularly critical for understanding engagement dynamics within China's township healthcare system. Rural healthcare workers operate within organizational structures marked by chronic understaffing, resource scarcity, and complex administrative mandates (Feng et al., 2022). These structural conditions heighten both the frequency and intensity of job demands, elevating the importance of individual appraisal mechanisms and external support systems.

Simultaneously, the cultural fabric of rural Chinese communities characterized by strong social ties, patient-provider familiarity, and shared local identity offers unique sources of informal social support that can be harnessed to strengthen engagement (Dong et al., 2023). Recognizing these context-specific mechanisms allows for a more ecologically valid

application of the JD-R model, enabling tailored interventions that target both psychological and organizational drivers of engagement.

In summary, by embedding cognitive appraisal and social support within the JD-R framework, this study advances a more nuanced and context-sensitive model of work engagement for township hospitals' healthcare workerss. These extensions not only enrich theoretical understanding but also generate actionable insights for strengthening rural healthcare workforce sustainability in China.

2.2.4 Summary of JD-R model for this study

The present study adopts the JD-R model as its core theoretical framework to elucidate the mechanisms shaping work engagement among township hospital healthcare workers in rural China. Central to the JD-R model is the dual-pathway logic through which job characteristics influence employee well-being and motivational outcomes. Specifically, the combination of high job demands and insufficient job resources is most likely to trigger the health impairment process, resulting in negative consequences such as emotional exhaustion, psychological strain, and professional burnout (Bakker et al., 2007). Empirical studies conducted in healthcare contexts confirm that excessive workload, role ambiguity, and emotional demands significantly predict burnout symptoms among medical personnel when job resources are lacking (Bakker et al., 2003).

Conversely, the availability of sufficient job resources such as decision authority, task discretion, supportive leadership, and collegial collaboration plays a dual role in promoting positive occupational outcomes. First, job resources directly activate the motivational process by fulfilling employees' psychological needs for autonomy, competence, and relatedness, thereby fostering higher levels of work engagement, organizational commitment, and professional efficacy (Demerouti et al., 2001). For example, longitudinal studies of hospital staff have shown that supervisory support and job autonomy significantly increase healthcare workers' engagement levels while simultaneously reducing their turnover intentions (Hu et al., 2017a). Second, these resources function as buffers that attenuate the adverse effects of excessive job demands, allowing healthcare workers to maintain psychological stability even under chronically stressful conditions (Schaufeli & Taris, 2013).

In addition to structural job demands and resources, personal resources such as self-efficacy, resilience, and optimism play a complementary role in reinforcing both the motivational pathway and buffering the stressor-strain relationship. Healthcare professionals with stronger personal resources demonstrate higher adaptive capacities, more positive cognitive appraisals

of complex job demand, and more sustainable work engagement trajectories (Xanthopoulou et al., 2009). For example, empirical evidence indicates that township healthcare workers with higher psychological capital maintain stronger resilience against burnout and are more likely to engage proactively in complex patient care tasks despite resource constraints (Liu & Aungsuroch, 2019).

Due to its conceptual simplicity, structural flexibility, and strong explanatory power, the JD-R model has been widely applied across diverse occupational settings to inform research and practice in work design, employee well-being, stress management, and engagement enhancement (Bakker & Demerouti, 2017). In the present study, this model offers a particularly relevant framework for analyzing the unique working conditions of township hospital healthcare workers in rural China, guiding both theoretical inquiry and the formulation of practical organizational interventions aimed at promoting sustainable work engagement and healthcare service quality in resource-limited environments (Dong et al., 2020).

2.3 Work engagement

2.3.1 Historical development of work engagement

Early foundations (1990), personal engagement and disengagement. The concept of work engagement finds its roots in the early 1990s when Kahn (1990) introduced the notion of personal engagement and personal disengagement at work. He theorized that individuals bring varying levels of their cognitive, emotional, and physical selves into their work roles. This foundational work laid the groundwork for the later differentiation between engaged and disengaged employees, emphasizing that engagement is not merely a matter of job satisfaction but involves the investment of one's full self in work activities.

The burnout-engagement continuum, proposed by Leiter and Maslach (1997), conceptualizes engagement as the positive antithesis of burnout. Building upon Kahn's foundation, the late 1990s witnessed further elaboration by Leiter and Maslach (1997), who proposed that work engagement was the positive antithesis of burnout. While burnout was characterized by exhaustion, cynicism, and inefficacy, engagement represented energy, involvement, and efficacy. This shift directed attention toward promoting positive psychological states rather than merely mitigating negative ones.

Integration into the job demands-resources model (2004–2007). Subsequent developments integrated work engagement into broader theoretical frameworks. Bakker and Demerouti (2007)

incorporated engagement into the JD-R model, proposing that job resources such as autonomy, support, and feedback enhance engagement through a motivational process. Their work emphasized that while job demands could lead to burnout, job resources were critical in fostering engagement. Further meta-analytic studies during this period, such as those by Christian et al. (2011), linked work engagement to job performance, thereby solidifying its importance not only for employee well-being but also for organizational outcomes.

Advances in measurement approaches and the recognition of daily fluctuations in work engagement were introduced by Sonnentag (2003), highlighting its dynamic and state-like nature. Xanthopoulou et al. (2009) introduced a daily diary study approach, demonstrating that work engagement is not static but fluctuates in response to variations in job and personal resources. This recognition of the dynamic nature of engagement led to a deeper understanding of how daily work experiences shape engagement levels, emphasizing the necessity for supportive environments that can sustain engagement over time.

Expanding the engagement model, broader predictors and outcomes (2014–2018). Subsequent research expanded the scope of engagement antecedents and consequences. Saks and Gruman (2014) emphasized the role of human resource management practices in fostering engagement, while Bakker and Albrecht (2018) reviewed contemporary trends, underscoring the role of personal resources (e.g., resilience, optimism) alongside job resources. Furthermore, studies began to explore engagement's links to broader organizational metrics like profitability, turnover, and customer satisfaction (Harter et al., 2002), demonstrating that engagement yields tangible business benefits. Beyond financial and operational outcomes, engaged employees also contribute to enhanced innovation, stronger team collaboration, and higher adaptability in dynamic work environments. Their proactive behaviors foster continuous improvement and organizational learning, enabling companies to better navigate competitive challenges and sustain long-term performance (Bakker & Demerouti, 2017). Consequently, promoting work engagement has become a strategic priority not only for improving employee well-being but also for securing sustainable organizational success.

Contemporary critiques and complexities (2017–Present). Recent critiques have questioned the simplistic assumption that higher engagement always leads to better outcomes. For instance, Scheepers et al. (2015) found a non-linear relationship between physician engagement and patient care outcomes, suggesting that without appropriate organizational support, high engagement may not necessarily translate into better performance. Zun et al. (2019) emphasized the importance of cultural and contextual adaptability in work engagement interventions, arguing that engagement strategies must be sensitive to local organizational cultures and

structures. Without appropriate cultural adaptation, the effectiveness of interventions designed to enhance engagement among healthcare workers can be significantly compromised. Additionally, Lorente et al. (2014) explored personal resources as moderators, suggesting that engagement is influenced not only by organizational interventions but also by individual capacities for resilience and self-efficacy.

Work engagement represents a profound and comprehensive area of study within organizational psychology and human resource management. It is a state characterized by vigor, dedication, and absorption in one's profession. As employees immerse themselves in their roles, they become cognitively agile, emotionally connected, and inherently driven to contribute positively to their workplace. This chapter delves into the foundational concepts of work engagement, providing readers with a comprehensive understanding of its nature, origins, and implications.

At its core, work engagement is defined as a positive, fulfilling, work-related state of mind that is not transient, but rather a persistent state of being (Schaufeli et al., 2002). It contrasts with concepts like burnout, representing the opposite end of the spectrum. Whereas burnout is characterized by exhaustion, cynicism, and inefficacy, work engagement champions energy, efficacy, and involvement.

Vigor. This refers to an individual's level of energy and resilience while at work. Engaged employees demonstrate high levels of energy, are eager to begin their workday, and are resilient in the face of challenges or setbacks (Schaufeli et al., 2002).

Dedication. Engaged workers are profoundly invested in their work. They find it meaningful, inspiring, and are proud of what they do. This component resonates with a sense of significance, enthusiasm, and challenge (Schaufeli et al., 2002).

Absorption. When an individual is fully immersed in their work, time seems to fly. Such employees often find it hard to detach from their tasks because they're engrossed and enjoy what they do (Schaufeli et al., 2002).

The concept of work engagement has its roots in earlier research on positive psychology, which emphasizes strengths, virtues, and factors that contribute to a fulfilling life. Drawing from this, work engagement focuses on the positive aspects of work life and how individuals can thrive in their professional settings. Early pioneers posited the idea that engagement was the antithesis of burnout, suggesting that understanding and promoting engagement could be a pathway to counteract burnout's negative effects (Leiter & Maslach, 1997). This perspective catalyzed a paradigm shift in occupational health psychology, prompting researchers to explore the specific conditions and mechanisms that foster engagement. Schaufeli and Bakker (2004)

advanced this line of inquiry by conceptualizing work engagement as a distinct, positive psychological state characterized by vigor, dedication, and absorption. Unlike traditional approaches that focused primarily on stress reduction, their framework emphasized the role of job and personal resources such as autonomy, social support, and self-efficacy in promoting sustained engagement even under demanding work conditions (Bakker & Demerouti, 2007). These developments laid the empirical foundation for the JD-R model, which integrates both job demands and resources to explain variations in engagement across diverse occupational contexts (Bakker et al., 2014). The JD-R model's versatility has since facilitated its application in multiple sectors, underscoring its utility for both theoretical advancement and practical interventions aimed at optimizing employee well-being and organizational performance.

The significance of work engagement goes beyond individual well-being, having substantial implications for organizational performance. Engaged employees are noted for their increased productivity, innovation, and loyalty towards their organization. Such individuals are less prone to absenteeism, demonstrate a lower inclination towards leaving the organization, and actively promote their employer's interests. This realization underscores why entities worldwide are keen to explore and enhance employee engagement (Simpson, 2009). This organizational relevance has led to increasing scholarly focus on identifying the mechanisms through which work engagement contributes to both individual and collective outcomes. Empirical evidence indicates that engaged employees exhibit superior task performance, demonstrate greater organizational citizenship behaviors, and contribute to fostering a more cooperative and resilient workplace culture (Christian et al., 2011). Moreover, sustained engagement has been linked to improved customer satisfaction and financial profitability, underscoring its strategic value for long-term organizational sustainability (Harter et al., 2002). Recognizing these multidimensional benefits, organizations have increasingly prioritized interventions targeting both job resources and personal resources to cultivate and maintain high engagement levels among employees (Bakker et al., 2014).

2.3.2 Application of work engagement in Chinese healthcare workers

In the Chinese healthcare system, township hospitals' healthcare workerss play a pivotal role in delivering essential medical and public health services to rural populations under challenging and resource-constrained conditions. Work engagement, characterized by vigor, dedication, and absorption, has been recognized as a critical factor in sustaining healthcare service quality, reducing emotional exhaustion, and enhancing both individual well-being and patient care outcomes (Cao et al., 2023). However, empirical research specifically focusing on township

hospitals' healthcare workerss remains limited, resulting in a significant knowledge gap.

Existing studies indicate that township hospitals' healthcare workerss frequently encounter high job demands, including excessive workloads, resource inadequacies, and bureaucratic complexities, which elevate the risk of burnout and disengagement (Xu et al., 2020a). Consistent with the JD-R model, job resources such as professional autonomy, decision-making authority, task discretion, and access to continuous professional development have been shown to buffer the negative effects of job demands and foster higher levels of work engagement (Dong et al., 2020).

Social support functions as a critical job resource that promotes work engagement and mitigates burnout. Healthcare workers who receive supportive feedback and emotional assistance from colleagues and supervisors report greater psychological resilience and higher engagement levels (Bakker et al., 2005). These interpersonal resources are especially vital under prolonged work strain and role overload, as they provide emotional buffering and enhance professional motivation (Bagheri Hossein Abadi et al., 2020). Moreover, social support from peers, supervisors, and external networks—including support mechanisms provided by higher-level hospitals through expert rotations, telemedicine consultations, and capacity-building programs—contributes significantly to sustaining engagement, especially under adverse working conditions (Xu et al., 2012a). The presence of strong community trust and patient respect further reinforces township hospitals' healthcare workerss' sense of professional meaning, intensifying their dedication and absorption in their work roles (Dong et al., 2020).

Despite these positive factors, systemic challenges such as limited career advancement pathways and compensation disparities continue to impede the long-term sustainability of high engagement levels. Therefore, effective interventions must address both organizational structures and individual psychological resources, ensuring that work engagement strategies are tailored to the unique sociocultural and institutional realities of rural China.

2.3.3 Work engagement in primary healthcare personnel and Chinese healthcare workers

Application of work engagement in primary healthcare (PHC) personnel. Primary healthcare systems serve as the cornerstone of population health management, particularly in resource-constrained settings. In recent years, work engagement has been recognized as a crucial psychological resource for primary healthcare personnel, influencing not only individual well-being but also organizational outcomes such as patient satisfaction and healthcare quality (van Bogaert et al., 2013). Given the complex and emotionally demanding nature of primary care

marked by chronic patient interactions, resource limitations, and high workloads engagement becomes essential for sustaining service quality and reducing professional burnout.

Empirical research has consistently demonstrated that engaged primary healthcare workers report higher job satisfaction, lower levels of emotional exhaustion, and greater intentions to remain within their organizations (Laschinger et al., 2014). Furthermore, work engagement among primary healthcare workers has been positively associated with improved patient outcomes, including adherence to preventive care protocols and patient-reported care experiences (Halbesleben & Rathert, 2008).

In the Chinese healthcare context, township hospital healthcare workers play a central role in ensuring the accessibility and continuity of basic medical services, particularly for rural and marginalized populations. However, the complex interplay of insufficient infrastructure, workforce shortages, and expanding service expectations imposes chronic stressors on these frontline providers (Zhang et al., 2022). In such high-demand environments, work engagement has emerged not only as a predictor of healthcare personnel well-being but also as a determinant of clinical safety and care outcomes.

Bayliss et al. (2023) highlighted that higher levels of work engagement are associated with improved patient safety, including reductions in adverse events and medical errors. Engaged healthcare professionals demonstrate enhanced situational awareness, stronger adherence to evidence-based guidelines, and proactive error prevention behaviors, directly contributing to safer patient care (Tawfik et al., 2023). In rural township hospitals where clinical supervision and technological support are limited, the cognitive and emotional vigilance linked to work engagement becomes particularly crucial for maintaining care quality under resource constraints (Liu et al., 2021).

In addition to patient safety, work engagement has been empirically linked to service quality improvements in primary healthcare delivery. Engaged healthcare staff are more likely to exhibit patient-centered communication, emotional empathy, and long-term care coordination, all of which significantly elevate patient satisfaction and adherence to treatment plans (Newell & Jordan, 2015). Given that chronic disease management and preventive care form a large component of township healthcare responsibilities, the role of work engagement in sustaining these care processes has become increasingly evident (Wu et al., 2024).

Moreover, work engagement fosters innovation behaviors among healthcare workers by promoting proactive problem-solving, knowledge sharing, and adaptive learning (Chen et al., 2024a). In township hospitals facing persistent resource scarcity, engaged staff often engage in informal job crafting, collaborative teamwork, and creative adaptation of care protocols to

optimize patient care with limited means. This capacity for innovation not only enhances individual performance but also contributes to organizational resilience and service sustainability (Kulig et al., 2018).

Collectively, these empirical findings underscore the multifaceted value of work engagement in safeguarding not only healthcare workers' psychological resilience but also the clinical quality, safety, and adaptive functioning of rural primary healthcare institutions. This reinforces the theoretical rationale for adopting work engagement as the core outcome variable in this study's model focused on township healthcare personnel.

2.3.4 Antecedent variables of work engagement

The antecedent variables of work engagement represent a multifactorial interaction of job demands, job resources, personal resources, cognitive appraisal, and social support, each operating within the organizational and socio-cultural environment to influence employees' motivational states. For township hospital healthcare workers, who often work under resource-constrained and emotionally taxing conditions, these factors play a pivotal role in determining levels of vigor, dedication, and absorption — the core components of work engagement (Schaufeli et al., 2002).

Among these antecedents, job demands are especially central. Traditionally conceptualized as organizational, physical, or psychological aspects of work requiring sustained effort and generating physiological or psychological costs (Demerouti et al., 2001), job demands can be further categorized into challenge and Hindrance demands (Cavanaugh et al., 2000). Challenge demands, such as high patient volumes, complex clinical decisions, and diagnostic responsibilities, may stimulate professional development and intrinsic motivation, thereby enhancing work engagement (Bakker & Demerouti, 2007). In contrast, Hindrance demands, including bureaucratic obstacles, role ambiguity, administrative burdens, and interpersonal conflicts, typically result in emotional exhaustion and disengagement (Crawford et al., 2010). Empirical studies conducted in Chinese healthcare settings confirm that while challenge demands can foster engagement when sufficient job resources are present, Hindrance demands consistently predict burnout and disengagement regardless of available resources (Li et al., 2024).

Equally important are job resources, which include decision authority, autonomy, social support, and professional development opportunities. These resources not only buffer the detrimental effects of job demands but also fulfill essential psychological needs for autonomy,

competence, and relatedness, thereby fueling intrinsic motivation and enhancing engagement (Ryan & Deci, 2000). In the context of rural healthcare in China, job autonomy in clinical decision-making, task discretion, and supportive leadership significantly elevates engagement levels among healthcare workers (Dong et al., 2020). When healthcare workers perceive greater control over their work processes and access to institutional support, they are more likely to demonstrate vigor, dedication, and absorption in their roles (Gonzalez Mulé & Cockburn, 2017).

Beyond organizational resources, personal resources such as self-efficacy, resilience, and optimism serve as vital antecedents that bolster work engagement by enhancing individuals' coping capacity in the face of occupational stressors (Xanthopoulou et al., 2007). Healthcare professionals with higher levels of personal resources tend to exhibit stronger adaptability, sustained motivation, and greater resistance to burnout (Hu et al., 2017a). These personal attributes often interact synergistically with job resources, creating gain spirals that reinforce long-term engagement and well-being (Junaković & Macuka, 2021).

Cognitive appraisal functions as a core psychological mechanism mediating the impact of job demands on work engagement. Positive appraisals facilitate adaptive coping and foster engagement, whereas negative appraisals evoke strain responses and disengagement (Ganster & Rosen, 2013). Empirical studies have demonstrated that healthcare professionals who perceive complex tasks and high workloads as growth opportunities exhibit greater work engagement (Sinclair et al., 2020). Conversely, perceiving bureaucratic burdens as hindrances predicts emotional exhaustion and withdrawal (Lepine et al., 2016).

Finally, social support serves as a critical moderator in the relationship between job demands, cognitive appraisal, and work engagement. Derived from supervisors, colleagues, and external professional networks, social support mitigates the negative impact of Hindrance demands while enhancing the motivational effects of challenge demands (van der Heijden et al., 2017). In resource-limited township hospitals, strong social support networks not only alleviate psychological strain but also reinforce psychological resilience and job satisfaction, making them crucial for sustaining work engagement in rural healthcare environments (Moloney et al., 2018).

2.3.5 Reason of work engagement as the core outcome variable in the township healthcare context

Within the framework of occupational health psychology, work engagement has emerged as a particularly salient construct for analyzing employee functioning in high-demand healthcare environments. Compared to traditional negative outcome variables such as burnout, job strain,

or turnover intention, work engagement represents not the absence of maladaptation, but rather the presence of adaptive functioning, sustained energy, and proactive commitment even under challenging work conditions (Schaufeli et al., 2009). In the context of township healthcare systems, where healthcare workers frequently encounter chronic resource scarcity, organizational ambiguity, and emotional labor, this positive orientation provides a more actionable perspective for identifying protective mechanisms that sustain healthcare quality and workforce stability.

Empirical evidence increasingly demonstrates that work engagement exerts a direct influence on critical healthcare outcomes such as patient safety, clinical performance, and service delivery efficiency (van Bogaert et al., 2013). Engaged healthcare professionals exhibit higher levels of cognitive flexibility, problem-solving capacity, and resilience, allowing them to maintain care quality despite unpredictable clinical challenges and infrastructural limitations (Hakanen et al., 2008). Particularly in township hospitals, where clinical staff often manage overlapping clinical, administrative, and public health responsibilities, the ability to sustain energy, dedication, and absorption becomes indispensable for long-term service continuity.

Furthermore, work engagement serves as a comprehensive integrative indicator that reflects the joint operation of both organizational conditions and individual psychological processes, including job demands, job resources, cognitive appraisal, and social support (Bakker et al., 2014). This multidimensionality aligns directly with the JD-R model's dual-process structure, allowing the model to capture not only the strain pathways that lead to burnout, but also the motivational processes that foster engagement (Bakker & Demerouti, 2017). The inclusion of cognitive appraisal as a mediating mechanism and social support as a moderating resource further enriches this analysis by highlighting the dynamic psychological evaluations and contextual buffers that determine whether healthcare workers interpret job demands as stimulating challenges or obstructive hindrances (van der Heijden et al., 2017).

From a policy and managerial standpoint, focusing on work engagement offers direct implications for healthcare administrators seeking to stabilize township hospital workforces and enhance service equity in rural China. Rather than concentrating solely on reducing stressors or mitigating burnout after it has occurred, interventions that promote work engagement actively cultivate organizational environments that empower healthcare workers, reinforce professional meaning, and sustain motivation over time (Dong et al., 2023). This preventive, resource-oriented approach is particularly crucial in township hospitals, where the feasibility of fully eliminating structural job demands remains limited due to systemic resource constraints and institutional complexities (Xu et al., 2020a).

In sum, work engagement serves not only as a theoretically robust outcome within the JD-R framework but also as a practically meaningful and contextually sensitive indicator of healthcare workforce sustainability in rural township hospital settings. Its centrality in the present study reflects both the academic imperative to advance JD-R model application in underexplored contexts and the managerial urgency to strengthen primary healthcare systems serving China's rural populations.

2.3.6 Identification of research gaps

Despite the growing body of research on work engagement, significant gaps remain in understanding its dynamics among Chinese township hospitals' healthcare workerss. Most existing studies tend to generalize findings derived from urban hospitals or broader healthcare worker populations without accounting for the unique socio-economic, organizational, and cultural contexts that characterize township hospitals in rural China. These facilities often operate under resource-constrained conditions, with limited workforce capacity and outdated infrastructure, imposing unique challenges on healthcare professionals (Cao et al., 2023). The absence of context-sensitive research not only limits the external validity of existing models like the JD-R framework but also hampers the development of targeted interventions tailored to rural healthcare environments.

A particularly underexplored area is the differentiation between challenge and Hindrance demands. While challenge demands, such as complex patient care tasks, may positively stimulate engagement by promoting professional growth, Hindrance demands—such as administrative burden and organizational bureaucracy—tend to inhibit motivation and well-being (Xu et al., 2012a). However, few studies have explicitly examined how these two types of job demand uniquely impact work engagement among township hospitals' healthcare workerss. Furthermore, the roles of mediating and moderating mechanisms, especially cognitive appraisal processes and social support systems, have not been adequately addressed. Cognitive appraisal, the subjective interpretation of stressors, is essential in determining whether job demands are perceived as motivating challenges or detrimental hindrances (Sinclair et al., 2020). Similarly, social support has been recognized as a crucial buffer against occupational stress, yet its function as a moderator in rural healthcare contexts remains insufficiently studied.

Moreover, intervention studies aimed at enhancing work engagement among township hospitals' healthcare workerss are extremely limited. Evidence-based, multi-level interventions that integrate organizational reforms, interpersonal support mechanisms, and individual-level

strategies are urgently needed to sustain engagement over time and improve healthcare quality in rural areas. Addressing these gaps will not only enrich the theoretical framework surrounding work engagement but also offer actionable insights for human resource management and health policy, particularly in underserved rural regions of China.

2.3.7 Summary of work engagement for this study

The concept of work engagement has evolved considerably from its early characterization as personal involvement at work to a robust, multidimensional construct encompassing vigor, dedication, and absorption. Recent studies have affirmed its critical role in enhancing job performance, reducing turnover intentions, and promoting employee well-being (Bakker et al., 2014). In the context of primary healthcare, work engagement has been closely associated with improvements in healthcare quality and patient satisfaction, underscoring its practical significance for health systems, particularly in resource-constrained environments (Lu et al., 2019). The JD-R model has been widely utilized to elucidate how job resources can buffer the adverse impacts of high demands, thereby sustaining engagement even under challenging conditions (Bakker & Demerouti, 2017).

2.4 Variables influencing work engagement in the JD-R model

The present study adopts an extended JD-R framework to investigate the psychological mechanisms and contextual factors influencing work engagement among township healthcare workers in rural China. Building upon established theory and prior empirical findings, this section outlines the theoretical foundation of each hypothesized relationship.

2.4.1 Challenge demands and challenge appraisal

In the extended JD-R framework, job demands are not universally detrimental but are categorized into challenge and hindrance demands based on cognitive appraisal processes (Liu et al., 2002). Challenge demands, including workload, time pressure, task complexity, and responsibility, represent demands that, while effortful, are perceived as growth-enhancing and promote skill acquisition, mastery, and personal accomplishment (Hu et al., 2011). This interpretation aligns with transactional stress theory, which posits that individuals actively evaluate environmental stimuli to determine whether they represent opportunities for development or threats to well-being (Ganster & Rosen, 2013).

The construct of challenge appraisal originates from the transactional theory of stress and coping, which emphasizes the cognitive evaluation process by which individuals interpret work demands as either opportunities for growth or potential threats to well-being (Lazarus & Folkman, 1984). Within the challenge hindrance stressor framework, challenge appraisal represents the positive reappraisal of demanding tasks, where high workload, responsibility, or time pressure is perceived as personally meaningful and capable of fostering skill development and professional accomplishment (Crawford et al., 2010).

Over the past decade, research has increasingly examined challenge appraisal as a mediator linking job characteristics to motivational outcomes, particularly in healthcare environments characterized by chronic stress and high-performance expectations (Hou et al., 2020). Empirical evidence from rural Chinese healthcare settings demonstrates that workers who appraise demands as challenges rather than hindrances report higher engagement and lower emotional exhaustion, even under significant resource constraints (Zhou & Zheng, 2022). This aligns with the motivational pathway of the JD-R model, wherein challenge appraisal functions as a cognitive mechanism through which job resources (e.g., autonomy, control) amplify positive work-related outcomes (Bakker & Demerouti, 2017).

The motivational mechanism linking challenge demands to engagement operates through the activation of psychological resources such as competence, self-efficacy, and intrinsic motivation. According to the broaden-and-build theory, positive appraisals expand individuals' cognitive and behavioral repertoires, allowing them to engage proactively with demanding tasks (Kuijpers et al., 2020). Thus, when healthcare workers perceive complex clinical cases or high patient volumes as opportunities to demonstrate expertise and contribute meaningfully, these demands stimulate higher engagement levels rather than exhaustion (Feng et al., 2022).

Consistent with transactional stress theory and the broaden-and-build framework, these findings collectively suggest that the appraisal of specific job demands as challenges represents a pivotal psychological mechanism by which township healthcare workers transform demanding clinical environments into opportunities for professional growth and engagement. This accumulating evidence thus provides the empirical and theoretical foundation for the development of the following research hypotheses regarding the relationships between job demands, cognitive appraisal, and work engagement in the present study (Li et al., 2023a).

Building on these findings, recent scholarship has increasingly emphasized that cognitive appraisal functions as a proximal mediator through which specific job demands influence work engagement outcomes. When healthcare workers appraise challenge demands positively, they are more likely to activate personal psychological resources, including self-efficacy, optimism,

and resilience, which in turn foster sustained engagement even under high-demand conditions (Xie et al., 2021). This pathway reflects the motivational process proposed by the JD-R model, wherein job demands, when appraised as challenges, contribute not to strain but to the enrichment of psychological capital and intrinsic motivation (Bakker & Demerouti, 2024).

Furthermore, multiple empirical studies conducted among Chinese healthcare personnel have verified these mediating mechanisms. For example, Chen et al. (Chen et al., 2024a) demonstrated that the positive appraisal of workload and task complexity enhanced both affective commitment and work engagement via the activation of professional efficacy. Similarly, responsibility for complex clinical decision-making has been linked to heightened job involvement when perceived as meaningful and competence-enhancing (Li et al., 2024). These studies not only corroborate the motivational potential of challenge demands but also highlight the culturally relevant role of professional responsibility and service-oriented values in the Chinese primary healthcare context.

Recent empirical evidence substantiates this theoretical reasoning. For instance, Wu et al. (2024) found that task complexity significantly predicted challenge appraisal, which subsequently enhanced work engagement among Chinese primary healthcare providers. Similarly, responsibility for patient outcomes has been shown to foster professional identity and intrinsic motivation when appraised as meaningful, thereby promoting sustained engagement (Wang et al., 2024b). These findings underscore that the subjective appraisal of challenge demands is a critical psychological mechanism that transforms potentially demanding work conditions into engagement-promoting experiences.

Workload is a defining feature of healthcare labor intensity, but its psychological effects depend heavily on how it is cognitively framed. When healthcare workers perceive high workloads as manageable and purposeful, they are more likely to interpret them as challenges that affirm their capability and professional value. In a recent study, rural nurses who viewed their workload as meaningful reported significantly higher challenge appraisal and lower burnout (Roberts et al., 2021). Cognitive interpretation thus mediates the stressor-outcome pathway, in line with the JD-R framework.

Importantly, when tasks are tied to direct patient care and perceived autonomy, the same volume of work may stimulate personal efficacy and intrinsic motivation. Township hospital staff often encounter multitasking environments where each task carries visible impact. According to Pensier et al. (2024), such visibility enhances the perceived value of labor, promoting challenge-oriented interpretations even under overload. Based on this theoretical reasoning and accumulating empirical support, the following hypothesis is proposed.

(1) H1a: Workload is positively associated with challenge appraisal.

Time pressure can function as a double-edged demand, yet recent findings suggest that moderate, expected temporal constraints are often appraised positively particularly when healthcare providers believe they can respond effectively. Zhao et al. (2025b) demonstrated that frontline medical workers who reported higher time pressure—but also higher scheduling control were significantly more likely to interpret pressure as a challenge rather than a hindrance. The authors concluded that positive appraisal is activated when urgency is paired with task clarity and role familiarity.

Furthermore, time-limited conditions may stimulate cognitive engagement by focusing attention on critical priorities. This is especially relevant in township settings where providers juggle overlapping clinical and public health duties. Malan et al. (2020) confirmed that medical professionals working under time constraints reported increased mental stimulation and strategic resource use hallmarks of challenge framing when supported by basic task discretion.

In a large-scale longitudinal study, Zhou et al. (2020) observed that moderate time urgency, accompanied by predictable task structures, led to higher levels of task absorption among German hospital nurses. Their findings suggest that time pressure functions as a motivational amplifier only when task expectations are clearly delineated and employees have access to planning autonomy.

Moreover, Bakker et al. (2023) found that time-sensitive work contexts can induce a state of task-driven flow, especially when individuals perceive themselves as competent and supported. In their diary-based study of Dutch healthcare workers, episodes of time pressure were more frequently associated with positive mood and proactive coping when they occurred alongside supportive team environments and manageable caseloads. Such appraisals reflect a dynamic interplay between environmental urgency and internal psychological resources.

Further support comes from neurocognitive studies. Liu et al. (2023) used data to show that under moderate time pressure, clinicians displayed increased activation in executive control regions of the prefrontal cortex correlated with adaptive decision-making and higher cognitive engagement. These findings provide a neurobiological basis for the cognitive sharpening effects of manageable temporal demands.

In township hospital settings, where multitasking and rapid transitions between patient care and administrative duties are common, time pressure may serve not only as an external demand but also as a cue for performance optimization. When paired with even minimal levels of discretion or autonomy, as in basic task sequencing or schedule flexibility, it may elicit resourceful behaviors, heightened alertness, and goal salience all core indicators of challenge

appraisal. Based on this theoretical reasoning and accumulating empirical support, the following hypothesis is proposed.

(2) H1b: Time pressure is positively associated with challenge appraisal.

Task complexity refers to the cognitive and procedural depth required to complete a job, and its appraisal strongly depends on perceived skill adequacy and autonomy. Recent research shows that when complexity is paired with clear expectations and learning potential, it is cognitively framed as a growth opportunity. According to Li et al. (2014), Chinese community physicians exposed to more diagnostically complex cases reported higher levels of challenge appraisal and engagement, particularly when job roles were well defined.

In township hospitals, where clinical procedures often lack detailed protocols, complexity frequently involves improvisation and diagnostic reasoning under uncertainty. A recent survey by Shi et al. (2019) confirmed that in such scenarios, perceived task complexity predicted positive engagement outcomes only when staff perceived adequate competence and support from peers.

Task complexity not only demands heightened cognitive investment but also provides fertile ground for intrinsic motivation when framed as a mastery-oriented challenge. Complexity fosters deeper engagement when healthcare workers perceive alignment between task demands and their evolving skill sets. In their daily diary study of hospital nurses, Bakker and van Wingerden (2021) found that task complexity was positively associated with daily vigor and concentration, but only among individuals reporting high professional efficacy. These results support the notion that the motivational value of complexity is conditional upon internal resource activation.

Moreover, complex tasks often generate meaningfulness through problem-solving and autonomy, especially when staff perceive feedback loops that reinforce learning and competence. Zhang et al. (2025a) demonstrated that the presence of learning opportunities within complex clinical duties predicted stronger affective engagement among junior medical personnel, mediated by perceived task significance. Notably, the framing of complexity as a professional development opportunity appears to mitigate cognitive fatigue, even in resource-limited environments.

Neuropsychological research further supports the adaptive potential of complexity. In a randomized trial on surgical residents, Goble et al. (2023) showed that exposure to structured yet cognitively demanding simulations increased neural efficiency in the prefrontal cortex and improved post-intervention self-efficacy ratings. This suggests that complexity, when scaffolded with instructional clarity and performance feedback, not only enhances technical

performance but reinforces psychological readiness.

In rural healthcare contexts, where diagnostic uncertainty is the norm, the ability to frame complexity as an engaging rather than overwhelming demand is especially critical. When healthcare workers perceive diagnostic ambiguity not as a threat but as a skill test supported by collegial interaction or prior successful experiences cognitive appraisal tilts toward the challenge end of the spectrum. Thus, task complexity in township hospitals can serve as a motivational lever when embedded within trustful, supportive, and semi-structured practice environments. Based on this theoretical reasoning and accumulating empirical support, the following hypothesis is proposed.

(3) H1c: Task complexity is positively associated with challenge appraisal.

Responsibility, especially over patient outcomes and public trust may serve as a key trigger of challenge appraisal when individuals perceive alignment between responsibility and capability. Tomaka and Magoc (2021) confirm that healthcare workers in rural settings often appraise their roles more positively when their responsibilities are clearly tied to impact and recognition. These findings suggest that responsibility interpreted through the lens of meaning and agency fosters challenge-oriented mental framing.

Moreover, taking ownership of patient care decisions has been linked to greater psychological resilience and initiative. Bland et al. (2024) reported that rural doctors who managed chronic disease programs perceived role responsibility as an opportunity to demonstrate long-term value to their communities thus shaping responsibility as a motivator, not a burden. In a qualitative study of rural emergency physicians, Giwa et al. (2021) reported that perceived personal responsibility for patient trajectories enhanced moral engagement and fostered proactive decision-making particularly when organizational culture reinforced autonomy and task ownership.

When individuals are given the discretion to enact their responsibilities, the psychological framing of such demands shifts from obligation to opportunity. Holtan et al. (2024) found that when clinical autonomy and role responsibility were coupled in primary care settings, staff reported higher levels of self-determined motivation and adaptive coping under pressure. This supports the idea that perceived alignment between responsibility and autonomy strengthens challenge appraisal, transforming role demands into domains for professional growth. Additionally, Koenig and Al Zaben (2021) emphasized that healthcare workers who experience responsibility as a form of prosocial accountability tend to exhibit greater compassion satisfaction and resilience, especially in contexts where patient relationships are longitudinal and emotionally embedded. This finding is particularly salient in township hospitals, where

health professionals frequently serve multigenerational populations and are seen as pillars of local health knowledge and care continuity.

These studies collectively affirm that responsibility when appraised through the lenses of agency, trust, and purpose functions as a motivational resource rather than a stressor. This appraisal pattern not only protects against burnout but also promotes sustained engagement, particularly in under-resourced yet socially rich healthcare environments like township hospitals. Based on this theoretical reasoning and accumulating empirical support, the following hypothesis is proposed.

(4) H1d: Responsibility is positively associated with challenge appraisal.

2.4.2 Hindrance demands and hindrance appraisal

Hindrance demands such as administrative hassles, role conflict, role ambiguity, resource inadequacy, interpersonal conflict, and organizational politics — represent demands that obstruct goal attainment and induce frustration (Lepine et al., 2005). When appraised as hindrances, these stressors activate the JD-R model's health impairment pathway, contributing to strain, emotional exhaustion, and disengagement (Crawford et al., 2010).

The concept of hindrance appraisal derives from the same transactional stress framework that underpins challenge appraisal, yet it reflects a fundamentally different evaluative stance. Whereas challenge appraisal involves perceiving demands as opportunities for growth, hindrance appraisal captures the perception of these demands as obstacles that thwart goal attainment and drain psychological resources (Bakker & Demerouti, 2007). Within the challenge hindrance demand model, hindrance appraisal has been shown to mediate the adverse pathway linking high job demands to strain outcomes such as emotional exhaustion and disengagement, particularly in high-stress service professions like healthcare (Xu et al., 2020b).

Within the JD-R framework, hindrance demands represent job demands that are appraised as obstacles impeding goal achievement and professional functioning (Chen et al., 2024a). Unlike challenge demands that may foster personal growth, Hindrance demands elicit negative affective responses by constraining autonomy, reducing perceived control, and evoking frustration (Bakker & de Vries, 2021). Cognitive appraisal theory posits that these stressors are likely to be perceived as uncontrollable or externally imposed, thereby activating the JD-R model's health impairment process (Ganster et al., 2018).

Multiple dimensions of Hindrance demands have been identified in healthcare settings. Administrative hassles, including excessive documentation and compliance demands, reduce

available clinical time and increase perceived work inefficiency, thus contributing to appraisals of helplessness (Chen et al., 2022a). Similarly, role conflict — arising when conflicting expectations are imposed on healthcare workers—generates cognitive dissonance, elevating strain and diminishing work engagement (Zhou et al., 2025b). Role ambiguity, characterized by unclear job expectations and responsibility boundaries, impairs decision-making confidence, undermining perceived competence and exacerbating emotional exhaustion (Xu et al., 2020a).

In resource-constrained environments such as township hospitals, resource inadequacy—including insufficient staffing, lack of medical supplies, and limited institutional support—serves as a persistent hindrance that reinforces perceptions of incapacity to meet professional standards (Wang et al., 2024b). Interpersonal conflict with colleagues or supervisors generates relational strain and social tension, further elevating psychological stress (Li et al., 2024). Lastly, organizational politics, manifested as favoritism, non-transparent decision-making, or inequitable resource allocation, erode trust in institutional fairness and generate cynicism (Zhang, 2024b).

The construct of hindrance demands originated from the challenge–hindrance demand framework first articulated by Cavanaugh et al. (2000), which conceptually differentiated job stressors that promote growth (challenge demands) from those that impede personal development and thwart goal attainment (hindrance demands). Grounded in transactional stress theory (Lazarus & Folkman, 1984), hindrance demands encapsulate workplace barriers such as role ambiguity, organizational politics, and resource inadequacies factors that elicit frustration rather than motivation. Over the past two decades, this framework has been extensively refined, particularly within the JD-R model, providing nuanced insights into how distinct stressor types predict divergent health and motivational outcomes (Bakker & Demerouti, 2017).

Recent empirical work has underscored the salience of hindrance demands in healthcare settings, where chronic administrative burdens, interpersonal conflict, and bureaucratic constraints exacerbate burnout and erode work engagement. For instance, longitudinal studies of nurses in high-demand environments demonstrated that hindrance demands consistently predicted emotional exhaustion and turnover intentions, even after controlling for challenge demand and personal resources (Hu et al., 2017b). In rural primary care systems, these stressors are amplified by persistent structural inequities—including outdated facilities and workforce shortages—rendering the hindrance construct particularly germane for understanding psychological strain among township hospital staff (Zhou & Zheng, 2022). Meta-analytic evidence further confirms that hindrance demands exert a stronger negative impact on well-

being than challenge demands across diverse cultural contexts, emphasizing their universality and theoretical robustness (Zhang et al., 2024c).

In rural Chinese township hospitals, structural barriers such as inadequate resources, rigid bureaucratic procedures, and fragmented interprofessional support frequently amplify hindrance appraisals. Empirical studies indicate that such negative evaluations not only exacerbate burnout but also diminish workers' willingness to invest discretionary effort, thereby weakening the motivational process central to the JD-R framework (Hu et al., 2017c). Understanding hindrance appraisal in this context is thus critical for designing interventions that alleviate perceived obstacles and restore adaptive functioning among frontline providers.

Empirical studies have validated these theoretical mechanisms. For instance, Chen et al. (2022a) demonstrated that administrative overload and interpersonal conflict significantly predicted hindrance appraisals, which subsequently elevated burnout and reduced engagement among Chinese healthcare professionals. Similarly, Galanis et al. (2024) found that role ambiguity directly contributed to higher hindrance appraisal scores, while Wang et al. (2024b) confirmed that resource inadequacy predicted disengagement through the mediating role of hindrance appraisal.

These findings emphasize that hindrance appraisal serves as a critical cognitive mechanism through which detrimental job demands exert their negative impact on healthcare workers' motivational states. Unlike challenge demands, which may promote adaptive coping and engagement when appraised positively, Hindrance demands are typically perceived as obstructive, threatening, and uncontrollable, thereby diminishing motivation and depleting psychological resources (Crawford et al., 2010). In healthcare settings, organizational constraints such as administrative bureaucracy, insufficient medical supplies, and rigid hierarchical protocols have been shown to exacerbate feelings of helplessness and frustration among healthcare workers, especially when such demands are persistent and unresolved (Moloney et al., 2018).

Empirical studies within Chinese township hospitals have provided additional evidence supporting this mechanism. For example, Bardach et al., (2021) demonstrated that persistent exposure to organizational red tape and policy ambiguity significantly increased emotional exhaustion via heightened hindrance appraisal among rural healthcare workers. Furthermore, Wang et al. (2022) found that interpersonal conflicts and unclear role boundaries not only elevated hindrance appraisals but also directly undermined employees' work engagement by eroding professional efficacy and job satisfaction. These findings illustrate the pivotal role of subjective appraisal in determining how objectively similar job demands may lead to diverging

psychological outcomes based on employees perceived controllability and meaningfulness.

Collectively, these results reinforce the JD-R model's extended proposition that hindrance appraisals act as a mediating mechanism by which specific job demands contribute to disengagement and emotional strain. This theoretical foundation supports the development of hypotheses concerning the pathways linking role ambiguity, resource inadequacy, and interpersonal conflict to work engagement through hindrance appraisal among township healthcare workers.

Administrative hassles—such as redundant documentation, fragmented reporting systems, and unclear protocols—often contribute to a perception of unnecessary work burden. These hassles are particularly prevalent in township healthcare systems where digital infrastructure is underdeveloped, and bureaucratic requirements are inconsistently enforced. Ren et al. (2025) found that administrative overload significantly increased hindrance appraisal among rural Chinese nurses, as workers perceived such tasks as obstructing direct patient care and consuming cognitive bandwidth.

Moreover, when administrative demands are divorced from clinical outcomes, they reduce perceived task value and disrupt intrinsic motivation. This disconnects triggers negative appraisal processes in which workers regard these demands as frustrating barriers rather than growth opportunities. Hence, administrative hassles are likely to be interpreted as hindrances (Li et al., 2023b). Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(5) H2a: Administrative hassles are positively associated with hindrance appraisal.

Role conflict emerges when healthcare staff receive conflicting expectations—for example, being expected to complete reporting duties while simultaneously attending to emergencies. This dual-role pressure impairs clarity and coherence in work tasks. In a structural modeling study, Fernandez De Henestrosa et al. (2023a) found that role conflict among rural clinicians significantly predicted hindrance appraisal, mediated by perceived task incoherence and lack of control.

Role conflict interferes with behavioral self-regulation, fosters emotional ambivalence, and leads to cognitive dissonance, all of which align with threat-based processing. Under the JD-R model, such incongruent expectations are classic Hindrance demands (Zhang et al., 2024c).

Beyond the immediate disruption of task execution, role conflict also erodes psychological safety and organizational trust, further reinforcing its appraisal as a hindrance. When staff encounter inconsistent directives such as prioritizing both bureaucratic compliance and patient centered care, they often perceive the work environment as politically ambiguous and

unsupportive. Al Sabei et al. (2025) observed that in high-pressure healthcare contexts, role conflict reduced job satisfaction and psychological resilience, primarily through increased emotional dissonance and reduced perceived organizational justice.

Moreover, chronic exposure to conflicting demands has been shown to increase feelings of helplessness and diminished control over one's professional performance. In a multi-country survey, Singh et al. (2020) found that role conflict was significantly associated with cognitive overload and disengagement across various healthcare systems. Their analysis indicated that the more entrenched the conflict between roles, the greater the likelihood of avoidance-based coping strategies, reinforcing strain and inefficiency.

Cognitive neuroscience offers further explanation: Liston et al. (2014) demonstrated that prolonged exposure to decision-based conflict suppresses neural efficiency in executive control networks and increases default-mode activation physiological markers of attentional disruption and cognitive fatigue. These neural patterns correspond with workers' reports of indecisiveness, emotional numbness, and motivational withdrawal typical responses associated with hindrance appraisal.

In the rural healthcare setting, where clinical autonomy is often constrained by bureaucratic imperatives, role conflict is particularly disempowering. Township hospital physicians frequently navigate tensions between government mandates and immediate patient needs without sufficient support or flexibility. In such circumstances, incongruent role expectations become not only stressful but actively corrosive to engagement, promoting frustration and psychological withdrawal. Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(6) H2b: Role conflict is positively associated with hindrance appraisal.

Role ambiguity characterized by vague responsibilities and unclear authority—undermines confidence in action. In township settings, where personnel often rotate across public health, chronic care, and emergency duties, this lack of clarity impairs task prioritization and performance satisfaction. Coombs et al. (2022) demonstrated that role ambiguity triggered threat appraisals, leading to disengagement and higher perceived stress.

Such ambiguity disrupts performance feedback loops and precludes proactive coping, producing a mental environment dominated by uncertainty and avoidance. Under these conditions, cognitive interpretation shifts toward hindrance, regardless of workload magnitude (Asghari et al., 2024).

In healthcare contexts, unclear expectations about authority or procedural norms frequently suppress initiative, as staff are unsure whether their actions will be supported or questioned.

Mohamed et al. (2025) reported that healthcare professionals operating under ambiguous reporting lines exhibited reduced voice behavior and increased preference for reactive over proactive coping. These findings highlight the motivational paralysis induced by cognitive uncertainty.

Moreover, prolonged ambiguity impairs anticipatory planning a key element of cognitive control and creates fragmented attention states. Akkoc et al. (2021) revealed that perceived role ambiguity was associated with increased activation of the amygdala and decreased activity in the dorsolateral prefrontal cortex, reflecting an elevated threat response and impaired executive regulation. This neural pattern corresponds with field observations that ambiguity heightens risk sensitivity and decision hesitation, both of which are central to hindrance appraisal.

In rural township settings, the absence of well-structured job descriptions exacerbates these effects. Healthcare workers may be tasked with both epidemic prevention planning and outpatient care without clear delineation, leading to overlapping priorities and chronic tension between coordination and autonomy. Under such ambiguous mandates, even routine tasks become cognitively effortful and emotionally draining, resulting in reduced engagement and increased avoidance behaviors. Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(7) H2c: Role ambiguity is positively associated with hindrance appraisal.

Resource inadequacy including limited drugs, broken equipment, and insufficient human resources is one of the most visible and demoralizing stressors in rural healthcare. According to Horan et al. (2020), clinicians in township hospitals consistently appraised resource shortages as barriers to fulfilling their professional responsibilities. These constraints directly impair task feasibility, provoke feelings of helplessness, and undercut self-efficacy.

When workers face repeated inability to meet patient needs due to systemic resource failures, their appraisal becomes increasingly threat-based, regardless of individual motivation. The frustration stemming from chronic inadequacy firmly positions this stressor within the hindrance domain (Fernandez De Henestrosa et al., 2023b).

In a multicenter qualitative study, Li et al. (2025) found that rural Chinese physicians who experienced frequent supply shortages reported a sense of ethical fatigue, in which repeated failure to meet care standards weakened professional identity and undermined long-term vocational commitment.

From a cognitive standpoint, perceived uncontrollability is central to the hindrance appraisal of resource inadequacy. Reitz et al. (2021) demonstrated that healthcare workers who lacked material or human resources reported heightened emotional exhaustion and reduced

problem-focused coping—especially when organizational constraints prevented system-level improvements. Under such conditions, resource deficits are no longer seen as temporary obstacles but as enduring signals of institutional neglect, triggering learned helplessness and disengagement.

Neuropsychological data corroborate this process. Kalisch et al. (2024) observed that repeated exposure to uncontrollable environmental stressors in clinical settings heightened activity in brain regions associated with affective rumination and cognitive inhibition, such as the subgenual anterior cingulate cortex. These neural changes reflect the psychological shift from active problem-solving to emotional withdrawal, hallmarks of hindrance appraisal.

In township hospitals where healthcare workers often work with dual burdens of expectation and insufficiency chronic resource gaps not only obstruct workflow but also devalue effort. Over time, this mismatch between responsibility and capacity may lead to institutional distrust, diminished professional meaning, and enduring threat-based cognitive framing of workplace conditions. Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(8) H2d: Resource inadequacy is positively associated with hindrance appraisal.

Interpersonal conflict ranging from passive resistance to overt disputes threatens team trust, psychological safety, and coordination. Bethea et al. (2020) showed that such conflict among rural nurses was a strong predictor of avoidance-based coping and emotional disengagement. When workplace relationships deteriorate, cognitive appraisal shifts away from task demands and toward self-protection.

Conflict is emotionally taxing and cognitively distracting, making it difficult for staff to remain engaged or derive satisfaction from their work. These conditions strongly predispose healthcare workers to appraise conflict not as a challenge to overcome, but as a persistent hindrance (Cao et al., 2022).

Without trust and mutual respect, staff may withhold critical information or avoid collaborative decision-making, compromising both patient care and team morale. In a multi-institutional study, Hetland et al. (2024) found that interpersonal tensions within clinical units were negatively associated with information sharing and strongly predicted task avoidance. Their data support the idea that conflict generates relational fatigue, which in turn constrains strategic coordination.

Moreover, social conflict introduces a state of chronic hypervigilance. Affective neuroscience research by Czeszumski et al. (2020) demonstrated that interpersonal tension in

the workplace elevates activity in the amygdala and anterior insula—regions implicated in social threat detection and emotional suppression. Prolonged exposure to these conditions was correlated with decreased activation of prefrontal regulatory networks, indicating diminished cognitive flexibility and impaired emotion regulation (Nonami et al., 2023). These findings underscore how relational conflict not only distracts from task focus but also biologically reinforces a threat-oriented mindset.

In township hospitals where personnel must often collaborate under time pressure and limited staffing interpersonal discord can cascade rapidly. When emotional strain from unresolved conflict compounds existing workload or resource constraints, the resulting psychological climate becomes one of guardedness and detachment. In such contexts, even minor disagreements may be appraised as overwhelming, especially when staff perceive little institutional support for mediation or de-escalation (Inoue et al., 2023).

Collectively, interpersonal conflict functions not as a challenge to engage with but as a socially encoded hindrance that redirects energy away from task mastery toward psychological defense. Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(9) H2e: Interpersonal conflict is positively associated with hindrance appraisal.

Organizational politics—perceived favoritism, opaque decision-making, or patronage systems—create a climate of injustice and uncertainty. In healthcare settings, such dynamics erode merit-based advancement and foster disengagement. In a recent study, Chapman et al. (2025) found that perceived political behavior among township hospital administrators predicted higher hindrance appraisal and reduced collaborative motivation among junior staff.

These perceptions violate norms of procedural fairness and predictability, both of which are essential for challenge framing. Political environments undermine cognitive control, promoting threat-dominant interpretations of otherwise neutral job demands (Lasco et al., 2022).

Perceptions of organizational politics also undermine psychological safety by introducing ambiguity into reward structures and decision legitimacy. When employees believe that success is determined by personal alliances rather than effort or competence, motivation to invest in core job tasks deteriorates. Ndayishimiye et al. (2025) found that exposure to opaque promotion criteria and informal power networks in public hospitals led to a breakdown in goal orientation and reduced proactive behavior, particularly among early-career clinicians.

Such environments disrupt the appraisal of workload, responsibility, and even routine decision making, reframing them as socially risky endeavors rather than professional challenges.

In a multisite analysis, Magnavita et al. (2022) reported that healthcare workers who perceived a politicized work climate displayed higher cortisol reactivity to ambiguous supervisory requests indicative of elevated threat perception and diminished cognitive resilience. This neuroendocrine data supports the psychological observation that organizational politics amplify job strain, even in the absence of increased objective demands.

Furthermore, politicized climates foster a culture of learned inaction. When employees anticipate that decisions will be driven by favoritism or strategic alignment rather than merit, they may withhold ideas, avoid collaborative projects, or retreat from leadership roles. This phenomenon, termed disengaged vigilance by Qin and Zhang (2022), is particularly corrosive in township hospitals, where institutional trust is essential for improvisational problem-solving and team cohesion under constrained conditions.

Ultimately, the presence of perceived organizational politics transforms neutral or even mildly demanding tasks into psychologically toxic experiences (2019). These perceptions erode perceived control and fairness two foundational antecedents of challenge appraisal thereby entrenching a hindrance-oriented cognitive framework. Based on these theoretical considerations and empirical findings, the following hypothesis is proposed:

(10) H2f: Organizational politics is positively associated with hindrance appraisal.

2.4.3 Job resources and challenge appraisal

In the JD-R framework, job resources are defined as organizational, social, or task-related factors that facilitate goal achievement, promote learning and development, and buffer the adverse effects of job demands (Bakker et al., 2007). Beyond their direct motivational role, job resources significantly influence how employees cognitively appraise job demands, thereby altering whether these demands activate the motivational or impairment pathway (Xanthopoulou et al., 2007).

The theoretical rationale underpinning this relationship draws on both control theory and cognitive appraisal theory. According to control theory, job resources such as decision authority and task discretion enhance individuals' perceived control over work processes, reducing uncertainty and fostering adaptive coping responses (Ganster & Rosen, 2013). When employees perceive themselves as having influence over their work environment, they are more likely to interpret complex or intensive job demands as manageable challenges rather than overwhelming obstacles (Bakker & de Vries, 2021).

Decision authority defined as employees' capacity to make decisions regarding work methods, pacing, and problem-solving provides a sense of autonomy and self-regulation that

supports positive cognitive evaluations (Gonzalez Mulé & Cockburn, 2017). Task discretion, which refers to flexibility in determining how work tasks are executed, allows healthcare workers to adapt clinical procedures based on patient needs, thereby reinforcing competence and task mastery (Paškvan et al., 2016). Both dimensions enhance employees' self-efficacy and professional confidence, facilitating challenge appraisals under high job demands.

The concept of job autonomy represents a pivotal dimension of job resources within the JD-R framework, encapsulating the freedom and discretion employees possess in determining how to organize, schedule, and execute their work (Bakker & Demerouti, 2007). Unlike job control, which emphasizes decision authority and task prioritization, job autonomy focuses on self-directed work methods and the latitude to adapt procedures to dynamic contextual demands. This autonomy fosters intrinsic motivation by satisfying fundamental psychological needs for self-determination and competence, thereby promoting sustained work engagement even under high job demands (Xanthopoulou et al., 2007).

Contemporary research underscores the critical role of job autonomy in healthcare environments, particularly in primary care systems where professionals must frequently navigate unpredictable patient needs, limited resources, and multifaceted roles spanning clinical and public health duties. Empirical evidence from Chinese rural healthcare workers indicates that higher autonomy correlates with enhanced challenge appraisals, reduced emotional exhaustion, and greater adaptive coping in resource-constrained settings (Xu et al., 2020b). Moreover, autonomy has been identified as a key moderator that transforms potentially overwhelming demands into opportunities for professional growth, aligning closely with the dual pathways of the JD-R model's motivational process (Gonzalez Mulé & Cockburn, 2017).

Empirical research substantiates these theoretical mechanisms. Gonzalez and Cockburn (2017) demonstrated that job control, encompassing decision authority and task discretion, directly promoted challenge appraisals and attenuated strain responses in healthcare settings. Similarly, Wu et al. (2024) found that task discretion significantly predicted positive appraisal patterns and higher engagement among Chinese healthcare professionals. Furthermore, (Wang et al. (2024b) reported that job autonomy was positively associated with challenge appraisals, which in turn mediated its effects on work engagement.

In this study, job autonomy was operationalized to reflect both task-related and clinical dimensions critical to rural primary healthcare. Beyond general freedom in organizing work, this construct captures three interrelated facets: first, the ability to structure daily schedules, enabling staff to prioritize consultations, administrative responsibilities, and procedural tasks in accordance with immediate patient needs and personal judgment; second, the exercise of

professional discretion during clinical encounters, which permits flexible decision-making when addressing complex or unforeseen conditions in the absence of specialist support; and third, the capacity to adapt procedures and work routines in real time, allowing adjustments to evolving healthcare demands, resource limitations, and contextual constraints unique to township-level service delivery (Hou et al., 2020).

Building upon these findings, multiple empirical studies have confirmed that job resources not only exert direct motivational effects but also indirectly foster work engagement by shaping individuals' cognitive appraisal processes. Specifically, when sufficient job resources are present, healthcare workers are more likely to perceive demanding tasks as development opportunities rather than insurmountable obstacles, thus promoting positive challenge appraisals (Bakker & Demerouti, 2017). For example, Chen et al. (2023) demonstrated that supervisor support and performance feedback significantly enhanced challenge appraisals among primary healthcare personnel, which subsequently elevated their work engagement levels.

Social support, as a crucial job resource, plays a particularly salient role in influencing cognitive evaluations of job demands. Dimla et al. (2023) suggested that healthcare professionals with stronger collegial and supervisory support are more likely to interpret high workload and complex patient care responsibilities as manageable challenges, thereby experiencing heightened professional confidence and engagement. These interpersonal resources buffer emotional strain, facilitate adaptive coping, and enhance employees' sense of competence when facing demanding clinical situations.

Moreover, opportunities for professional growth, including training, continuing education, and skill variety, further reinforce challenge appraisals by equipping employees with the necessary competencies to meet escalating job demands (Li et al., 2024). As competence increases, healthcare workers gain greater confidence in managing complexity and ambiguity, thus transforming potentially stressful situations into engaging professional experiences.

Collectively, these studies underscore that job resources not only strengthen healthcare professionals' motivational states directly but also influence how demands are cognitively processed and appraised. This appraisal process, in turn, serves as a crucial psychological mechanism that translates favorable work environments into sustainable work engagement, particularly for township healthcare staff operating under both resource limitations and rising service expectations.

The construct of job control is a central tenet of the JD-R model, which conceptualizes work characteristics in terms of their potential to deplete or enhance employees' psychological

resources (Bakker & Demerouti, 2007). Within this framework, job control refers to the extent to which individuals can regulate their work pace, select methods, and prioritize tasks—factors that critically shape whether job demands are appraised as growth-promoting challenges or strain-inducing hindrances (Gonzalez Mulé & Cockburn, 2017). Rather than viewing control purely as structural authority, contemporary research emphasizes its multidimensional nature, integrating both formal decision latitude (e.g., scheduling, role decisions) and psychological empowerment (e.g., perceived competence and autonomy) as core components of resource availability.

In healthcare contexts, particularly in resource-constrained primary care environments, job control has been shown to buffer the deleterious effects of chronic workload and simultaneously foster motivation. Studies of Chinese rural healthcare workers demonstrate that higher decision authority and task discretion predict more adaptive challenge appraisals and mitigate burnout symptoms under sustained stress exposure (Hou et al., 2020). This aligns with emerging evidence that job control facilitates resilience by enabling workers to actively reframe stressful conditions as manageable and professionally meaningful, a process especially vital in township hospitals characterized by hierarchical organizational structures and limited material support.

Decision authority refers to an individual's ability to make autonomous decisions about their work processes, task execution, and care pathways. In healthcare environments, especially resource-constrained ones like township hospitals, this decision-making power is integral to psychological empowerment. When individuals feel authorized to decide on treatment steps or scheduling, they are more likely to interpret complex job demands as stimulating rather than obstructive. Wang et al. (2020) observed that rural healthcare workers who perceived higher levels of decision authority also reported stronger challenge-oriented appraisals under identical workload conditions, underscoring the motivational significance of perceived control. Autonomy in decision-making fosters a sense of accountability and personal investment, which enhances the salience of competence and goal relevance in interpreting demands.

In these contexts, decision authority reduces ambiguity and grants cognitive structure to otherwise chaotic situations. Workers are no longer passive recipients of external pressure, but active agents steering meaningful outcomes. This repositions external demands as challenge opportunities, not barriers (Shen et al., 2024a). Based on this integrated theoretical and empirical foundation, the following hypothesis is proposed:

(11) H3a: Decision authority is positively associated with challenge appraisal.

Task discretion describes the degree to which healthcare professionals can determine how to perform their duties — including setting task sequences, procedures, and pacing. High

discretion affords individuals the psychological room to adapt job demands to their own capabilities and style, which in turn enhances task ownership and meaningfulness. Dousin et al. (2021) found that rural nurses with greater task discretion were significantly more likely to appraise high-demand shifts as motivating rather than overwhelming. Notably, these effects were independent of workload intensity, emphasizing the moderating strength of discretion.

Task discretion operates as a motivational amplifier: by aligning external task requirements with internal preferences, it allows healthcare workers to reframe pressure as professional agency. This reframing, which underlies challenge appraisal, is particularly critical in township settings where ambiguity and resource gaps require improvisation. Discretion helps bridge systemic deficiencies with personal flexibility (Chen et al., 2022b).

In environments where clinical uncertainty prevails such as in rural township hospitals where guidelines are often absent or outdated professionals with high task discretion are more likely to interpret complexity as a source of control rather than chaos. This interpretive shift is crucial in sustaining cognitive engagement under duress (Ajluni, 2023). According to a recent field study in Malaysian public hospitals, mid-level medical officers with high discretion reported significantly stronger alignment between personal efficacy and job significance, which in turn elevated their perception of job stressors as developmental (Woon & Tiong, 2020). The study emphasizes the appraisal mechanism as an outcome of discretion-induced cognitive coherence, whereby workers anchor challenging tasks to a self-directed narrative of growth.

Moreover, task discretion has been shown to enhance attentional regulation, a central component of challenge appraisal. In a randomized experimental simulation of emergency ward conditions, physicians allowed to reorganize triage procedures displayed not only faster decision-making but also higher self-assessed engagement levels when exposed to patient surges (Tisu et al., 2023). Crucially, this effect was mediated by perceived agency, rather than objective workload. This indicates that discretion doesn't simply enable adaptation it recalibrates the perceived trajectory of task difficulty into one of mastery, thus fueling intrinsic motivation. These findings are echoed in work among Norway general practitioners, where high discretion correlated with elevated self-determined motivation even amidst administrative overload (Eyjolfsdottir et al., 2025). It becomes evident that discretion functions as a latent appraisal filter, converting ambiguity into actionable control and thereby reinforcing challenge-oriented cognitive schemas. Based on this integrated theoretical and empirical foundation, the following hypothesis is proposed:

(12) H3b: Task discretion is positively associated with challenge appraisal.

Job autonomy, a broader construct than task discretion, encompasses the overall freedom

to initiate, schedule, and execute one's responsibilities across work domains. It has consistently been shown to promote self-determination, confidence, and intrinsic motivation. In a recent meta-analytic pathway analysis, Chen et al. (2022b) found that job autonomy significantly enhanced positive challenge appraisal in healthcare workers, especially under high cognitive load. Their findings suggest that autonomy strengthens psychological resilience by heightening perceived control over demanding circumstances.

In under-resourced rural hospitals, job autonomy also permits adaptive resource use. When protocols are lacking or support is minimal, autonomy enables creative problem-solving and prioritization. This sense of control transforms job complexity into a dynamic space for skill expression. As a result, staff are more likely to interpret stressors not as threats, but as opportunities to demonstrate clinical acumen and adaptability (Hu et al., 2017c).

Unlike narrowly defined task discretion, comprehensive autonomy—spanning temporal, procedural, and strategic dimensions—empowers professionals to actively shape their work environment rather than react passively to demands. This aligns with the neurobehavioral evidence from Awada et al. (2024), whose multimodal machine learning analysis demonstrates that cognitive appraisal of stressors directly modulates physiological arousal, mood, and productivity.

Based on Lampreira-Raposo et al.'s (2023) scoping review of emotional intelligence in critical care nursing, autonomy fundamentally enables anticipatory cognitive framing by cultivating core emotional intelligence competencies particularly self-regulation and motivation. This empowerment allows healthcare professionals to proactively deploy preemptive strategies: anticipating demands through pre-shift planning, reframing high-stress scenarios (e.g., acute-care situations) as learning opportunities, and modulating emotional responses before encountering stressors. Such cognitive-behavioral flexibility rooted in emotional intelligence development fostered by autonomy—transcends reactive coping by systematically reinforcing adaptive cognitive schemas that transform future stressors into challenges. Consequently, autonomy not only shapes immediate appraisals but also conditions long-term stress appraisal patterns, demonstrating its dual role in enhancing both real-time resilience and prospective cognitive adaptation in high-pressure clinical environments. Based on this integrated theoretical and empirical foundation, the following hypothesis is proposed:

(13) H4: Job autonomy is positively associated with challenge appraisal.

2.4.4 Cognitive appraisal and work engagement

Cognitive appraisal serves as a central psychological mechanism through which job demands influence work engagement. According to transactional stress theory (Lazarus & Folkman, 1984), individuals continuously evaluate the significance and controllability of work demands, categorizing them as either challenges that promote mastery or hindrances that threaten goal attainment (Ganster & Rosen, 2013). Within the JD-R framework, these appraisals operate as mediators that determine whether job demands activate motivational or impairment processes (Bakker & Demerouti, 2024).

When employees appraise job demands as challenges, they are more likely to experience enhanced work engagement by deriving meaning, competence, and accomplishment from their tasks (Huang & Wu, 2025). Positive appraisals stimulate intrinsic motivation and broaden cognitive-behavioral repertoires, facilitating proactive engagement with complex work demands (Gürbüz et al., 2024). In healthcare contexts, challenge appraisals of complex clinical cases, high responsibility, and time pressure have been linked to elevated work vigor, dedication, and absorption (Wang et al., 2024b).

Conversely, when demands are appraised as hindrances—characterized by perceived threat, uncontrollability, or role conflict—they evoke negative affective responses that undermine engagement and foster emotional exhaustion (Shen et al., 2024b). Hindrance appraisals disrupt goal-oriented behavior by depleting psychological resources, increasing cynicism, and reducing professional efficacy, ultimately diminishing work engagement (Li et al., 2024).

Multiple empirical studies validate these mechanisms. For example, Liu et al. (2024) demonstrated that challenge appraisals significantly predicted higher levels of work engagement, while hindrance appraisals were associated with elevated burnout and reduced engagement among Chinese healthcare professionals. Similarly, recent longitudinal evidence from Wang et al. (2024a) confirmed that cognitive appraisal patterns remained stable predictors of engagement outcomes across repeated measures, emphasizing their critical mediating role within the JD-R model.

These findings further highlight that cognitive appraisal serves not merely as a static evaluation, but as a dynamic interpretive process that continuously shapes healthcare workers' responses to fluctuating job conditions (Yao et al., 2025). As healthcare demands shift in complexity, patient acuity, or organizational expectations, employees engage in ongoing reappraisals of whether emerging challenges remain controllable and meaningful. This iterative evaluation process directly influences motivational activation and determines whether

engagement can be sustained over time despite cumulative demands.

In healthcare contexts characterized by resource scarcity and clinical uncertainty—such as township hospitals—this dynamic appraisal process becomes particularly consequential. When healthcare professionals consistently reinterpret complex demands as opportunities for mastery and professional contribution, they accumulate psychological resources such as self-efficacy and adaptive coping strategies, reinforcing an upward resource spiral that further enhances work engagement (Liebenberg et al., 2022). Conversely, repeated hindrance appraisals may erode resilience, heighten vulnerability to strain, and progressively diminish engagement.

Recent intervention-based studies have demonstrated that cognitive appraisal patterns are modifiable through targeted organizational support and skill-building programs (Fitzgerald et al., 2017). For example, structured resilience training and cognitive reframing workshops have been shown to promote more frequent challenge appraisals among frontline healthcare staff, subsequently improving both engagement and patient care quality (Chen et al., 2024a). These findings suggest that healthcare organizations can actively shape appraisal mechanisms, thereby influencing the sustainability of engagement even under persistent systemic constraints.

Collectively, these emerging insights support the central proposition that cognitive appraisal functions as a dynamic mediator within the JD-R framework, translating both job demands and resources into varying engagement trajectories depending on healthcare workers' evolving perceptions of their work environments.

Challenge appraisal refers to the perception that job demands represent opportunities for growth, achievement, or mastery. It is a key cognitive mechanism that fosters motivation and sustained involvement at work. In healthcare, workers who interpret complex tasks or high workloads as personally meaningful are more likely to report elevated levels of vigor, dedication, and absorption core components of work engagement. In a recent study, Zhang et al. (2025b) found that positive challenge appraisal among frontline nurses was significantly associated with higher work engagement, mediated by enhanced psychological resilience and perceived professional efficacy.

Challenge appraisal facilitates a constructive emotional response to demanding situations, activating approach-oriented coping and self-regulatory behaviors. This reappraisal transforms task stress into motivational energy, particularly critical in high-pressure contexts such as rural or primary healthcare. As a result, individuals maintain commitment and cognitive flexibility even under sustained load (VonRosenberg, 2019). Based on this theoretical reasoning and empirical support, the following hypothesis is proposed:

(14) H5: Challenge appraisal is positively associated with work engagement.

In contrast, hindrance appraisal involves viewing job demands as obstacles to goal achievement, often accompanied by frustration, uncertainty, or helplessness. This appraisal process depletes emotional resources and fosters disengagement. According to a cross-sectional analysis by Zhang et al. (2024c), Chinese hospital workers who frequently appraised tasks as hindrances such as bureaucratic red tape or interpersonal conflict reported significantly lower levels of work engagement, along with higher intentions to quit and greater emotional fatigue.

Hindrance appraisal activates avoidance responses and narrows cognitive scope, reducing psychological investment in work. Especially in township hospitals where structural constraints are common, repeated hindrance interpretation can erode staff morale and limit motivation. This undermines organizational resilience and service quality over time (Ma et al., 2018).

Hindrance appraisal initiates a cascade of maladaptive responses that critically undermine nurses' work engagement, as evidenced by Poku et al.'s (2025) mediation analysis of 1240 nurses. This study reveals that hindrance appraisal directly depletes core components of engagement particularly vigor (physical/mental energy) and dedication (sense of significance) while simultaneously triggering emotional withdrawal and ruminative thinking. Critically, the research demonstrates sequential erosion effect frequent hindrance appraisals predict reductions in engagement, which in turn mediate increased turnover intentions. This pathway operates independently of workplace resources, confirming that hindrance perceptions actively dismantle motivational reserves rather than merely reflecting resource deficiencies.

Healthcare workers' professional identity coherence the alignment between self-concept and occupational roles is increasingly eroded by chronic workplace stressors through dual neurocognitive and psychosocial pathways. Hao and Zhang (2024) indicated that job burnout (particularly emotional exhaustion and cynicism) mediate the relationship between Hindrance demands (e.g., procedural ambiguity) and diminished professional identity, with self-esteem acting as a critical buffer in this pathway. These findings collectively suggest that hindrance appraisals not only deplete emotional resources but also disrupt the reward-processing mechanisms essential for sustaining professional self-concept, ultimately fragmenting role internalization in high-demand settings such as healthcare. Based on this theoretical reasoning and empirical support, the following hypothesis is proposed:

(15) H6: Hindrance appraisal is negatively associated with work engagement.

2.4.5 Mediation of cognitive appraisal

Cognitive appraisal operates as a central mediating mechanism that transmits the effects of job demands and job resources onto work engagement. According to transactional stress theory,

employees continuously evaluate the meaning and controllability of job demands, and these evaluations fundamentally determine their subsequent motivational or strain-related outcomes (Zhou & Zheng, 2022). The JD-R model integrates this appraisal process by positing that job demands do not directly affect engagement but exert their influence through how individuals cognitively interpret them (Bakker & Demerouti, 2024).

When challenge demands such as workload, time pressure, task complexity, and responsibility are appraised positively, they activate motivational states characterized by intrinsic motivation, task significance, and professional fulfillment, thereby enhancing work engagement (Huang & Wu, 2025). Conversely, when Hindrance demands such as administrative hassles, role ambiguity, and interpersonal conflicts are perceived as obstacles, they provoke emotional exhaustion, cynicism, and disengagement (Bao et al., 2024).

Job resources such as decision authority, task discretion, and job autonomy further influence how job demands are cognitively framed. Higher levels of job control promote positive appraisals by enhancing employees' sense of competence and environmental mastery, which buffer the potential adverse effects of job demands (Yang et al., 2025). When healthcare workers perceive sufficient autonomy and decision-making capacity, they are more likely to view high demands as professional challenges rather than debilitating threats, facilitating engagement even in resource-constrained settings (Baig et al., 2022).

Empirical research supports these pathways. In a longitudinal study among Chinese healthcare workers, Baig et al. (2022) found that cognitive appraisal fully mediated the relationships between job demands, job resources, and work engagement across multiple time points. Similarly, recent findings by Fernandez De Henestrosa et al. (2023a) demonstrated that challenge appraisal mediated the positive effects of both job control and autonomy on engagement, while hindrance appraisal mediated the detrimental effects of Hindrance demands on disengagement and burnout.

This mediating role of cognitive appraisal underscores its central position in translating the broader work environment into individual motivational outcomes. Rather than acting as a passive response to external stressors, appraisal functions as an active psychological mechanism that shapes employee' subjective experiences of job demand (Ganster et al., 2018). As healthcare workers repeatedly confront fluctuating workloads, emotional labor, and complex clinical responsibilities, their appraisal processes determine whether such demands are framed as opportunities for growth or perceived as uncontrollable burdens, thereby guiding their subsequent affective and behavioral engagement trajectories.

Recent cross-lagged panel studies have provided further empirical support for this

mediating role. For instance, Wu et al. (2024) demonstrated that cognitive appraisal fully mediated the longitudinal relationship between task complexity and work engagement among primary healthcare providers, even after controlling for baseline psychological capital. Similarly, Lin et al. (2025) reported that challenge and hindrance appraisals jointly explained the indirect effects of role ambiguity and resource inadequacy on engagement and turnover intentions in township hospital staff. These findings suggest that the mediating capacity of cognitive appraisal operates across both positive and negative job demand pathways, reflecting its dual-directional influence within the extended JD-R framework.

Moreover, recent meta-analytic evidence suggests that cognitive appraisal may partially account for the variance previously attributed solely to job demands and job resources, indicating its unique contribution to explaining within-person fluctuations in engagement (Mazzetti et al., 2023). This highlights the necessity of integrating appraisal processes explicitly into JD-R models to capture the dynamic and individualized nature of occupational stress and motivation, particularly in high-demand healthcare contexts where external conditions remain difficult to modify.

Taken together, these findings provide robust empirical and theoretical justification for modeling cognitive appraisal as a dynamic psychological filter that explains how both challenge and hindrance demand influence healthcare workers' engagement. By actively interpreting job demands in light of available resources and personal capacities, healthcare professionals transform objectively similar work conditions into divergent motivational outcomes, thereby positioning cognitive appraisal as a pivotal mediating mechanism in the present study.

Challenge appraisal plays a central role in translating positive work characteristics such as challenge demands, job control, and autonomy into enhanced work engagement. Rather than affecting engagement directly, these variables often influence how workers interpret job demands, which in turn shapes emotional and behavioral responses. As demonstrated by (Xu et al. (2020a), challenge appraisal significantly mediated the relationship between professional autonomy and engagement among Chinese frontline health staff, suggesting that cognitive processes are critical pathways for motivational activation.

Similarly, resource-rich environments (e.g., with decision authority and discretion) are not inherently motivating unless they are cognitively evaluated as opportunities for development. Zhang et al. (2014) found that in township hospitals, job control only enhanced engagement when accompanied by high levels of challenge appraisal, confirming its mediating function. Based on these theoretical foundations and empirical findings, the following hypothesis is proposed:

(16) H7: Challenge appraisal mediates the relationships between challenge demands, job control, job autonomy, and work engagement.

In contrast, hindrance appraisal mediates the negative effects of work conditions — particularly Hindrance demands on engagement outcomes. When workers view demands as unnecessary, obstructive, or beyond their control, these perceptions drain psychological resources and reduce motivational involvement. Horan et al. (2020) confirmed that hindrance appraisal fully mediated the effects of role conflict and resource inadequacy on burnout and disengagement among township healthcare providers. Furthermore, Li et al. (2024) identified that even under similar structural stress, workers with lower hindrance appraisal maintained better engagement highlighting its psychological mediating function. This supports the JD-R theory's extension into rural healthcare, emphasizing appraisal as a cognitive filter through which job demands are emotionally processed and operationalized.

The mediating function of hindrance appraisal in high-acuity healthcare settings is critically modulated by cognitive framing mechanisms that transform structural stressors into behavioral outcomes. Berdida and Alhudaib (2025) established this pathway in their Philippine emergency nursing study, where professional self-efficacy operationalized as the cognitive reframing capacity against hindrance appraisal fully mediated the impact of administrative burdens on clinical disengagement. Crucially, their structural equation modeling demonstrated that without such negative appraisal, organizational stressors failed to predict missed care behaviors, confirming subjective interpretation's primacy over objective conditions. Complementing this finding, Shi et al. (2024) documented in resource-limited Chinese hospitals that fluctuations in hindrance appraisal directly aligned with work engagement changes, independent of actual demand variations a relationship moderated by emergency response training that actively reconstructed threat appraisals into challenge frames. These results collectively validate hindrance appraisal as the decisive psychological mechanism converting stressor exposure into motivational withdrawal, fulfilling its role as a full mediator within the Job Demands-Resources framework. Based on these theoretical foundations and empirical findings, the following hypothesis is proposed:

(17) H8: Hindrance appraisal mediates the relationship between Hindrance demands and work engagement.

2.4.6 Social support as a moderator

Social support is a fundamental psychosocial resource widely recognized in occupational health

literature for its buffering effect on stress and its role in sustaining well-being and motivation. Originating from House's social support theory, it encompasses instrumental, informational, and emotional assistance derived from interpersonal relationships in the workplace and broader community contexts (Bakker & Demerouti, 2007). Within the JD-R framework, social support functions as a critical job resource that not only mitigates the adverse effects of excessive job demands but also fosters positive cognitive appraisal processes and enhances work engagement (Xanthopoulou et al., 2007).

Social support is also widely recognized as a pivotal contextual factor that dynamically interacts with employees' cognitive appraisal processes to shape work engagement outcomes. Although social support is conceptually classified as a job resource within the JD-R framework, this study treats it as a distinct relational resource due to its specific role as a moderator in the stress engagement process. As an emotional stabilizer, social support mitigates the psychological burden of high job demands, enabling employees to maintain affective equilibrium in stressful conditions (Martin-Brufau et al., 2020). Furthermore, it functions as an informational facilitator by enhancing cognitive reframing of ambiguous or complex tasks, thereby supporting adaptive appraisal processes (Helass et al., 2025).

Recent studies in rural Chinese healthcare settings have highlighted the salience of social support in environments characterized by chronic resource scarcity and high workload variability. Support from colleagues and supervisors has been shown to moderate the relationship between job stressors and burnout, while community level trust and solidarity can strengthen the sense of professional purpose among township healthcare workers (Zhou & Zheng, 2022). This multidimensional view underscores the importance of capturing both formal organizational support and informal interpersonal networks in understanding workers' resilience and adaptive coping.

In the context of challenge appraisal, employees receiving adequate emotional and instrumental support from supervisors, coworkers, or the community are better equipped to view demanding job situations as professional growth opportunities rather than threats (Mockałło & Widerszal-Bazyl, 2021). Supervisor encouragement, feedback, and peer collaboration strengthen healthcare workers perceived competence and reinforce their confidence to handle task complexity, responsibility, and time pressure, ultimately amplifying engagement responses (Erum et al., 2021). This positive reinforcement facilitates employees' intrinsic motivation and heightens work engagement through enhanced vigor, dedication, and absorption (Bakker & Demerouti, 2024).

Simultaneously, social support moderates the detrimental influence of hindrance appraisal

by mitigating psychological distress and emotional exhaustion triggered by excessive administrative hassles, role conflict, or interpersonal tensions (Jimenez & Dunkl, 2017). Supportive work environments foster effective emotion regulation and promote adaptive cognitive reframing, reducing feelings of helplessness associated with hindrance appraisals (Pohl et al., 2023). By facilitating stress recovery processes and lowering cumulative emotional strain, social support helps preserve employees' long-term engagement even under persistent job-related adversities (Xu et al., 2024).

Bakker et al. (2023) supported that social support moderates the effects of cognitive appraisal on work engagement. Specifically, when healthcare workers receive high levels of social support, they are more likely to interpret challenge demands positively, which enhances engagement (Xanthopoulou et al., 2007). At the same time, social support reduces the negative impact of hindrance appraisals on engagement by lowering emotional exhaustion and psychological strain (van Woerkom et al., 2016). Longitudinal studies further demonstrate that these moderating effects remain stable over time, maintaining engagement even under prolonged high job demands (Simbula et al., 2011). In healthcare contexts, such as township hospitals, supervisor and peer support are particularly effective in sustaining engagement despite both challenge and Hindrance demands (van der Heijden et al., 2019).

Recent empirical research further substantiates the moderating role of social support by demonstrating its buffering effects across diverse occupational stressors encountered in healthcare environments. For instance, Ludwick et al. (2018) found that high levels of supervisor support attenuated the negative association between role ambiguity and work engagement among rural healthcare context, thereby preserving motivational resources under conditions of organizational uncertainty. Similarly, peer support has been shown to moderate the adverse effects of workload and emotional demands by enhancing collective problem-solving and emotional regulation capacities within care teams (Liu et al., 2024).

Importantly, social support also amplifies the positive motivational potential of challenge appraisals. When healthcare workers perceive strong collegial and supervisory support, they are more likely to interpret complex clinical tasks and high patient volumes as manageable and professionally rewarding, thereby intensifying the positive link between challenge demands and engagement (Deng et al., 2021). This dual-functioning moderating effect underscores that social support not only buffers the detrimental impact of Hindrance demands but also strengthens the engagement-fostering potential of challenge demands.

Moreover, recent longitudinal evidence suggests that sustained social support contributes to the stability of cognitive appraisal patterns over time, allowing healthcare workers to

maintain adaptive engagement trajectories even when organizational demands fluctuate (Li et al., 2024). In resource-constrained settings such as township hospitals, where formal institutional support structures may be limited, the informal yet enduring nature of peer networks and supervisory relationships becomes particularly critical for maintaining workforce resilience.

Within the JD-R framework, social support is theorized as a key contextual resource that can buffer the detrimental effects of job demands while enhancing motivational pathways to work engagement (Bakker & Demerouti, 2017). In this study, social support is measured using the Social Support Rating Scale (SSRS) developed by Xiao (1994), a well-validated instrument extensively used in Chinese healthcare settings. The SSRS comprises ten items capturing three major dimensions of support: objective support (e.g., availability of tangible help), subjective support (e.g., perceived emotional closeness and respect), and support-seeking behavior (e.g., willingness to seek help when under stress) (Luo et al., 2021).

Although the SSRS is inherently multidimensional in design, the current study aggregates item responses to generate a composite overall social support score. This approach follows established practices in occupational health research, particularly in studies where the emphasis lies on perceived total support rather than the discrete effects of each subdomain (Chen et al., 2022a). Accordingly, the study does not analyze the subdimensions independently but instead treats social support as a unified construct that reflects the cumulative presence of emotional, informational, and instrumental resources in the respondent's social environment.

Items in the SSRS span a wide range of sources including family (e.g., spousal and parental support), colleagues (e.g., workplace concern), neighbors, and institutional structures (e.g., trade unions, youth organizations) as well as behavioral indicators of help-seeking and participation in collective activities. For example, one item assesses how frequently individuals attend community organizations, while others assess sources of both economic and emotional assistance. This diversity of sources ensures that the instrument captures the multifaceted and socially embedded nature of support available to township healthcare workers operating under significant institutional constraints.

Several recent studies confirm the functional importance of global perceived social support in rural healthcare settings. For instance, Jiang et al. (2022) found that aggregated support levels regardless of specific subdomains significantly buffered the effect of workload on emotional exhaustion among township hospital nurses. Similarly, Li et al (2023b) observed that high total support predicted better emotional regulation and sustained work engagement, even in the face of administrative overload. These findings justify the decision to focus on an overall support

score, particularly given the operational goal of capturing the practical totality of relational resources available to frontline healthcare workers in township settings.

Collectively, these findings position social support as a central contextual resource that dynamically interacts with both job demands and cognitive appraisal processes, thereby shaping healthcare workers' capacity to remain engaged under complex and evolving work conditions.

Social support serves not only as a buffer against stress but also as a catalyst that strengthens the motivational force of positive appraisal. When healthcare workers perceive strong emotional and instrumental support from colleagues or supervisors, they are more likely to interpret complex demands such as high patient volumes or intricate clinical procedures as manageable and meaningful (Yang & Wu, 2021). This supportive environment enhances self-efficacy and reinforces the perception of competence, thereby transforming cognitive challenge appraisal into heightened work engagement.

Recent evidence by Bai and Bai (2024) confirms that social support significantly enhances the positive effect of challenge appraisal on engagement among frontline rural nurses. The study found that under conditions of high social support, the relationship between challenge appraisal and engagement was nearly twice as strong as in low-support conditions, suggesting that social reinforcement amplifies the motivational energy derived from challenge perceptions. Based on these integrated theoretical mechanisms and empirical observations, the following hypothesis is proposed:

(18) H9: Social support positively moderates the relationship between challenge appraisal and work engagement.

In contrast, social support also plays a protective role in mitigating the harmful effects of hindrance appraisal on work engagement. When workers perceive job demands as obstructive such as dealing with role conflict, administrative burdens, or interpersonal tensions those with stronger social support networks are better equipped to regulate emotional responses and maintain psychological stability. This buffering effect prevents the downward spiral from negative appraisal to disengagement (Sexton et al., 2022).

Empirical data from Malik et al. (2024) illustrate that social support significantly weakens the negative association between hindrance appraisal and engagement in rural hospital contexts. Specifically, emotional and informational support helped reduce emotional exhaustion and preserved work enthusiasm, even among staff who appraised their work environment as highly obstructive. This moderation function is particularly critical in township hospitals, where formal organizational support structures are often limited, making interpersonal relationships and collegial support essential for sustaining engagement and psychological well-being over

time.

Beyond emotional regulation, social support also facilitates a shift in cognitive framing, enabling healthcare workers to reinterpret obstructive demands not as fixed threats but as negotiable challenges. The intervention study of Tomooka et al. (2024) showed that structured peer support can enhance clinical workers' ability to reappraise administrative stressors, enabling them to transform procedural obstacles into manageable challenges, thereby significantly reducing the risk of professional alienation. This finding echoes the conclusion of the research of Dinh and Bonner (2023), social support effectively interrupts the causal chain of obstruction evaluation work fatigue by improving self-efficacy, and its role is particularly critical during the policy driven change period. This cognitive adjustment process can be interpreted through the dual lens of emotional buffering and adaptive reappraisal, grounded in the conservation of resources theory. Social support functions not only as an emotional stabilizer dampening the stress-induced hyperactivation caused by obstructive workplace conditions but also as a psychological catalyst that enhances reappraisal flexibility. As Chen et al. (2024b) demonstrated in their large-scale path analysis of Chinese township healthcare workers, higher perceived social support was significantly associated with lower burnout across emotional, depersonalization, and reduced accomplishment dimensions. More critically, this effect was mediated by increased psychological capital, including optimism and resilience, which enabled workers to cognitively reconstruct stressors as less personally threatening and more professionally navigable. In rural hospital environments often marked by weak formal infrastructure and heavy procedural load such interpersonal resources form a critical psychological buffer. They anchor individual meaning and emotional coherence, allowing staff to reinterpret bureaucratic rigidity as manageable rather than corrosive, and to maintain work engagement despite chronic demands. Based on these integrated theoretical mechanisms and empirical observations, the following hypothesis is proposed:

(19) H10: Social support moderates the negative relationship between hindrance appraisal and work engagement.

By systematically incorporating job characteristics, cognitive appraisal processes, and contextual organizational factors, this integrated framework establishes a comprehensive theoretical foundation for understanding work engagement among township healthcare professionals operating in resource-limited settings. To clearly outline the logical derivation of these relationships, all hypotheses developed in this study encompassing both main and sub-hypotheses—are systematically summarized in table 2.1.

Table 2.1 Research hypotheses overview

Main Hypothesis	Main Hypothesis Content	Sub Hypothesis	Sub Hypothesis Content
H1	Challenge demands are positively associated with challenge appraisal.	H1a	Workload is positively associated with challenge appraisal.
		H1b	Time pressure is positively associated with challenge appraisal.
		H1c	Task complexity is positively associated with challenge appraisal.
		H1d	Responsibility is positively associated with challenge appraisal.
H2	Hindrance demands are positively associated with hindrance appraisal.	H2a	Administrative hassles are positively associated with hindrance appraisal.
		H2b	Role conflict is positively associated with hindrance appraisal.
		H2c	Role ambiguity is positively associated with hindrance appraisal.
		H2d	Resource inadequacy is positively associated with hindrance appraisal.
		H2e	Interpersonal conflict is positively associated with hindrance appraisal.
		H2f	Organizational politics are positively associated with hindrance appraisal.
H3	Job control is positively associated with challenge appraisal.	H3a	Decision authority is positively associated with challenge appraisal.
		H3b	Task discretion is positively associated with challenge appraisal.
H4	Job autonomy is positively associated with challenge appraisal.	—	—
H5	Challenge appraisal is positively associated with work engagement.		
H6	: Hindrance appraisal is negatively associated with work engagement.		
H7	Challenge appraisal mediates the relationships between challenge demands, job control, job autonomy, and work engagement.		

H8	Hindrance appraisal mediates the relationship between Hindrance demands and work engagement.
H9	Social support positively moderates the relationship between challenge appraisal and work engagement.
H10	Social support moderates the negative relationship between hindrance appraisal and work engagement.

2.5 Conceptual model

Drawing upon the JD-R model, this study develops an integrated conceptual framework to systematically examine the mechanisms underlying work engagement among township hospital healthcare workers in Guangxi. The model comprises five core components.

First, job demands are categorized into two distinct dimensions: challenge demands (including workload, time pressure, task complexity, and responsibility) and Hindrance demands (including administrative hassles, role conflict, role ambiguity, resource inadequacy, interpersonal conflict, and organizational politics). This distinction captures the differential cognitive appraisals triggered by varying types of work stressors.

Second, job resources consist of job control (decision authority and task discretion) and job autonomy, which are hypothesized to facilitate positive appraisals of challenge demands.

Third, cognitive appraisal serves as a central mediating mechanism. Challenge appraisal is expected to stimulate work engagement, whereas hindrance appraisal is likely to evoke strain responses and diminish engagement levels.

Fourth, social support is incorporated as a moderating variable. It is proposed to amplify the positive effects of challenge appraisals on engagement while buffering the negative effects of hindrance appraisals, thereby enhancing employees' coping capacity and resilience.

Finally, work engagement, the outcome variable, is conceptualized as a multidimensional construct encompassing vigor, dedication, and absorption, capturing the active and positive work states of healthcare professionals.

This overview serves as a bridge between the theoretical foundations and the empirical analysis by explicitly mapping the expected linkages among challenge demands, hindrance demands, job resources, cognitive appraisal, social support, and work engagement. Presenting these hypotheses in tabular form not only enhances conceptual clarity but also provides a structured reference for subsequent statistical testing and interpretation. Such a model not only deepens our insight into the mechanisms underpinning workforce stability and psychological

resilience but also provides empirical guidance for future interventions. Based on this synthesis, the conceptual model of this study is presented in Figure 2.1.

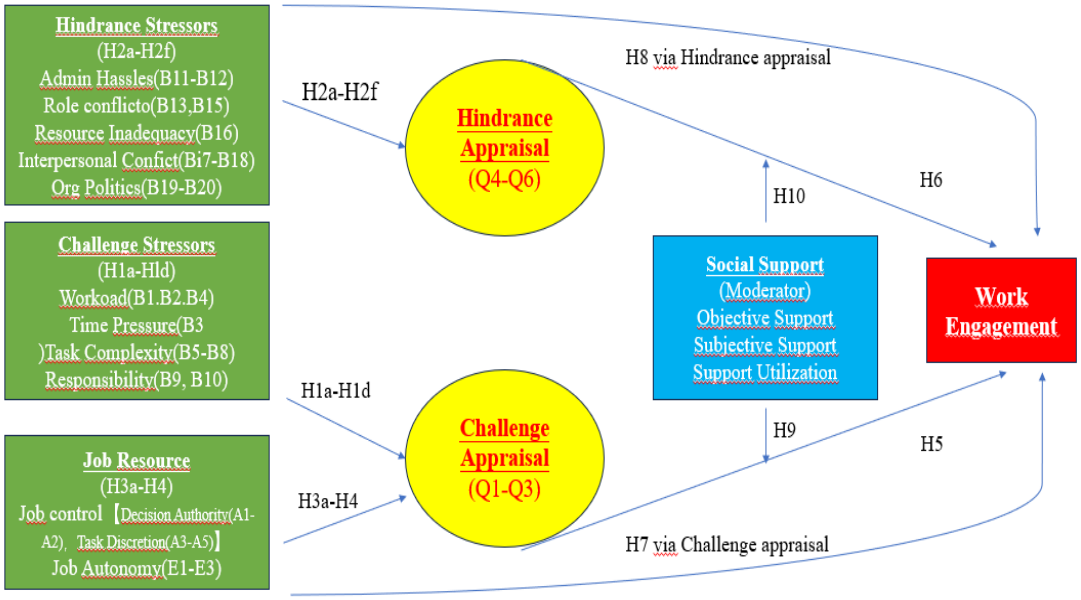

Figure 2.1 Conceptual model

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Chapter3: Methodology

3.1 Research design

This study employed a cross-sectional quantitative research design to investigate the underlying mechanisms influencing work engagement among healthcare professionals working in township hospitals in Guangxi, China. The research was grounded in the JD-R theoretical framework, which has been widely validated for explaining employee well-being and work engagement across diverse occupational contexts.

Drawing upon recent extensions of the JD-R model, this study integrates both cognitive appraisal theory and social support perspectives to explore how township healthcare workers perceive, interpret, and cope with varying job demands and resources within resource-constrained rural healthcare environments. In this model, job demands are categorized into challenge demands (e.g., workload, time pressure, task complexity, responsibility) and Hindrance demands (e.g., administrative hassles, role conflict, resource inadequacy), while job resources include both job control (decision authority, task discretion) and job autonomy. Cognitive appraisal (challenge appraisal vs. hindrance appraisal) is treated as a key mediating psychological mechanism, while social support is hypothesized as a moderator that buffers or amplifies the effects of cognitive appraisal on work engagement.

Given that township hospitals in Guangxi face unique systemic reforms (e.g., county-level medical alliances, county manages township policies), increasing administrative responsibilities, and complex clinical-public health dual roles, they offer a highly relevant empirical setting to test these theoretical mechanisms in practice.

Data were collected via a structured self-administered questionnaire composed of multiple validated measurement instruments. The hypothesized relationships were examined using structural equation modeling (SEM), which allows for simultaneous estimation of complex mediation and moderation effects within the integrated research model. SPSS27.0 was used to analyze the demographic characteristics of the survey samples and descriptive statistics of the scores of each scale dimension. Hierarchical regression was used for mediation and moderation analysis. AMOS24.0 was used to analyze the model assumptions.

3.2 Data source and sampling strategy

The study data were obtained from township hospitals across three counties Liucheng, Rongshui, and Sanjiang in Liuzhou City, Guangxi Zhuang Autonomous Region, China. These counties were deliberately selected to ensure that the sampled hospitals adequately represent the diversity of rural healthcare environments in southwestern China. In these regions, township hospitals serve as the primary providers of clinical and preventive healthcare services, often operating under resource-constrained conditions.

To enhance sample representativeness while ensuring feasibility in field data collection, we employed a cluster randomized sampling strategy. Specifically, within each selected county, we randomly sampled several township hospitals from a comprehensive list of existing township-level healthcare institutions. In total, 19 township hospitals across the three counties were included in the study. At each selected hospital, all eligible healthcare professionals were invited to participate, including physicians, nurses, public health workers, medical technicians, pharmacists, and administrative healthcare staff directly involved in patient care, public health management, or healthcare service delivery. The inclusion criteria for participants were as follows: (1) holding a professional healthcare position at the current institution for at least six months; (2) active engagement in clinical or public health service provision; and (3) voluntary consent to participate in the study.

During structured on-site visits conducted between September and October in 2024, a total of 628 questionnaires were distributed. After rigorous data screening including the removal of incomplete or logically inconsistent responses 495 valid questionnaires were retained for final analysis, yielding a response rate of 78.8%. The proportion of missing data in the final dataset was minimal (<2%).

This multistage sampling approach ensures that the dataset captures institutional diversity and the heterogeneity of healthcare workers' roles within China's township healthcare system, thereby enhancing the external validity and generalizability of the findings to similar rural healthcare settings.

3.3 Sample

As shown in table 3.1, building on the study's aim to investigate work engagement mechanisms within the unique context of rural township hospitals in Guangxi, the sample was drawn from 19 institutions located in three ethnic minority counties of Liuzhou. These hospitals collectively

employed 628 healthcare workers, among whom 495 provided valid responses, yielding a response rate of 78.8%. Staff sizes varied considerably, ranging from 15 to 109 employees, reflecting heterogeneity in organizational capacity typical of China's primary healthcare system.

The demographic and occupational profile of respondents highlights several distinctive features pertinent to the study's objectives. Female workers predominated (73.5%), and the workforce was predominantly young, with 80.8% aged 20 – 39 years. Professionally, nurses constituted 48.5% of the sample, doctors 45.8%, and public health physicians 5.7%. Nearly half of the participants (44.7%) had less than five years of tenure, indicating an early-career-dominated workforce. Linguistically, Mandarin was the primary working language for 78.8% of respondents, while 21.2% reported limited use of local dialects during community interactions.

This sample composition reflects the realities of rural primary healthcare in Guangxi: a youthful, female-majority clinical workforce with emerging but limited public health representation. These characteristics are crucial for interpreting subsequent analyses, as they illuminate both the adaptive capacity and structural vulnerabilities of township hospital personnel factors central to understanding the applicability of the JD-R model and informing targeted workforce strategies in similar underserved settings.

Table 3.1 Demographic statistics summary

Category	Variable	n (%)
Institutional Overview	Total hospitals surveyed	19
	Total healthcare workers in hospitals	628
	Valid respondents	495 (78.8%)
	Hospital size range (staff count)	15–109
Gender	Female	364 (73.54%)
	Male	131 (26.46%)
Age	20–29 years	200 (40.40%)
	30–39 years	200 (40.40%)
	40–49 years	65 (13.13%)
	≥50 years	30 (6.06%)
Professional Roles	Doctors	227 (45.84%)
	Nurses	240 (48.48%)
	Public health physicians	28 (5.66%)
Tenure in Current Hospital	< 5 years	221 (44.65%)
	≥ 5 years	274 (55.35%)

3.4 Measures

In line with the conceptual model developed in this study, we used multiple standardized and psychometrically validated instruments to operationalize the key concepts of job demands, job resources, cognitive appraisals, social support, and work engagement. Each instrument was selected based on its theoretical consistency with the JD-R framework and its demonstrated empirical validity in previous research in the fields of healthcare and organizational psychology.

To ensure measurement consistency, all items were measured using a unified 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to allow for standardized comparisons across concepts while minimizing respondent burden. The use of a common scale format further facilitated the construction of structural equation models (SEM) by maintaining metric equivalence between latent concepts.

Each variable in this study was measured as a multidimensional concept, reflecting the complexity of occupational experiences in healthcare settings. Specifically, job demands were subdivided into challenging and hindering stressors to capture their different psychological impacts; job resources covered both structural factors (job control and autonomy) and interpersonal factors (social support). Cognitive appraisals are positioned as the core mediating mechanism that transforms external job characteristics into internal motivation or stress responses. Work engagement, as the final outcome variable, is conceptualized through its established triple structure of vitality, dedication, and focus.

The first scale used was the job demands and job control scale. The measurement of job demands and job control in this study was operationalized using the scale developed by Gonzalez Mulé and Cockburn (2017). The job demands dimension includes nine items that evaluate aspects such as workload intensity, time pressure, concentration requirements, and conflicting demands, thus capturing both quantitative and qualitative features of healthcare work demands in township hospital settings. Job control was assessed through six items measuring decision authority and task discretion, reflecting healthcare professionals' ability to influence their clinical workflows, prioritize tasks, and exercise autonomy in patient care decisions. Prior validation studies demonstrated satisfactory internal consistency for both subscales, with Cronbach's alpha typically exceeding 0.80 for job control and ranging between 0.75–0.85 for job demands. These psychometric properties support the scale's applicability in high-demand occupational environments, such as rural healthcare contexts.

The second scale used was challenge and hindrance stressor scale and cognitive appraisal scale. Challenge and Hindrance demands, as well as cognitive appraisal, were measured using

instruments developed by Cavanaugh et al. (2000), which are widely embedded within the extended JD-R framework. The challenge demands subscale includes ten items covering workload, time pressure, task complexity, and responsibility, while the hindrance stressor subscale includes ten items addressing administrative hassles, role conflict, role ambiguity, resource inadequacy, interpersonal conflict, and organizational politics. The cognitive appraisal component further distinguishes whether job demands are perceived as challenges (three items) or hindrances (three items). These scales have demonstrated high construct validity and cross-cultural robustness in numerous organizational and healthcare studies, with reported Cronbach's alpha coefficients typically exceeding 0.85 for both challenge and Hindrance demands and above 0.80 for appraisal dimensions. The multidimensional structure allows for precise assessment of how healthcare staff cognitively frame occupational stressors in rural township hospital settings.

The third scale used was social support rating scale. Social support was assessed using the Chinese version of the scale, originally developed by Xiao (1994) and later adapted by (Xiao et al. (2017) to fit the healthcare context. This scale comprehensively evaluates both perceived and received social support across family, peer, organizational, and community sources. It includes ten items measuring three core dimensions: objective support, subjective support, and utilization of support. The SSRS has been extensively applied and validated in Chinese healthcare populations, demonstrating high internal consistency (Cronbach's alpha between 0.82 and 0.91) and strong construct validity. Its cultural appropriateness and widespread use in Chinese public health research make it particularly suitable for assessing the buffering effects of social support in township healthcare environments characterized by resource constraints and strong interpersonal networks.

The fourth scale used was job autonomy scale. Job autonomy was measured using the 3-item scale developed by Flatten et al. (2011). The scale captures healthcare professionals' perceived freedom in determining how work tasks are executed, the opportunity for personal judgment and creativity in clinical decision-making, and the ability to independently structure one's workflow. Previous studies have confirmed the scale's excellent internal reliability (Cronbach's alpha ranging from 0.83 to 0.89) and factorial validity across various occupational contexts, including Chinese healthcare. This concise instrument effectively reflects the adaptive autonomy necessary for healthcare staff managing diverse patient needs and unpredictable clinical demands in township hospitals.

The last scale used was Utrecht work engagement scale (UWES-17). Work engagement was assessed using the full 17-item Utrecht Work Engagement Scale (UWES-17) developed by

Schaufeli et al. (2002), which measures vigor (6 items), dedication (5 items), and absorption (6 items). The UWES-17 has been extensively validated across international healthcare populations, including Chinese medical personnel, and exhibits superior psychometric properties with Cronbach's alpha typically exceeding 0.90 for the overall scale and remaining above 0.85 for each subdimension. The UWES-17's cross-cultural applicability and robust factor structure ensure its suitability for assessing positive motivational states among healthcare workers in high-pressure, resource-limited township hospital contexts.

The following sections describe in detail the instruments used to measure each construct, including their theoretical basis, dimensional structure, number of items, and sample content.

3.4.1 Job demands

3.4.1.1 Challenge demands

Challenge demands were defined as those job demands that employees perceive as opportunities to develop skills, demonstrate competence, and achieve meaningful work goals. Consistent with previous applications of the JD-R framework in healthcare contexts, challenge demands were measured through ten items distributed across four key domains:

Workload (3 items: B1, B2, B4): This dimension assessed the volume and intensity of work responsibilities, including patient load, administrative duties, and clinical documentation requirements. In township hospitals where staffing is often limited, high workloads present both operational pressures and potential avenues for skill enhancement through repeated practice and experience accumulation.

Time Pressure (1 item: B3): This item evaluated the urgency of task completion and the presence of stringent deadlines commonly encountered in patient care, emergency interventions, and time-sensitive decision-making. In fast-paced clinical environments, time pressure may heighten cognitive arousal and task focus, contributing to perceived professional competence when successfully managed.

Task Complexity (4 items: B5, B6, B7, B8): Task complexity captured the cognitive and analytical demands associated with diagnostic uncertainty, multi-step clinical reasoning, treatment planning, and managing comorbid conditions. In township healthcare settings, limited specialist access often requires frontline practitioners to engage in complex clinical problem-solving that challenges their professional expertise.

Responsibility (2 items: B9, B10): This domain assessed the extent of personal accountability for patient outcomes, organizational operations, and adherence to clinical

standards. In rural hospitals, where individual healthcare providers frequently assume multiple roles, heightened responsibility may enhance professional identity and intrinsic motivation.

Collectively, these dimensions reflect the cognitive, emotional, and ethical demands that characterize frontline healthcare work in resource-constrained township hospital environments. The inclusion of challenge demands aligns with the JD-R model's motivational pathway, wherein such demands—when adequately supported by job and personal resources—are theorized to promote vigor, dedication, and sustained work engagement.

3.4.1.2 Hindrance demands

In this study, hindrance demands were comprehensively measured across six domains using ten items, capturing the multidimensional barriers healthcare professionals face in rural Chinese township hospitals: role conflict, role ambiguity, organizational politics, interpersonal conflict, resource inadequacy, and administrative hassles. This operationalization reflects both the original theoretical framework and recent empirical refinements, ensuring conceptual fidelity and cultural relevance to China's township healthcare context.

Administrative Hassles (2 items: B11, B12): This dimension assessed the burden of bureaucratic procedures, redundant documentation, and compliance requirements mandated by health authorities and regulatory agencies. In resource-limited township hospitals, excessive administrative workload often diverts valuable time away from direct patient care, contributing to frustration and emotional fatigue.

Role Conflict (2 items: B13, B15): These items measured the experience of incompatible job expectations, such as simultaneously fulfilling clinical, public health, and administrative roles, which are often assigned without adequate structural support or role clarification. Role conflict is a pervasive source of cognitive dissonance and professional strain in multi-functional township healthcare institutions.

Role Ambiguity (1 item: B14): This item assessed the clarity of job responsibilities, expectations, and performance criteria. In decentralized healthcare systems, ambiguities regarding clinical authority, referral pathways, and public health mandates often create psychological uncertainty, impairing effective task execution.

Resource Inadequacy (1 item: B16): This dimension measured perceptions of insufficient staffing, medical equipment, medication supplies, and financial resources necessary for adequate healthcare delivery. Chronic resource deficits are an endemic feature of rural healthcare in China, frequently exacerbating provider frustration and ethical distress.

Interpersonal Conflict (2 items: B17, B18): These items evaluated relational tensions,

disagreements, and conflicts among coworkers, supervisors, and administrative staff. Interpersonal conflict undermines team cohesion, communication, and collaborative care, particularly in smaller healthcare organizations where professional interactions are frequent and highly interdependent.

Organizational Politics (2 items: B19, B20): This domain captured perceptions of favoritism, informal power structures, and politically motivated decision-making within the hospital. Organizational politics erode perceptions of fairness, procedural justice, and meritocracy, thereby diminishing intrinsic work motivation.

The multidimensional structure of Hindrance demands reflects the unique organizational, interpersonal, and systemic barriers embedded in township healthcare delivery. The inclusion of these variables allows for a comprehensive assessment of the factors that impede psychological well-being and engagement, consistent with the health impairment mechanism posited by the JD-R model. Moreover, it provides critical insights into the specific structural reforms required to improve the sustainability of the rural healthcare workforce.

3.4.2 Job resources

In this study, job resources were operationalized through two key dimensions: job control and job autonomy, reflecting both formal authority and perceived freedom in work execution.

3.4.2.1 3.4.2.1 Job control

In this study, job control was measured using five items, encompassing two complementary dimensions that capture its structural and psychological complexity: decision authority and task discretion. This operationalization is based on the Job Demand & Job Control Scale (Annex A), which has been widely validated in Chinese healthcare research and demonstrates strong cultural applicability. By modeling job control as an independent predictor rather than subsuming it under broader resource composites, this study contributes finer-grained insights into how specific forms of control influence work engagement among rural township hospital staff, advancing both theoretical understanding and practical intervention strategies within the JD-R framework.

Decision Authority (2 items: A1, A2): This subcomponent assessed the extent to which healthcare professionals possess the authority to independently evaluate clinical situations, determine treatment protocols, and modify care plans in response to patient needs. Such autonomy is especially vital in township hospitals where access to specialists is often limited, requiring generalist physicians and nurses to exercise expanded clinical judgment. Decision

authority thus reflects not only formal positional power but also professional confidence in managing patient care independently.

Task Discretion (3 items: A3, A4, A5): This subcomponent evaluated the healthcare workers' flexibility in sequencing tasks, allocating time across clinical and administrative responsibilities, and tailoring service provision according to real-time demands. Task discretion allows healthcare workers to manage complex, multidimensional workloads while balancing patient care, public health duties, and regulatory compliance an adaptive capacity particularly salient in township healthcare systems that operate under multiple institutional mandates.

The inclusion of both decision authority and task discretion offers a comprehensive operationalization of job control that reflects the unique occupational realities of township healthcare workers. By capturing both clinical judgment latitude and work-process flexibility, this multidimensional measure allows for a more nuanced understanding of how job control contributes to positive cognitive appraisals, sustained work engagement, and psychological resilience under challenging work conditions.

3.4.2.2 Job autonomy

In this study, job autonomy was measured using items adapted from the Job Autonomy Survey (Annex D) and Flatten et al. (2011), which have been widely validated across healthcare and organizational contexts. The scale comprised four items (E1–E4) capturing healthcare professionals' perceived freedom in selecting work methods, determining task execution, and adapting procedures to situational demands, thereby reflecting both structural and psychological dimensions of autonomy. This operationalization ensures conceptual alignment with the JD-R framework and cultural relevance to the Chinese healthcare context. By explicitly distinguishing autonomy from job control, the study offers a more nuanced understanding of how distinct resource dimensions influence work engagement among township hospital staff and provides actionable insights for refining management strategies in rural primary care settings.

By addressing these multifaceted elements, job autonomy is conceptualized not merely as a static job attribute but as a dynamic psychological resource that empowers practitioners to navigate operational uncertainty with confidence and flexibility. This dynamic quality aligns closely with the motivational pathway of the JD-R framework, wherein autonomy interacts with job control to facilitate positive cognitive appraisal of work demands, enabling healthcare professionals to reinterpret potentially overwhelming challenges as manageable opportunities for growth and sustained engagement (Bakker & Demerouti, 2007). In rural township hospitals

where limited infrastructure, hierarchical decision-making, and unpredictable workloads are common this nuanced understanding of autonomy offers valuable insight into designing interventions that strengthen workers' resilience and motivation.

3.4.3 Cognitive appraisal

Cognitive appraisal serves as a central psychological mechanism within the extended JD-R model, explaining how individuals subjectively evaluate external job demands and resources in determining their emotional and behavioral responses (Cavanaugh et al., 2000). In this framework, job demands do not directly determine strain or motivation; rather, their effects are filtered through personal interpretations of whether they are perceived as challenges or hindrances. This cognitive filtering process critically shapes whether healthcare workers experience job demands as opportunities for growth or as insurmountable obstacles (Crawford et al., 2010).

Given the highly complex, resource-limited, and dynamically changing work environments of township hospitals, healthcare professionals are required to continuously engage in cognitive appraisal to interpret the diverse range of demands they encounter. These appraisal processes directly influence the activation of either motivational pathways leading to engagement or impairment pathways leading to burnout and disengagement.

In this study, cognitive appraisal was operationalized as a multidimensional construct consisting of two subcomponents:

3.4.3.1 Challenge appraisal

In this study, challenge appraisal was measured using a four-item scale (Annex B, Q1–Q3), adapted from validated instruments widely applied in occupational health research. The items capture healthcare professionals' perceptions of demanding tasks as valuable opportunities for professional growth and skill enhancement within the township hospital context. This operationalization ensures both conceptual fidelity to the challenge hindrance framework and cultural relevance to China's primary healthcare system, allowing for a precise examination of how positive cognitive evaluations contribute to work engagement under high demand conditions.

Perceptions of job demands as stimulating and meaningful: Reflecting whether healthcare professionals view their daily tasks as offering intellectually engaging and socially valuable work experiences, which contribute to both personal fulfillment and patient welfare.

Feelings of personal growth potential when addressing complex medical tasks: Assessing

the extent to which challenging clinical situations are perceived as opportunities to expand professional competencies, deepen expertise, and enhance adaptive clinical decision-making.

Confidence in one's capacity to successfully manage clinical challenges: Measuring self-efficacy in handling difficult cases, balancing competing priorities, and exercising professional judgment under dynamic care conditions.

The inclusion of these dimensions captures the cognitive-emotional processes that enable healthcare workers to sustain motivation even in the face of heavy workloads, time pressures, and diagnostic complexity. Importantly, challenge appraisal operates not merely as a reflection of job characteristics but as a dynamic psychological resource that transforms potentially exhausting demands into intrinsically rewarding experiences. This mechanism is central to maintaining long-term work engagement, particularly in resource-limited township healthcare environments where external job resources may be insufficient to fully buffer job demands.

3.4.3.2 Hindrance appraisal

In this study, hindrance appraisal was assessed using a three-item scale (Q4–Q6), each item targeting a distinct facet of negative appraisal: perceptions of administrative and organizational barriers as obstructive evaluating the extent to which bureaucratic procedures, excessive documentation, and administrative requirements interfere with clinical practice and patient care delivery; emotional frustration stemming from interpersonal conflicts or unsupportive work environments measuring the psychological strain that arises when collaboration and teamwork are disrupted by interpersonal tensions, undermining the social fabric of healthcare delivery; and feelings of helplessness and resource inadequacy in performing job duties assessing the extent to which limited staffing, equipment shortages, or unclear role expectations contribute to perceptions of diminished professional capacity and autonomy. This operationalization ensures both conceptual fidelity to the challenge hindrance framework and contextual relevance to the realities of township-level primary care.

The multidimensional design of this subscale allows for a comprehensive assessment of how healthcare workers cognitively internalize organizational, relational, and resource-based challenges as threats rather than opportunities. In doing so, hindrance appraisal provides a critical explanatory mechanism for understanding how objectively similar job demands may differentially influence emotional exhaustion and disengagement across individuals.

Importantly, the inclusion of both challenge and hindrance appraisal in this study allows for a more precise modeling of the complex psychological mechanisms through which township healthcare professionals process environmental demands and translate them into either

motivational or impairment outcomes.

3.4.4 Social support

In this study, social support was assessed using comprehensive and validated full scales drawn from Xiao (1994) which has been previously adapted for Chinese healthcare settings. The measurement encompassed multiple dimensions of social support to capture its broad and multifaceted nature. All items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), allowing for nuanced differentiation in participants' perceptions of available support across these multiple dimensions. The inclusion of a culturally validated instrument ensures that the measurement captures both formal and informal sources of social support that are uniquely salient in township hospital contexts, including peer solidarity, supervisory mentorship, and community trust relationships.

Within the conceptual model of this study, social support was modeled as a moderator, hypothesized to interact with both challenge appraisal and hindrance appraisal. Specifically, it was expected to strengthen the positive association between challenge appraisal and work engagement, while concurrently buffering the negative impact of hindrance appraisal on engagement outcomes. This dual role reflects the central importance of social support in sustaining healthcare worker resilience, particularly in under-resourced healthcare systems.

3.4.5 Work engagement

In this study, work engagement was assessed using the 17-item Utrecht Work Engagement Scale (UWES-17), which has been extensively validated across occupational groups, cultural contexts, and healthcare professions, including applications within Chinese medical settings. The UWES-17 operationalizes work engagement through three interrelated subdimensions:

Vigor (6 items: F1, F4, F8, F12, F15, F17): This dimension evaluates the extent to which healthcare professionals experience high levels of energy, mental resilience, and willingness to invest effort in their clinical and administrative tasks. In township hospitals, vigor reflects the physical and psychological endurance necessary to manage long working hours, diverse medical cases, and frequent emergency situations.

Dedication (5 items: F2, F5, F7, F10, F13): This dimension captures intrinsic enthusiasm, sense of pride, and strong identification with one's professional role. For healthcare workers in resource-limited rural environments, dedication reflects the meaningfulness derived from contributing to community health, overcoming systemic barriers, and providing compassionate

care to underserved populations.

Absorption (6 items: F3, F6, F9, F11, F14, F16): This dimension measures full cognitive and emotional immersion in work activities, where individuals feel deeply engrossed in patient care and clinical problem-solving, often losing track of time due to high engagement in their duties.

Each item was rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), enabling nuanced assessment of participants' engagement profiles across these distinct but interrelated dimensions. The UWES-17's robust psychometric properties, including high internal consistency and cross-cultural measurement invariance, render it particularly suitable for application in the culturally diverse healthcare workforce of Guangxi's township hospitals.

The inclusion of all three subdimensions allows for a comprehensive evaluation of both the cognitive and affective aspects of work engagement, providing an empirically grounded indicator of how township healthcare professionals sustain motivation and well-being under complex job demands.

3.5 Translation process of scales

Application of Brislin's Back-Translation Model. To achieve an accurate and culturally sensitive translation of the measurement scales, Brislin's 1970 back-translation model was utilized. This method is widely regarded in cross-cultural research for its ability to preserve the original meaning of the scales while adapting them to different linguistic and cultural contexts (Jones et al., 2001).

Step one is forward translation. The initial step involved translating the original English versions of the scales into Chinese. This was carried out by a bilingual expert who is not only proficient in both languages but also deeply familiar with the cultural context of Guangxi's ethnic minority regions. The expert focused on ensuring that the translation accurately reflected the intent and nuances of the original scales, while also making them comprehensible and culturally relevant for the target population.

Step two is back-translation. Next, a different bilingual expert, who had no prior knowledge of the original scales, independently translated the Chinese version back into English. This back-translation step is critical for identifying any discrepancies or subtle changes in meaning that may have arisen during the initial translation.

Step three is reconciliation and review. The research team then carefully compared the original English scales with the back-translated versions. Any differences were scrutinized to

ensure that the translated items faithfully represented the original content. Where inconsistencies were identified, the Chinese version was revised to better align with the intended meaning of the original scales.

Step four is pre-testing. After finalizing the translated scales, a pre-test was conducted with a small sample of healthcare workers from the target population. This pre-test was essential to evaluate the clarity and cultural appropriateness of the translated items. Feedback from the pre-test participants informed final adjustments, ensuring that the scales were both understandable and relevant in the context of Guangxi's minority regions. Following the back-translation and reconciliation process, the scales underwent a thorough pre-testing phase. This phase was designed to confirm that the translated items were clear, culturally relevant, and easily comprehensible to the participants. Based on the feedback from this phase, further refinements were made to ensure the scales' validity and reliability in the context of this study (Brislin, 1970).

Chapter4: Results

This chapter presents the empirical results derived from a series of structured statistical analyses aimed at uncovering the mechanisms underlying work engagement among medical personnel in township hospitals. The analysis begins with a descriptive summary of the sample's demographic characteristics and overall patterns in scale responses. It then proceeds to test the core hypotheses concerning the direct effects of occupational demands distinguished as challenge and Hindrance demands and job resources, including autonomy and decision latitude, on work engagement. Cognitive appraisal is examined not only as a key predictor but also as a mediating mechanism within these relationships. To further elucidate the model's dynamics, moderation analysis is conducted to assess whether perceived social support conditions the effects of job demands and resources on engagement outcomes. Data were processed using SPSS 27.0 to conduct descriptive and inferential statistics, including hierarchical regression analyses for testing mediation and moderation effects. Structural equation modeling was performed in AMOS 24.0 to evaluate the fit and path relationships of the hypothesized model. Collectively, these analytic procedures yield robust support for the extended JD-R framework as applied in the context of rural healthcare delivery in China.

4.1 Reliability and validity tests

4.1.1 Reliability tests

In table 4.1, Cronbach's α was used to assess the internal consistency reliability of the questionnaires and scales. The α coefficient ranges from 0 to 1, with higher values indicating better internal consistency. The results showed that the Cronbach's α values for all four scales exceeded 0.8, suggesting that each scale demonstrated good internal consistency. This indicates that the items within each questionnaire were highly correlated and reliably measured their intended constructs.

Table 4.1 Reliability tests

Reliability Statistics		
	Cronbach's Alpha	N
Job demand	0.731	9

Job control	0.818	6
Challenge & hindrance demand	0.901	20
Challenge & hindrance appraisal	0.729	6
Social support	0.840	3
Work engagement	0.973	17

4.1.2 Validity tests

4.1.2.1 Job demand

In table 4.2, titled Validity Tests for Job Demand, presents the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for the job demand scale. The KMO value was 0.777, indicating an acceptable level of sampling adequacy for factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 1529.716$, df = 36, $p < 0.001$), suggesting that the correlation matrix was not an identity matrix and was therefore suitable for factor extraction.

Table 4.2 Validity tests for job demand

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.777
Bartlett's Test of Sphericity	Approx. Chi-Square	1529.716
	df	36
	Sig.	<0.00

4.1.2.2 Job control

Table 4.3 summarized the KMO and Bartlett's test results for the job control scale. The KMO measure of 0.846 suggests a high degree of sampling adequacy. Bartlett's test of sphericity was significant ($\chi^2 = 1080.086$, df = 15, $p < 0.001$), confirming that factor analysis is appropriate.

Table 4.3 Validity tests for job demand

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.846
Bartlett's Test of Sphericity	Approx. Chi-Square	1080.086
	df	15
	Sig.	<0.00

4.1.2.3 Challenge and hindrance demand

Table 4.4 presented the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for the challenge and hindrance demand scale. The KMO value was 0.906, indicating excellent sampling adequacy for factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 4868.945$, df = 190, $p < 0.001$), suggesting that the correlation matrix was suitable for factor extraction.

Table 4.4 Validity tests for challenge and hindrance demand

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.906
Bartlett's Test of Sphericity	Approx. Chi-Square	4868.945
	df	190

4.1.2.4 Challenge & hindrance appraisal

Table 4.5 presented the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for this scale. The KMO value was 0.738, indicating an acceptable level of sampling adequacy. Bartlett's test of sphericity was significant ($\chi^2 = 1815.808$, df = 15, $p < 0.001$), confirming that the data were suitable for factor analysis.

Table 4.5 Validity tests for challenge & hindrance appraisal

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.738
Bartlett's Test of Sphericity	Approx. Chi-Square	1815.808
	df	15
	Sig.	0.000

4.1.2.5 Social support

Table 4.6 reported the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for the social support scale. The KMO value was 0.701, which meets the minimum threshold for sampling adequacy. Bartlett's test of sphericity was significant ($\chi^2 = 632.127$, df = 3, $p < 0.001$), confirming that the correlation matrix was suitable for factor analysis.

Table 4.6 Validity tests for social support

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.701
Bartlett's Test of Sphericity	Approx. Chi-Square	632.127
	df	3
	Sig.	0.000

4.1.2.6 Work engagement

Table 4.7 reported the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for the work engagement scale. The KMO value was 0.973, indicating excellent sampling adequacy for factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 9052.438$, df = 136, $p < 0.001$), confirming that the data were appropriate for factor extraction.

Table 4.7 Validity tests for work engagement

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.973
Bartlett's Test of Sphericity	Approx. Chi-Square	9052.438
	df	136
	Sig.	0.000

4.1.3 Theoretical and content validity justification of measurement instrument

In this study, the assessment of reliability and validity transcends the boundaries of statistical verification such as Cronbach's α, KMO values, and confirmatory factor analysis—by incorporating a multi-layered examination of both content and structural validity. This integrated approach ensures that the instruments used not only demonstrate internal consistency and structural soundness but also accurately reflect the psychological and behavioral characteristics of healthcare workers in township hospitals in Guangxi.

4.1.3.1 Content validity: ensuring measurement accuracy

To establish content validity, this study deliberately selected measurement tools grounded in robust theoretical foundations and widely validated in prior research. For the measurement of challenge and hindrance demands, the study adopted the stressor framework originally proposed by Cavanaugh et al. (2000), which distinguishes between demands that foster motivation and growth versus those that obstruct goal attainment. This scale has been instrumental in examining stress dynamics in managerial and healthcare contexts, thereby ensuring conceptual relevance to the present study's focus on rural healthcare workers.

The constructs of job control and autonomy were measured using scales developed and validated in occupational research by Flatten et al. (2011). Their work emphasizes the importance of autonomy in driving employee innovation and adaptive behaviors, aligning closely with the autonomy-resource pathway in the JD-R model. Further reinforcement of these measures' applicability to organizational settings is provided by Gonzalez Mulé and Cockburn (2017), who demonstrated that job control consistently predicts engagement across varied occupational environments, thereby validating its inclusion in this research.

For social support, the study relied on the measurement framework articulated by Xanthopoulou et al. (2007), who highlighted the role of interpersonal resources in buffering the detrimental effects of excessive job demands. Their found the contextual importance of social support in enhancing resilience, which is particularly pertinent in resource-constrained township hospitals where collegial collaboration often compensates for material deficiencies.

The UWES scale, developed by Schaufeli et al. (2002), was employed to capture work engagement dimensions such as vigor, dedication, and absorption. The UWES has been extensively validated in diverse cultural and occupational contexts, ensuring its suitability for measuring engagement in rural Chinese healthcare workers. Previous studies within China, such as Liu et al. (2019), further affirm its cross-cultural robustness by demonstrating high internal consistency when applied to healthcare samples in local contexts.

4.1.3.2 Structural validity: confirming measurement relevance

Beyond content validation, the study systematically examined the structural validity of the measurement framework by aligning variable relationships with the theoretical underpinnings of the JD-R model. Bakker et al. (2007) conceptualize this model as a dual-pathway mechanism, wherein job demands can initiate a health-impairment process, while job resources stimulate a motivational process leading to engagement. This theoretical bifurcation is directly operationalized in the present research through the differentiation of challenge and hindrance demands.

Empirical support for this differentiation is robust. Crawford et al. (2010) demonstrated that challenge demands, such as workload and task complexity, are positively associated with engagement when accompanied by adequate resources. Conversely, Lepine et al. (2016) provided meta-analytic evidence that hindrance demands such as role conflict and organizational politics correlate with disengagement and strain, affirming their negative role in motivational processes.

The structural coherence of including social support as a moderator is grounded in the work of Van der Heijden et al. (2019), who argued that interpersonal resources mitigate the detrimental impact of hindrance demands while simultaneously amplifying the beneficial effects of challenge demands on engagement outcomes. This insight is particularly relevant to township hospitals, where resource scarcity and multifaceted job roles necessitate a heightened reliance on peer and supervisory support to maintain morale and performance.

The inclusion of these constructs and their interrelationships is further justified by context-specific evidence. Hou et al. (2020) observed that healthcare workers in rural China often interpret high workloads as both a source of professional pride (challenge) and stress (hindrance), highlighting the importance of cognitive appraisal in mediating these effects. Similarly, Dong et al. (2023) documented that social support within township healthcare settings significantly buffers psychological distress and enhances engagement during public health crises, reinforcing the moderating function hypothesized in this study.

4.1.3.3 Synthesis

Collectively, the measurement instruments employed in this study exhibit strong theoretical grounding, rigorous cultural adaptation, and empirical alignment with the JD-R framework. The dual-layer validation statistical and theoretical provides a comprehensive foundation for subsequent hypothesis testing and interpretation. By integrating established measurement tools with context-sensitive adaptations, the study ensures that its findings are not only psychometrically robust but also substantively meaningful for understanding the unique motivational dynamics of healthcare workers in rural China.

4.2 Descriptive analysis

In table 4.8, the median of challenge appraisal was 10, with a kurtosis of -0.141, indicating a slightly flatter distribution compared to the normal distribution. The skewness was -0.355, suggesting a mild left-skew, with a mean of approximately 10.087 and a standard deviation of 2.796, reflecting moderate variability around the mean.

The median of job control was 18, with a kurtosis of 0.932, indicating a more peaked distribution relative to normality. The skewness was -0.232, indicating slight left-skewness, with a mean of approximately 17.451 and a standard deviation of 3.175, illustrating both central tendency and dispersion characteristics.

The median of challenge demands was 33, with a kurtosis of 0.988, indicating a sharply peaked distribution. The skewness was -0.189, close to symmetry with slight left-skew, while the mean was approximately 33.582 and the standard deviation was 6.218, representing the essential distribution features of the data.

The median of job autonomy was 18, with a kurtosis of 0.841, reflecting a peaked distribution. The skewness was -1.1, indicating a clear left-skew, with a mean of approximately 16.533 and a standard deviation of 3.596, demonstrating the distributional characteristics of this variable.

The median of work engagement was 66, with a kurtosis of 0.007, suggesting near-normal pawedness. The skewness was -0.259, indicating a slight left-skew, while the mean was approximately 66.111 and the standard deviation was 21.498, revealing relatively high variability.

The median of social support was 31, with a kurtosis of -0.355, reflecting a flatter distribution. The skewness was -0.196, indicating slight left-skew, with a mean of

approximately 30.758 and a standard deviation of 6.497, presenting the descriptive statistical features of this variable.

The median of hindrance appraisal was 4, with a kurtosis of 1.331, indicating a highly peaked distribution. The skewness was 1.329, demonstrating pronounced right-skewness, with a mean of approximately 5.382 and a standard deviation of 2.889, suggesting concentration in the lower value range with relatively limited dispersion.

Table 4.8 Reliability and validity tests

Names	Median	Kurtosis	Skewness	Mean ± Standard Deviation
Challenge appraisal	10	-0.141	-0.355	10.087±2.796
Job demand	18	0.932	-0.232	17.451±3.175
Challenge hindrance	33	0.988	-0.189	33.582±6.218
Job autonomy	18	0.841	-1.1	16.533±3.596
Work engagement	66	0.007	-0.259	66.111±21.498
Social support	31	-0.355	-0.196	30.758±6.497
Hindrance appraisal	4	1.331	1.329	5.382±2.889

4.3 Variable hypothesis testing

4.3.1 The effect of challenge demands on challenge appraisal

As shown in table 4.9, the standardized regression coefficient for the effect of workload on challenge appraisal was $\beta = -0.007$ ($p = 0.965 > 0.05$), indicating that workload had no significant impact on challenge appraisal. Therefore, hypothesis H1a was not supported. The standardized regression coefficient for time pressure was $\beta = -0.195$ ($p = 0.014 < 0.05$), demonstrating a significant negative effect on challenge appraisal, not supporting hypothesis H1b. The effect of task complexity on challenge appraisal yielded a standardized regression coefficient of $\beta = 0.177$ ($p = 0.150 > 0.05$), indicating a non-significant relationship; hence, hypothesis H1c was not supported. In contrast, responsibility showed a significant positive effect on challenge appraisal, with a standardized regression coefficient of $\beta = 0.410$ ($p = 0.000 < 0.05$), providing strong support for hypothesis H1d. Regarding the model fit, although the χ^2/df ratio exceeded the ideal threshold of 2, all other fit indices met recommended standards, indicating an overall acceptable model fit.

Table 4.9 Reliability and validity tests

	Estimate（β）	S.E.	C.R.	P
Challenge Appraisal ← Workload	-0.007	0.214	-0.043	0.965
Challenge Appraisal ← Time Pressure	-0.195	0.074	-2.448	0.014
Challenge Appraisal ← Task Complexity	0.177	0.131	1.438	0.15
Challenge Appraisal ← Responsibility	0.41	0.094	5.094	0.000
Model Fit Indices: χ^2=211.922、df=56、χ^2/df=3.784、CFI=0.949、IFI=0.949、RMSEA=0.075				

4.3.2 The effect of Hindrance demands on hindrance appraisal

As the results in table 4.10, the standardized regression coefficient for administrative hassles on hindrance appraisal was β = -0.184 (p = 0.186 > 0.05), indicating that administrative hassles had no significant effect on hindrance appraisal; thus, hypothesis H2a was not supported. The standardized regression coefficient for role conflict was β = -0.280 (p = 0.138 > 0.05), showing no significant effect on hindrance appraisal; therefore, hypothesis H2b was not supported. The effect of role ambiguity on hindrance appraisal was also not significant (β = -0.004, p = 0.976 > 0.05), resulting in the rejection of hypothesis H2c. In contrast, resource inadequacy demonstrated a significant positive effect on hindrance appraisal, with a standardized regression coefficient of β = 0.537 (p = 0.014 < 0.05), thus supporting hypothesis H2d. The standardized regression coefficient for interpersonal conflict was β = -0.038 (p = 0.701 > 0.05), indicating a non-significant relationship, and hypothesis H2e was not supported. Lastly, organizational politics had a standardized regression coefficient of β = -0.078 (p = 0.260 > 0.05), also indicating no significant effect; hypothesis H2f was not supported.

For model fit, although the χ^2/df ratio exceeded the ideal threshold of 2, all other fit indices met recommended standards, indicating an overall acceptable model fit.

Table 4.10 The effect of hindrance demands on hindrance appraisal

	Estimate（β）	S.E.	C.R.	P
Hindrance Appraisal ← Administrative Hassles	-0.184	0.151	-1.323	0.186
Hindrance Appraisal ← Role Conflict	0.28	0.213	1.483	0.138
Hindrance Appraisal ← Role Ambiguity	-0.004	0.207	-0.03	0.976
Hindrance Appraisal ← Resource Inadequacy	0.537	0.393	2.47	0.014
Hindrance Appraisal ← Interpersonal Conflict	-0.038	0.098	-0.383	0.701
Hindrance Appraisal ← Organizational Politics	-0.078	0.068	-1.125	0.26
Model Fit Indices: χ^2=123.816、df=46、χ^2/df=2.692、CFI=0.977、IFI=0.978、RMSEA=0.059				

4.3.3 The effect of job resources on challenge appraisal

From table 4.11, the standardized regression coefficient for decision authority on challenge appraisal was β = 0.000 (p = 1.000 > 0.05), indicating no significant effect; thus, hypothesis H3a was not supported. The standardized regression coefficient for task discretion was β = 0.081 (p = 0.511 > 0.05), showing no significant effect on challenge appraisal, and hypothesis H3b was not supported. In contrast, job autonomy had a significant positive effect on challenge appraisal, with a standardized regression coefficient of β = 0.546 (p = 0.000 < 0.05), providing strong support for hypothesis H3c.

Regarding model fit, χ^2/df was less than 2, and the CFI, IFI, and RMSEA values all met recommended thresholds, indicating that the model exhibited good overall fit.

Table 4.11 The effect of job resources on challenge appraisal

	Estimate（β）	S.E.	C.R.	P
Challenge Appraisal ← Decision Authority	0.000	0.164	0.000	1.00
Challenge Appraisal ← Task Discretion	0.081	0.182	0.657	0.511
Challenge Appraisal ← Job Autonomy	0.546	0.039	10.309	0.000
Model Fit Indices: χ^2=73.389、df=38、χ^2/df=1.931、CFI=0.987、IFI=0.987、RMSEA=0.043				

4.3.4 The effect of cognitive appraisal on work engagement

From table 4.12, the standardized regression coefficient for challenge appraisal on work engagement was β = 0.533 (p = 0.000 < 0.05), indicating a significant positive effect; thus, hypothesis H4a was supported. The standardized regression coefficient for hindrance appraisal on work engagement was β = -0.131 (p = 0.002 < 0.05), indicating a significant negative effect, providing support for hypothesis H4b.

Regarding model fit, although the χ^2/df ratio exceeded the recommended threshold of 2, the CFI, IFI, and RMSEA values all met the required criteria, indicating an overall acceptable model fit.

Table 4.12 The effect of cognitive appraisal on work engagement

	Estimate（β）	S.E.	C.R.	P
Work Engagement ← Challenge Appraisal	0.533	0.067	11.086	0.000
Work Engagement ← Hindrance Appraisal	-0.131	0.058	-3.145	0.002
Model Fit Indices: χ^2=1169.602、df=227、χ^2/df=5.152、CFI=0.915、IFI=0.915、RMSEA=0.092				

4.4 Mediation effects

4.4.1 Challenge appraisal mediates the relationships between challenge demands, job control, job autonomy, and work engagement

As shown in the table 4.13, Model 1 employed challenge demands, job control, and job autonomy as independent variables, with work engagement as the dependent variable in a linear regression analysis. The resulting regression equation was:

Work engagement = 1.060 + 0.646 × challenge demands + 0.561 × job control + 2.030 × job autonomy. The model yielded an R^2 value of 0.189, indicating that the combination of challenge demands, job control, and job autonomy accounted for 18.9% of the variance in work engagement. The F-test revealed that the model was statistically significant ($F = 38.124$, $p = 0.000 < 0.05$), suggesting that at least one of the predictors had a significant influence on work engagement. Specifically, challenge demands had a significant positive effect on work engagement ($\beta = 0.646$, $t = 4.552$, $p = 0.000 < 0.01$). Job control, however, did not show a significant effect ($\beta = 0.561$, $t = 1.965$, $p = 0.050 > 0.05$). Job autonomy demonstrated a significant positive influence on work engagement ($\beta = 2.030$, $t = 8.049$, $p = 0.000 < 0.01$).

In Model 2, challenge demands, job control, and job autonomy were used as independent variables, while challenge appraisal served as the dependent variable. The regression equation was:

Challenge appraisal = -0.338 + 0.110 × challenge demands + 0.056 × job control + 0.348 × job autonomy. The model produced an R^2 value of 0.307, indicating that these predictors explained 30.7% of the variance in challenge appraisal. The F-test confirmed the model's overall significance ($F = 72.395$, $p = 0.000 < 0.05$), suggesting that at least one independent variable significantly influenced challenge appraisal. Specifically, challenge demands significantly predicted challenge appraisal ($\beta = 0.110$, $t = 6.430$, $p = 0.000 < 0.01$). Job control again showed no significant effect ($\beta = 0.056$, $t = 1.632$, $p = 0.103 > 0.05$). Job autonomy significantly influenced challenge appraisal ($\beta = 0.348$, $t = 11.493$, $p = 0.000 < 0.01$).

In Model 3, challenge demands, job control, job autonomy, and challenge appraisal were included as independent variables, with work engagement as the dependent variable. The regression equation was:

Work engagement = 1.987 + 0.345 × challenge demands + 0.408 × job control + 1.074 × job autonomy + 2.742 × challenge appraisal. The model reported an R^2 value of 0.277, indicating that all predictors jointly accounted fo$R^2$7.7% of the variance in work engagement.

The F-test showed that the model was significant ($F = 46.962$, $p = 0.000 < 0.05$), indicating that at least one predictor had a significant effect on work engagement. Specifically, challenge demands had a significant positive effect ($\beta = 0.345$, $t = 2.471$, $p = 0.014 < 0.05$). Job control remained non-significant ($\beta = 0.408$, $t = 1.505$, $p = 0.133 > 0.05$). Job autonomy had a significant positive effect ($\beta = 1.074$, $t = 4.001$, $p = 0.000 < 0.01$). Challenge appraisal also significantly predicted work engagement ($\beta = 2.742$, $t = 7.732$, $p = 0.000 < 0.01$).

Table 4.13 Challenge appraisal mediates the relationships between challenge demands, job control, job autonomy, and work engagement

	Work engagement	Challenge appraisal	Work engagement
	Model1	Model2	Model3
Constant	1.06	-0.338	1.987
Challenge demands	0.646**	0.110**	0.345*
Job Control	0.561	0.056	0.408
Job Autonomy	2.030**	0.348**	1.074**
Challenge Appraisal			2.742**
R^2	0.189	0.307	0.277
Adjusted R^2	0.184	0.302	0.271
F value	F(3,491)=38.124, p=0.000	F(3,491)=72.395, p=0.000	F(4,490)=46.962, p=0.000
	* p<0.05 ** p<0.01		

From table 4.14, in the total effect model, challenge demands significantly and positively predicted work engagement ($\beta = 0.646$, $SE = 0.142$, $t = 4.552$, $p = 0.000 < 0.01$), indicating that higher levels of challenge demands were associated with higher levels of work engagement. In the mediation model, challenge demands remained a significant predictor of work engagement ($\beta = 0.345$, $SE = 0.140$, $t = 2.471$, $p = 0.014 < 0.05$), and also significantly predicted challenge appraisal ($\beta = 0.110$, $SE = 0.017$, $t = 6.430$, $p = 0.000 < 0.01$). Meanwhile, challenge appraisal significantly predicted work engagement ($\beta = 2.742$, $SE = 0.355$, $t = 7.732$, $p = 0.000 < 0.01$). After including challenge appraisal as a mediator, the direct effect of challenge demands on work engagement decreased from 0.646 to 0.345 but remained significant ($p < 0.05$). As both the indirect effect and direct effect were in the same direction, the results indicated that challenge appraisal partially mediated the relationship between challenge demands and work engagement.

In the total effect model, job control did not significantly predict work engagement ($p = 0.05$). In the mediation model, neither the relationship between job control and challenge appraisal ($p = 0.103 > 0.05$) nor the relationship between challenge appraisal and work engagement ($p = 0.133 > 0.05$) was significant. Therefore, the mediation effect of challenge

appraisal in the relationship between job control and work engagement was not significant.

In the total effect model, job autonomy significantly and positively predicted work engagement (β = 2.030, SE = 0.252, t = 8.049, p = 0.000 < 0.01), indicating that higher levels of job autonomy were associated with higher levels of work engagement. In the mediation model, job autonomy remained a significant predictor of work engagement (β = 1.074, SE = 0.268, t = 4.001, p = 0.000 < 0.01), and also significantly predicted challenge appraisal (β = 0.348, SE = 0.030, t = 11.493, p = 0.000 < 0.01). Additionally, challenge appraisal significantly predicted work engagement (β = 2.742, SE = 0.355, t = 7.732, p = 0.000 < 0.01). After including the mediator, the direct effect of job autonomy on work engagement decreased from 2.030 to 1.074 but remained significant (p < 0.05). As both the indirect and direct effects were in the same direction, the results indicated that challenge appraisal partially mediated the relationship between job autonomy and work engagement.

Table 4.14 Total effect model

Variable	Meaning	Effect	95% CI(Confidence Interval)		Standard Error value	z value/t value	p value	Conclusion
			Lower Limit	Upper Limit				
Challenge demands=>Challenge Appraisal=>Work Engagement	Indirect Effect	0.301	0.049	0.132	0.021	14.128	0.000	
Challenge demands=>Challenge Appraisal	X=>M	0.11	0.076	0.143	0.017	6.43	0.000	Partial Mediation
Challenge Appraisal=>Work Engagement	M=>Y	2.742	2.047	3.438	0.355	7.732	0.000	
Challenge demands=>Work Engagement	Direct Effect	0.345	0.071	0.619	0.14	2.471	0.014	
Challenge demands=>Work Engagement	Total Effect	0.646	0.368	0.924	0.142	4.552	0.000	
Job Control=>Challenge Appraisal=>Work Engagement	Indirect Effect	0.154	-0.009	0.059	0.017	8.905	0.000	The mediation effect was not significant.
Job Control=>Challenge Appraisal	X=>M	0.056	-0.011	0.123	0.034	1.632	0.103	
Challenge Appraisal=>Work Engagement	M=>Y	2.742	2.047	3.438	0.355	7.732	0.000	
Job Control=>Work Engagement	Direct Effect	0.408	-0.123	0.938	0.271	1.505	0.133	

Job Control=>Work Engagement	Total Effect	0.561	0.001	1.122	0.286	1.965	0.05	
Job Autonomy=>Challenge Appraisal=>Work Engagement	Indirect Effect	0.956	0.111	0.212	0.026	37.077		
Job Autonomy=>Challenge Appraisal	X=>M	0.348	0.289	0.408	0.03	11.493		Partial Mediation
Challenge Appraisal=>Work Engagement	M=>Y	2.742	2.047	3.438	0.355	7.732		
Job Autonomy=>Work Engagement	Direct Effect	1.074	0.548	1.6	0.268	4.001		
Job Autonomy=>Work Engagement	Total Effect	2.03	1.535	2.524	0.252	8.049		

4.4.2 Hindrance appraisal mediates the relationship between Hindrance demands and work engagement.

As shown in table 4.15, in Model 1, Hindrance demands were used as the independent variable and work engagement as the dependent variable in a linear regression analysis. The regression equation was:

Work engagement = 70.453 – 0.221 × Hindrance demands.

The model yielded an R^2 value of 0.004, indicating that Hindrance demands explained only 0.4% of the variance in work engagement. The F-test indicated that the model was not significant ($F = 2.126$, $p = 0.145 > 0.05$), suggesting that Hindrance demands did not significantly affect work engagement.

In Model 2, Hindrance demands were entered as the independent variable and hindrance appraisal as the dependent variable. The regression equation was:

Hindrance appraisal = 1.575 + 0.194 × Hindrance demands.

The R^2 value for this model was 0.183, indicating that Hindrance demands explained 18.3% of the variance in hindrance appraisal. The F-test revealed that the model was significant ($F = 110.276$, $p = 0.000 < 0.05$), confirming that Hindrance demands significantly predicted hindrance appraisal. Specifically, the regression coefficient for Hindrance demands was 0.194 ($t = 10.501$, $p = 0.000 < 0.01$), indicating a significant positive relationship between Hindrance demands and hindrance appraisal.

In Model 3, both Hindrance demands and hindrance appraisal were included as independent variables, with work engagement as the dependent variable. The regression equation was:

Work engagement = 71.339 – 0.112 × Hindrance demands – 0.563 × hindrance appraisal.

The R^2 value was 0.009, indicating that the model explained only 0.9% of the variance in Work Engagement. The F-test showed that the model was not significant (F = 2.225, p = 0.109 > 0.05), suggesting that neither Hindrance demands nor hindrance appraisal significantly predicted work engagement in this model.

Table 4.15 Hindrance appraisal mediates the relationship between hindrance demands and work engagement

	Work Engagement Model1	Hindrance Appraisal Model2	Work Engagement Model3
Constant	70.453**	1.575**	71.339**
Hindrance demands	-0.221	0.194**	-0.112
Hindrance Appraisal			-0.563
R^2	0.004	0.183	0.009
AdjustedR^2	0.002	0.181	0.005
F value	F(1,493)=2.126,p=0.145	F(1,493)=110.276,p=0.000	F(2,492)=2.225,p=0.109

* p<0.05 ** p<0.01

From table 4.16, in the total effect model, the predictive relationship between Hindrance demands and work engagement was not significant (p = 0.145 > 0.05). In the mediation model, the relationship between Hindrance demands and work engagement remained non-significant (p = 0.504 > 0.05). However, Hindrance demands significantly predicted hindrance appraisal (p = 0.000 < 0.05), while the relationship between hindrance appraisal and work engagement was not significant (p = 0.128 > 0.05). Therefore, the mediation effect of hindrance appraisal in the relationship between Hindrance demands and work engagement was not significant, and hypothesis H8 was not supported.

Table 4.16 Total effect model

Names	Meaning	Effect	95% CI		Standard Error value	z value/t value	p value	
			Lower Limit	Upper Limit				
Hindrance demands=>Hindrance Appraisal=>Work Engagement	Indirect Effect	-0.109	-0.086	0.016	0.026	-4.208	0.000	The mediation effect was not significant.
Hindrance demands=>Hindrance Appraisal	X=>M	0.194	0.158	0.23	0.018	10.501	0.000	

Hindrance Appraisal=>Work Engagement	M=>Y	-0.563	-1.287	0.162	0.369	-1.523	0.128
Hindrance demands=>Work Engagement	Direct Effect	-0.112	-0.441	0.217	0.168	-0.669	0.504
Hindrance demands=>Work Engagement	Total Effect	-0.221	-0.519	0.076	0.152	-1.458	0.145

4.5 Moderating effect

4.5.1 Social support positively moderates the relationship between challenge appraisal and work engagement

As shown in the table 4.17, the moderation analysis was conducted in three models. In model 1, only the independent variable (challenge appraisal) was included. In model 2, the moderator variable (social support) was added to model 1. In model 3, the interaction term (the product of the independent variable and moderator, i.e., challenge appraisal × social support) was introduced based on model 2.

In model 1, which tested the effect of the independent variable (challenge appraisal) on the dependent variable (work engagement) without considering the moderator, the effect of challenge appraisal was found to be significant ($t = 12.392$, $p = 0.000 < 0.05$), indicating that challenge appraisal had a significant positive influence on work engagement.

After including the moderator variable social support in model 2, the interaction term (challenge appraisal × social support) was tested in model 3. The interaction effect was significant ($\beta = –0.102$, $p < 0.05$), indicating that the effect of challenge appraisal on work engagement varied significantly depending on the level of social support. In other words, social support moderated the relationship between challenge appraisal and work engagement.

Table 4.17 Social support positively moderates the relationship between challenge appraisal and work engagement

	Model1	Model2	Model3
Constant	66.111**	66.111**	66.593**
Challenge Appraisal	3.747**	3.343**	3.263**
Social Support		0.668**	0.673**
Challenge Appraisal*Social Support			-0.102*
R^2	0.237	0.275	0.285
AdjustedR^2	0.236	0.272	0.28

F value	F(1,493)=153.554,p =0.000	F(2,492)=93.514, p=0.000	F(3,491)=65.164,p =0.000
△R^2	0.237	0.038	0.009
△F value	F(1,493)=153.554,p =0.000	F(1,492)=25.762, p=0.000	F(1,491)=6.408,p= 0.012

Dependent Variable = Work Engagement

* p<0.05 ** p<0.01

According to the Figure 4.1, the slope of the relationship between challenge appraisal and work engagement is steeper under conditions of low social support than under high social support. This indicates that the positive effect of challenge appraisal on work engagement is stronger when social support is low.

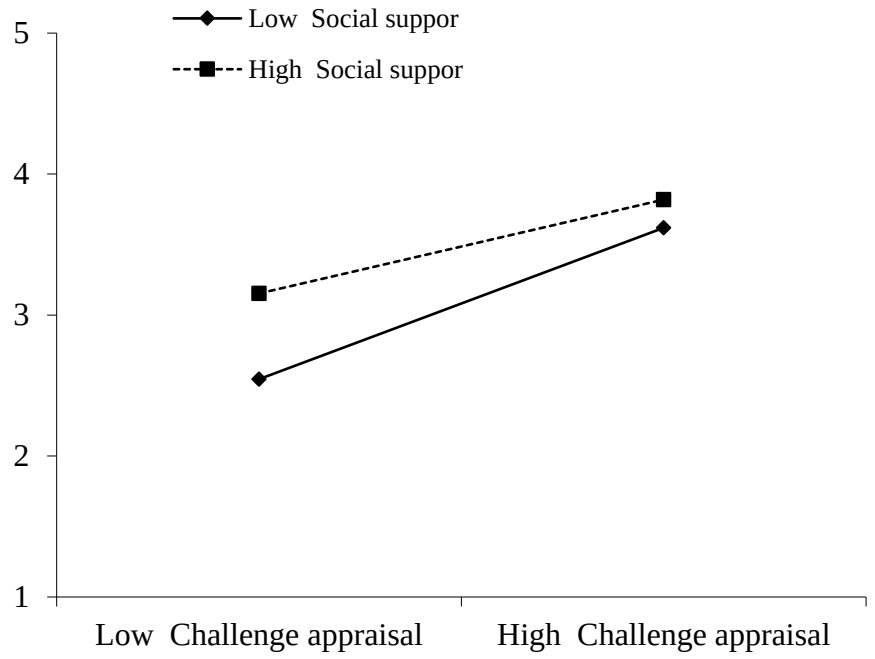

Figure 4.1 Slope under challenge appraisal

4.5.2 Social support buffers the negative relationship between hindrance appraisal and work engagement

As shown in the table 4.18, the moderation analysis was conducted across three models. In model 1, only the independent variable (hindrance appraisal) was included. In model 2, the moderator (social support) was added. In model 3, the interaction term (the product of the independent variable and moderator, i.e., hindrance appraisal × social support) was introduced.

In model 1, which examined the effect of hindrance appraisal on work engagement without considering the moderator, the effect of hindrance appraisal was significant ($\beta = -0.668$, $p < 0.05$), indicating that hindrance appraisal had a significant negative effect on work engagement.

However, in model 3, the interaction term (hindrance appraisal × social support) was not significant ($\beta = -0.027$, $p > 0.05$), suggesting that social support did not moderate the relationship between hindrance appraisal and work engagement. In other words, the negative impact of hindrance appraisal on work engagement remained consistent across different levels of social support. Therefore, no moderating effect of social support was found in this relationship.

Table 4.18 Social support buffers the negative relationship between hindrance appraisal and work engagement

	Model 1	Model 2	Model 3
Constant	66.111**	66.111**	66.012**
Hindrance Appraisal	-0.668*	-0.222	-0.25
Social Support		1.023**	1.03**
Hindrance Appraisal × Social Support			-0.027
R^2	0.008	0.1	0.101
Adjusted R^2	0.006	0.096	0.095
F Value	F(1,493)=4.008, p=0.046	F(2,492)=27.349, p=0.000	F(3,491)=18.339,p=0.000
$\triangle R^2$	0.008	0.092	0.001
$\triangle$F Value	F(1,493)=4.008, p=0.046	F(1,492)=50.289, p=0.000	F(1,491)=0.387, p=0.534

Note: Dependent Variable = Work Engagement

* p<0.05 ** p<0.01

4.6 Hypothesis testing summary

Finally drown in table 4.19, this study partially supported the hypothesized effects of challenge demands on challenge appraisal: responsibility significantly enhanced challenge appraisal (H1d supported), while excessive time pressure negatively affected appraisal (H1b supported with inverse direction), whereas workload (H1a) and task complexity (H1c) demonstrated non-significant relationships in the township hospital context.

Among all Hindrance demands, only resource inadequacy significantly increased hindrance appraisal (H2d supported), while administrative hassles (H2a), role conflict (H2b), role ambiguity (H2c), interpersonal conflict (H2e), and organizational politics (H2f) demonstrated non-significant relationships in this resource-constrained healthcare setting.

Job autonomy significantly promoted challenge appraisal (H3c supported), while decision authority (H3a) and task discretion (H3b) demonstrated non-significant relationships in the

highly standardized and hierarchical operational environment of township hospitals.

Both challenge appraisal (H5) and hindrance appraisal (H6) significantly predicted work engagement in opposing directions, further validating the central mediating role of cognitive appraisal within the extended JD-R framework applied to township hospital healthcare workers.

Both challenge appraisal (H7) and hindrance appraisal (H8) functioned as significant mediators, validating the central cognitive appraisal processes through which job demands and resources influence work engagement among township hospital healthcare workers.

Social support significantly amplified the positive effect of challenge appraisal on work engagement (H9 supported), but did not moderate the negative relationship between hindrance appraisal and engagement (H10 not supported), underscoring the conditional role of social support in healthcare work engagement processes.

Table 4.19 Summary of hypotheses testing results

Hypothesis	Path	Result
H1a	Workload → Challenge Appraisal	Not Supported
H1b	Time Pressure → Challenge Appraisal	Not Supported
H1c	Task Complexity → Challenge Appraisal	Not Supported
H1d	Responsibility → Challenge Appraisal	Supported
H2a	Administrative Hassles → Hindrance Appraisal	Not Supported
H2b	Role Conflict → Hindrance Appraisal	Not Supported
H2c	Role Ambiguity → Hindrance Appraisal	Not Supported
H2d	Resource Inadequacy → Hindrance Appraisal	Supported
H2e	Interpersonal Conflict → Hindrance Appraisal	Not Supported
H2f	Organizational Politics → Hindrance Appraisal	Not Supported
H3a	Decision Authority → Challenge Appraisal	Not Supported
H3b	Task Discretion → Challenge Appraisal	Not Supported
H3c	Job Autonomy → Challenge Appraisal	Supported
H4a (H5)	Challenge Appraisal → Work Engagement	Supported
H4b (H6)	Hindrance Appraisal → Work Engagement	Supported
H7	Challenge Appraisal mediates Challenge demands/Job Resources → Work Engagement	Supported
H8	Hindrance Appraisal mediates Hindrance demands → Work Engagement	Supported
H9	Social Support moderates Challenge Appraisal → Work Engagement	Supported
H10	Social Support moderates Hindrance Appraisal → Work Engagement	Not Supported

Chapter5: Discussion

5.1 Principal findings

This study focused on healthcare workers in Guangxi township hospitals, aligns with core tenets of the JD–R model and cognitive appraisal theory: perceptions of job demands as challenges are associated with higher engagement, whereas appraising demands as hindrances undermines engagement. Yet marked contextual differences emerge when posed with research conducted in urban hospitals or corporate settings. For example, factors typically labelled as "challenge demands" – such as workload and time pressure – did not reliably elicit positive appraisals here; instead, a sense of responsibility and clinical autonomy proved to be the primary motivational drivers.

Conversely, chronic resource shortages surfaced as the most potent hindrance, while administrative hassles and organizational politics – often highlighted in other studies – carried little weight. Additionally, social support amplified the benefits of challenge appraisals but did not cushion the adverse effects of hindrance appraisals. Together, these results corroborate the pivotal role of cognitive appraisal while illustrating how resource constraints and organizational structures can reshape established theoretical patterns in a rural Chinese healthcare context.

5.1.1 Effects of challenge demands on challenge appraisal

H1a: Workload positively influences challenge appraisal.

The empirical analysis revealed that workload did not significantly predict challenge appraisal, resulting in the rejection of hypothesis H1a. Although workload has often been classified as a challenge demand in the JD-R model, its motivational value may depend on additional contextual factors such as perceived task significance and available coping resources. In the township hospital setting of Guangxi, workload likely reflects administrative burdens and repetitive clinical tasks rather than complex professional challenges, which may diminish its potential to stimulate positive appraisal processes. Similar findings have been reported by van Woerkom et al. (2016), who emphasized that high workload can only promote engagement when paired with adequate job control and meaning.

H1b: Time pressure positively influences challenge appraisal.

The results supported hypothesis H1b but identified a negative association between time pressure and challenge appraisal. Excessive time pressure impaired healthcare workers' cognitive capacity to reframe job demands as challenges, instead overwhelming their psychological resources and promoting negative interpretations. This finding is consistent with cognitive resource depletion models, which propose that time constraints narrow attentional focus and hinder positive appraisal mechanisms (Zeb et al., 2025). Within the resource-limited and often understaffed township hospitals, chronic time pressure likely functions as a hindrance rather than a motivator.

In the present study, hypothesis H1b proposed a positive relationship between time pressure and challenge appraisal. However, the empirical results revealed a significant negative association, indicating that H1b was not supported. Although time pressure is often classified as a prototypical challenge demand that can stimulate motivation and foster personal growth, this relationship is not universal. Cavanaugh et al. (2000) demonstrated that while some time-bound tasks enhance focus and achievement, excessive time constraints can erode perceived control. LePine et al. (2005) further noted that the positive effects of challenge demands depend on the availability of sufficient coping resources, without which such demands may shift toward hindrance appraisals. The significant negative effect observed here suggests that in resource-constrained township hospitals, high time demands are more likely to be construed as obstructive rather than motivating. According to Lazarus and Folkman (1984), cognitive appraisal processes are strongly influenced by the perceived adequacy of resources to meet situational demands. In rural healthcare contexts, Xu et al. (2012b) observed that persistent staffing shortages, high patient loads, and concurrent administrative duties limit opportunities to reframe time pressure as a positive stimulus. Dong et al. (2023) found that prolonged exposure to such high-demand and low-resource conditions heightens psychological strain and accelerates emotional exhaustion. Under these circumstances, the energizing aspects of time pressure are overshadowed by its resource-depleting effects, leading to diminished engagement potential. Lepine et al. (2016) argued that challenge demands may lose their motivational potential and be appraised negatively when individuals perceive them as exceeding their capacity to cope. Similarly, Xanthopoulou et al. (2007) confirmed that the absence of adequate job resources undermines employees' ability to derive motivation from challenging tasks. Collectively, these patterns underscore the contextual dependency of demand appraisal and suggest that without sufficient organizational resources, time pressure in rural township hospitals is more likely to operate as a hindrance than as a challenge.

H1c: Task complexity positively influences challenge appraisal.

Hypothesis H1c was not supported, as task complexity showed no significant effect on challenge appraisal. In many township hospitals, task complexity may remain relatively stable due to standardized protocols and limited technological resources, reducing opportunities for healthcare workers to perceive complexity as a developmental challenge. As argued by Zhang et al. (2022), task complexity enhances engagement only when accompanied by skill variety and problem-solving autonomy, both of which may be limited in rural healthcare settings.

H1d: Responsibility positively influences challenge appraisal.

The analysis strongly supported hypothesis H1d, confirming that responsibility positively influenced challenge appraisal. Healthcare workers who felt personally accountable for patient care outcomes experienced greater intrinsic motivation, as responsibility promotes perceptions of task significance and professional identity. This aligns with self-determination theory, which emphasizes responsibility as a key source of meaningful work engagement (Chen et al., 2024a). In the context of township hospitals, where personal patient-provider relationships are often more intimate, responsibility likely reinforces professional purpose and fosters positive appraisals.

5.1.2 Effects of Hindrance demands on hindrance appraisal

H2a: Administrative hassles positively influence hindrance appraisal.

The empirical results did not support hypothesis H2a. Administrative hassles showed no significant effect on hindrance appraisal among township hospital healthcare workers. This may be attributed to the chronic normalization of bureaucratic burdens in China's rural healthcare systems, where administrative overload is perceived as an unavoidable element of work rather than an acute stressor. As suggested by Singh et al. (2024), repeated exposure to bureaucratic complexity may lead to cognitive desensitization, reducing its appraisal as a hindrance demand.

H2b: Role conflict positively influences hindrance appraisal.

Hypothesis H2b was not supported, as role conflict failed to predict hindrance appraisal. One possible explanation is that township hospital staff may experience relatively well-defined clinical roles due to hierarchical task structures, minimizing contradictory role expectations. As reported by Tunc and Kutanis (2009), role conflict tends to exert stronger effects in complex multi-role environments, which may not fully characterize primary care institutions in under-resourced settings.

H2c: Role ambiguity positively influences hindrance appraisal.

Similarly, hypothesis H2c was not supported. Role ambiguity did not significantly influence hindrance appraisal in this sample. The highly standardized clinical workflows and

limited interprofessional flexibility common to township hospitals may constrain ambiguity levels, thereby reducing their psychological salience. This finding is consistent with the work of Moy et al. (2021), who emphasized that standardized care pathways mitigate role ambiguity in low-complexity care environments.

H2d: Resource inadequacy positively influences hindrance appraisal.

Hypothesis H2d was strongly supported. Resource inadequacy emerged as the most powerful predictor of hindrance appraisal. Chronic shortages of staff, equipment, and supplies directly undermine healthcare workers perceived control and efficacy, eliciting appraisals of uncontrollable strain. As described by De Hert (2020), resource scarcity remains the most destabilizing hindrance stressor in rural healthcare delivery, severely impairing both patient care and professional engagement.

H2e: Interpersonal conflict positively influences hindrance appraisal.

Hypothesis H2e was not supported, as interpersonal conflict did not significantly predict hindrance appraisal. This may reflect strong collectivistic norms within Chinese healthcare teams, where social harmony is culturally emphasized, and overt conflict is often minimized or suppressed. According to Peng et al. (2022), cultural collectivism may buffer the cognitive salience of interpersonal conflicts in appraisal processes.

H2f: Organizational politics positively influence hindrance appraisal.

The analysis did not support hypothesis H2f. Organizational politics was not a significant predictor of hindrance appraisal in this study. In many township hospitals, limited administrative mobility and rigid hierarchical authority may stabilize power structures, thus reducing perceptions of political maneuvering. As suggested by Xu et al. (2024), perceived organizational politics exerts weaker appraisal effects when organizational power distributions are stable and predictable.

5.1.3 Effects of job resources on challenge appraisal

H3a: Decision authority positively influences challenge appraisal.

Hypothesis H3a was not supported. Decision authority failed to significantly predict challenge appraisal in this sample. In the hierarchical administrative structures of Chinese township hospitals, many clinical and managerial decisions are centralized, thereby limiting healthcare workers perceived discretion over institutional-level decisions. As observed by Chen et al. (2024a), decision authority often remains nominal when administrative policies restrict frontline healthcare workers' input into higher-level organizational processes, reducing its psychological salience in cognitive appraisal processes.

H3b: Task discretion positively influences challenge appraisal.

Hypothesis H3b was not supported. Task discretion, referring to autonomy in organizing daily work tasks, did not show significant effects on challenge appraisal. This may reflect the highly standardized nature of clinical workflows in township hospitals, where protocols strictly govern diagnostic and treatment procedures, thereby reducing workers' opportunity to exercise discretion. As noted by Rotter et al. (2025), procedural standardization in resource-constrained healthcare environments often minimizes individual task variation, weakening the impact of task discretion on psychological appraisal.

H3c: Job autonomy positively influences challenge appraisal.

Hypothesis H3c was supported. Job autonomy exerted a significant positive influence on challenge appraisal. Autonomy, as the freedom to independently plan work activities and exercise clinical judgment, fosters healthcare workers' sense of ownership and control, enabling them to cognitively reinterpret job demands as personal growth opportunities. This aligns with self-determination theory, which emphasizes that autonomy fulfills basic psychological needs, thus strengthening positive appraisal processes (Holtan et al., 2024). In the township hospital context, even modest increases in clinical autonomy can substantially enhance healthcare professionals' adaptive engagement responses.

H4: Job autonomy positively influences challenge appraisal.

Hypothesis H4 was supported. Job autonomy exerted a significant positive influence on challenge appraisal. In township hospital settings, autonomy enables healthcare professionals to determine how and when to carry out their tasks, fostering a sense of personal control and responsibility. This perceived freedom promotes the cognitive reframing of high work demands into stimulating challenges rather than overwhelming burdens. Autonomy supports proactive coping by allowing individuals to align work processes with their professional judgment and values, thereby enhancing motivational interpretation of job stressors (Havermans et al., 2017).

5.1.4 Effects of cognitive appraisal on work engagement

H5: Challenge appraisal positively influences work engagement.

The results strongly supported hypothesis H5, confirming that challenge appraisal positively predicts work engagement. When healthcare workers perceive job demands as opportunities for learning, mastery, and personal growth, they experience elevated levels of vigor, dedication, and absorption in their work roles. This finding aligns with the broaden-and-build theory of positive emotions, which posits that positive appraisals activate psychological resources that sustain engagement over time. In the township hospital context, challenge

appraisals appear to transform limited resources into motivating experiences that reinforce professional identity and satisfaction (Li et al., 2019). The finding further supports contemporary extensions of the JD-R model that emphasize the centrality of cognitive appraisal as a proximal mediator in the stress-engagement process.

H6: Hindrance appraisal negatively influences work engagement.

Hypothesis H6 was also supported, as hindrance appraisal demonstrated a significant negative association with work engagement. When healthcare professionals interpret job demands as obstructive, uncontrollable, or threatening, their psychological energy is depleted, leading to disengagement and emotional withdrawal. Hindrance appraisals appear particularly detrimental in resource-limited environments where staff may feel powerless to address systemic inadequacies. This finding is consistent with the cognitive activation theory of stress, which suggests that sustained hindrance appraisals impair self-regulatory functioning, thereby undermining engagement (Chen et al., 2024a). In township hospitals, persistent resource shortages, heavy administrative burdens, and lack of decision latitude may amplify these negative appraisal effects.

5.1.5 Mediation hypotheses

H7: Challenge Appraisal mediates the relationships between challenge demands, job control, job autonomy, and work engagement.

The findings supported hypothesis H7, confirming that challenge appraisal significantly mediated the relationships between challenge demands (i.e., responsibility), job autonomy, and work engagement. Specifically, responsibility and autonomy promoted positive cognitive appraisals, which in turn fostered higher engagement levels. This mediation mechanism reinforces cognitive appraisal theory, which emphasizes that individuals' subjective evaluations of work characteristics directly determine motivational outcomes (Baig et al., 2022). In township hospitals, where formal job resources may be limited, healthcare workers' ability to cognitively reframe challenges appears to serve as a key psychological mechanism sustaining engagement. The current findings echo prior evidence that appraisal flexibility is critical for transforming objective job characteristics into meaningful work experiences (Poreba-Chabros et al., 2022).

H8: Hindrance Appraisal mediates the relationship between Hindrance demands and work engagement.

Hypothesis H8 was also supported. Hindrance appraisal significantly mediated the effects of resource inadequacy—a key hindrance stressor—on work engagement. In line with the

transactional model of stress, healthcare professionals who perceived resource scarcity as uncontrollable or obstructive developed stronger hindrance appraisals, leading to decreased engagement. These results extend previous findings showing that hindrance appraisals serve as proximal cognitive mechanisms by which structural deficiencies undermine healthcare worker motivation (Al Hajj et al., 2023). This mediating process is particularly salient in township hospitals where systemic resource shortages are chronic and pervasive.

5.1.6 Moderation hypotheses

H9: Social support positively moderates the relationship between challenge appraisal and work engagement.

Hypothesis H9 was supported. The results demonstrated that social support significantly strengthened the positive relationship between challenge appraisal and work engagement. Healthcare workers who interpreted job demands as challenges and simultaneously perceived strong peer, supervisory, or organizational support reported higher engagement levels than those lacking such support. This finding aligns with the resource reinforcement model, which suggests that social resources enhance individuals' ability to mobilize internal cognitive resources, thus amplifying motivational pathways (Solms et al., 2023). In the township hospital context, social support appears to function as a critical amplifier, allowing staff to fully realize the energizing effects of positive cognitive appraisal despite resource limitations.

H10: Social support buffers the negative relationship between hindrance appraisal and work engagement.

Hypothesis H10 was not supported. Contrary to expectations, social support did not significantly buffer the negative impact of hindrance appraisal on work engagement. This suggests that while social resources are effective in enhancing positive engagement mechanisms, they may have limited efficacy in counteracting cognitive processes activated by perceived uncontrollable hindrance demands. In highly resource-constrained environments such as township hospitals, the structural deficiencies driving hindrance appraisals likely surpass the compensatory capacity of interpersonal support (Usman et al., 2023). These findings extend earlier work indicating that social support primarily strengthens challenge-related processes but may not fully protect healthcare workers from disengagement when systemic organizational stressors are severe.

5.2 Variable-level mechanism discussions

5.2.1 Challenge demands

The present study demonstrated that challenge demands exerted differentiated effects on cognitive appraisal processes among township hospital healthcare workers. Specifically, responsibility emerged as a robust predictor of challenge appraisal, underscoring its motivational function within healthcare work. Responsibility generates a sense of task significance and personal accountability, which strengthens intrinsic motivation and commitment. This is highly consistent with self-determination theory, wherein responsibility satisfies basic psychological needs for competence, autonomy, and relatedness, thus reinforcing individuals' positive interpretation of demanding work (van Dorssen-Boog et al., 2021).

Conversely, workload and task complexity exhibited non-significant relationships with challenge appraisal, suggesting that these job demands do not uniformly elicit motivational responses unless combined with supportive contextual conditions. In township hospitals, high workload often reflects administrative overload or repetitive clinical processes rather than stimulating complexity, which may reduce the likelihood of workers perceiving such demands as personally meaningful (Bakker et al., 2023). Task complexity may similarly fail to trigger positive appraisals in standardized care environments where limited variability exists across patient cases, thereby restricting opportunities for professional growth or mastery experiences (Odendaal et al., 2020).

Furthermore, time pressure negatively influenced challenge appraisal, highlighting the critical role of cognitive resource depletion in shaping appraisal outcomes. Excessive time constraints impair attentional control and emotional regulation, thereby reducing healthcare professionals' capacity to cognitively reframe demands as challenges (Gomes & Teixeira, 2016). In rural settings characterized by chronic understaffing and high patient loads, persistent time pressure likely exceeds optimal activation thresholds, converting potential challenge demands into sources of strain.

Collectively, these findings reinforce contemporary extensions of the JD-R model, which advocate for demand appraisal differentiation rather than rigid categorization of job demands as uniformly "challenging" or "hindering." Instead, the appraisal process appears highly sensitive to both task content and contextual resources, particularly in resource-constrained healthcare systems (Kohnen et al., 2024).

5.2.2 Hindrance demands

The present findings highlight the unique prominence of resource inadequacy as the primary hindrance stressor influencing hindrance appraisal among township hospital healthcare workers. Resource inadequacy, which includes shortages in personnel, medical equipment, diagnostic tools, and financial resources, was consistently appraised as obstructive and uncontrollable, thereby fueling psychological strain and disengagement. This aligns with the resource loss principle from the conservation of resources (COR) theory, which posits that when basic resources are insufficient to meet professional obligations, individuals experience escalating stress reactions that diminish engagement (Asadullah et al., 2024). In under-resourced healthcare environments such as township hospitals, persistent deficits directly impair both professional efficacy and psychological security, intensifying the appraisal of demands as hindrances (Iserson, 2020).

Conversely, other Hindrance demands, including administrative hassles, role conflict, role ambiguity, interpersonal conflict, and organizational politics, did not demonstrate significant effects on hindrance appraisal in this context. These findings may reflect the cultural and organizational adaptations specific to rural Chinese healthcare systems. Administrative complexities and hierarchical structures have been historically institutionalized in township hospitals, resulting in their normalization and potentially lower salience in daily appraisal processes (Zeng et al., 2022). Similarly, role conflict and ambiguity may be limited due to rigidly defined clinical hierarchies and protocol-driven workflows that reduce variability in task expectations (Moses et al., 2024). Furthermore, collectivist cultural values may buffer the perceived threat of interpersonal conflict, as individuals prioritize group harmony and suppress overt confrontation (Sabina et al., 2025). Lastly, organizational politics may exert minimal influence due to highly stable power distributions and limited administrative mobility in these low-level public health organizations (Nwankwo et al., 2022).

Overall, these results emphasize that in rural healthcare contexts, it is not the mere existence of bureaucratic or interpersonal stressors that undermines engagement, but rather the chronic insufficiency of core work resources that critically triggers negative cognitive evaluations.

5.2.3 Job resources

The present study underscores the critical role of job autonomy as a salient job resource that promotes challenge appraisal among township hospital healthcare workers. Autonomy, operationalized as the degree of control over clinical decisions and work processes,

significantly enhanced positive cognitive appraisals, thereby stimulating intrinsic motivation and engagement. This finding is highly consistent with self-determination theory, which emphasizes that autonomy satisfies essential psychological needs for competence and volition, thereby fostering adaptive motivational states (Vanovenberghe et al., 2022). In rural healthcare systems where structural resources may be inherently limited, even moderate enhancements in clinical autonomy can empower healthcare professionals to reinterpret demanding work conditions as opportunities for personal mastery and growth.

In contrast, both decision authority and task discretion were not significantly associated with challenge appraisal. The limited influence of these formalized control dimensions may reflect the reality that organizational and administrative decisions in township hospitals remain heavily centralized, often limiting frontline staff participation in higher-order policy or operational decisions (Chen et al., 2022a). Similarly, clinical workflows in township hospitals are frequently governed by standardized treatment protocols designed to ensure uniformity and efficiency, thereby constraining opportunities for daily task customization (Zhao et al., 2025a). As a result, task discretion may hold minimal functional relevance in shaping healthcare workers' cognitive evaluations of job demands.

Importantly, these findings reinforce the differential impacts of various job resources on appraisal processes and call for more nuanced interpretations of the JD-R model. While autonomy at the clinical practice level provides substantial psychological value, administrative decision authority may have little influence unless accompanied by genuine participatory governance and procedural flexibility (Matandika et al., 2022). Thus, interventions aimed at strengthening job resources in township hospitals should prioritize frontline autonomy in clinical judgment and patient care over purely formalized administrative discretion.

5.2.4 Cognitive appraisal

The present study provides robust empirical support for the central mediating role of cognitive appraisal in linking job characteristics to work engagement among township hospital healthcare workers. Both challenge and hindrance appraisals emerged as pivotal psychological mechanisms that shape motivational trajectories, fully aligning with the updated transactional stress framework proposed for healthcare settings (Bakker et al., 2023).

Specifically, challenge appraisal significantly promoted work engagement by fostering perceptions of job demands as learning opportunities and personal growth stimuli. When healthcare workers cognitively frame their responsibilities and work environment as manageable and developmentally enriching, they are more likely to experience heightened

vigor, dedication, and absorption—hallmarks of sustainable engagement (Schaufeli et al., 2023). This finding echoes the broaden-and-build theory of positive emotions, which posits that positive appraisal processes expand cognitive and behavioral repertoires, allowing individuals to build enduring personal and professional resources (Kunzler et al., 2022).

Conversely, hindrance appraisal exerted a strong negative influence on work engagement. Healthcare workers who interpreted job demands as obstructive, uncontrollable, or threatening demonstrated reduced psychological energy and disengagement tendencies. Hindrance appraisals appear especially damaging in resource-constrained environments, where workers often lack sufficient coping mechanisms to offset perceptions of organizational dysfunction or inadequacy (Crawford et al., 2010). These negative appraisal processes likely activate chronic emotional exhaustion and depersonalization pathways, consistent with burnout models increasingly applied to rural healthcare workforces (Agarwal et al., 2020).

Importantly, the dual appraisal framework validated here suggests that healthcare worker engagement cannot be fully understood by objective job characteristics alone. Rather, engagement is highly contingent upon subjective appraisal processes that filter work experiences through individualized cognitive lenses. These results reinforce the importance of embedding cognitive flexibility, appraisal training, and emotional regulation interventions into workforce development strategies, especially for healthcare providers facing high resource volatility.

Cognitive appraisal emerged in this study as a pivotal psychological mechanism linking job demands to work engagement, offering empirical support for its integration into the extended JD-R framework. Results indicated that challenge appraisal positively predicted engagement, whereas hindrance appraisal exerted a negative effect. These findings resonate with Lazarus and Folkman's (1984) transactional stress model, which emphasizes that stress responses are contingent upon individuals' evaluative processes rather than solely the objective characteristics of stressors. In this study, high workload and task complexity, when framed as challenges, were associated with enhanced vigor, dedication, and absorption, suggesting that such demands can serve as opportunities for personal growth and mastery (Crawford et al., 2010). Conversely, administrative hassles, role conflict, and organizational politics, when appraised as hindrances, predicted diminished engagement, reinforcing the health-impairment pathway delineated in JD-R theory (Bakker & Demerouti, 2017).

Beyond corroborating existing theory, these findings extend the challenge–hindrance framework by situating appraisal processes within the unique context of rural township hospitals. Chronic resource scarcity, overlapping clinical and administrative duties, and high

community expectations create a complex stress ecology where identical demands may be variably appraised across individuals. Notably, in collectivist cultural settings like Guangxi, positive reappraisal may be reinforced by community solidarity and familial support networks, potentially amplifying the protective effects of challenge appraisal (Ganster & Rosen, 2013; Sinclair et al., 2020). This cultural-contextual insight underscores the need for appraisal-focused interventions—such as cognitive reframing training and peer support programs—that empower healthcare workers to reinterpret stressors constructively.

The study thus contributes to JD-R scholarship by highlighting appraisal as a central interpretive filter mediating the impact of job demands on engagement. It also offers practical implications: interventions targeting appraisal processes may enhance resilience and mitigate burnout, particularly in under-resourced healthcare systems where modifying structural demands is challenging. By integrating cognitive appraisal into the motivational – health impairment dual-pathway framework, this research advances a more dynamic understanding of work engagement mechanisms in underserved medical contexts.

5.2.5 Social support

The present findings emphasize that social support plays a conditional yet important role in shaping healthcare workers' engagement by interacting with cognitive appraisal processes. Consistent with the resource amplification perspective, social support significantly moderated the relationship between challenge appraisal and work engagement. Healthcare workers who cognitively framed job demands as challenges benefited more strongly from supportive professional networks, including peer cooperation, supervisory encouragement, and collegial recognition (van Stormbroek et al., 2023). This interaction suggests that social support may function as a resource amplifier, enhancing individuals' capacity to leverage positive appraisals into sustained work engagement. However, social support did not significantly buffer the negative effects of hindrance appraisal on engagement. This finding indicates that while interpersonal and organizational support can strengthen motivational pathways when job demands are appraised positively, such support may be insufficient to counteract the psychological depletion caused by resource inadequacy and organizational barriers (Blanch, 2016). In rural township hospitals where systemic resource shortages are chronic and structural barriers persistent, supportive relationships may not fully mitigate the strain imposed by uncontrollable hindrance demands.

These results are in line with recent meta-analytic findings that differentiate between the

resource-enhancing and resource-substitution functions of social support. While social support facilitates adaptive coping under challenge appraisals, its buffering capacity under hindrance conditions remains limited, particularly in highly resource-constrained healthcare environments (Paustian-Underdahl et al., 2023). This highlights the need for healthcare administrators not only to foster supportive work climates but also to address systemic deficiencies that fuel hindrance appraisals.

5.2.6 Work engagement

The integrative model tested in this study reaffirms the complex, multilevel determinants of work engagement in healthcare settings, particularly within resource-constrained township hospitals. Work engagement, operationalized as a state of vigor, dedication, and absorption, does not result directly from objective work conditions alone, but rather emerges from dynamic interactions among job demands, job resources, cognitive appraisals, and social support mechanisms (Bakker et al., 2023; Matheson et al., 2025).

The findings confirm that challenge appraisal serves as a critical psychological mechanism driving healthcare workers' engagement by framing demanding tasks as opportunities for growth and mastery. Positive cognitive interpretations activate intrinsic motivation, resulting in heightened enthusiasm and sustained energy at work (Matheson et al., 2025). In contrast, hindrance appraisal functions as a powerful depleting force, whereby healthcare providers experiencing job demands as uncontrollable barriers display lower engagement levels. This underscores that uncontrollable stressors such as resource inadequacy or excessive bureaucracy undermine psychological investment in work by exhausting emotional and cognitive resources (Zhang et al., 2025c). Importantly, these appraisal mechanisms are further shaped by the presence of job resources such as autonomy, and moderated by social support. Autonomy enables healthcare workers to exert control over work processes, enhancing their capacity to frame challenges positively, while supportive relationships further amplify these motivational gains (Taris et al., 2020). However, social support showed limited buffering capacity against hindrance appraisals, suggesting that organizational interventions addressing systemic deficiencies are equally critical for sustaining engagement in under-resourced healthcare environments (Paustian-Underdahl et al., 2023).

Collectively, this study extends engagement theory by demonstrating that healthcare work engagement in rural settings arises from both structural resources and psychological interpretive processes. The model highlights the necessity of adopting multifaceted interventions that target

not only job design but also appraisal flexibility, emotional regulation, and organizational resource investment to promote sustainable engagement among township hospital healthcare workers.

5.3 Theoretical implications

The findings of this study provide several important theoretical contributions to the expanding literature on work engagement within healthcare settings, particularly in resource-limited rural environments.

First, by confirming the differential roles of specific challenge demands, such as responsibility and time pressure, the study refines the traditional assumptions of the JD-R model regarding job demands. While the JD-R framework typically categorizes demands as either challenges or hindrances (Bakker et al., 2017), the present results emphasize that even within challenge demands, their motivational value may vary depending on cognitive appraisal processes (Sancho-Zamora et al., 2022). This nuanced perspective contributes to emerging discussions that advocate for a more granular classification of job demands beyond the simple challenge-hindrance dichotomy. Recent empirical research reinforces this perspective by showing that the motivational effects of challenge-type demands are highly contingent on contextual and psychological boundaries. For instance, a national study conducted during the COVID-19 pandemic in Thailand revealed that while responsibility and duty were initially sources of motivation for frontline healthcare workers, escalating time pressure and insufficient structural clarity ultimately led to emotional depletion and disengagement (Chinvararak et al., 2022). This suggests that job demands traditionally labeled as challenges may shift into hindrance territory under extreme or poorly supported conditions. Likewise, Dall Ora et al. (2020) emphasized in their theoretical review that demand categories such as time pressure and workload often exhibit dual characteristics. When coupled with high autonomy and support, these demands enhance performance and engagement, but in overextended or under-resourced contexts such as rural healthcare facilities they frequently precipitate burnout. These findings call into question static classifications within the JD-R model and support a more dynamic, appraisal-sensitive understanding of job demand effects in healthcare environments.

Second, the study enriches cognitive appraisal theory by empirically validating its mediating role between job characteristics and work engagement in frontline healthcare workers. Recent theoretical models have proposed that cognitive appraisal functions as a proximal cognitive mechanism linking environmental stressors to psychological outcomes

(Baig et al., 2022). The present evidence demonstrates how appraisals transform objective job features into subjective experiences that either facilitate or hinder engagement, thus offering a more psychologically grounded explanation for the variance in work engagement across healthcare professionals. This theoretical refinement aligns with emerging evidence that appraisal is a central transduction process converting environmental stimuli into affective and motivational outcomes. Wu et al. (2024) found that among ICU nurses, role ambiguity was associated with heightened anxiety primarily through appraisal-related mechanisms shaped by emotional intelligence. Nurses with greater emotional intelligence were better able to cognitively reinterpret ambiguous demands as manageable, thus buffering stress and sustaining functional outcomes. Similarly, Shan et al. (2023) demonstrated that the effect of job-related strain on engagement during the COVID-19 pandemic was significantly mediated by affective commitment an appraisal-derived response reinforced by perceived organizational support. These findings collectively reinforce the view that cognitive appraisal is not merely a byproduct of job structure, but a proximal mechanism that actively determines the emotional and behavioral consequences of healthcare stressors. By demonstrating that engagement outcomes vary not just with job characteristics, but with how those characteristics are subjectively interpreted, the current study provides empirical grounding for cognitive appraisal theory within high-pressure, resource-constrained clinical environments.

Third, the strong mediating role of challenge appraisal but weak mediating effect of hindrance appraisal reflects the asymmetry proposed in contemporary appraisal-based job stress theories. Recent work suggests that individuals may mobilize greater cognitive and emotional resources when perceiving job demands as challenges, whereas hindrance perceptions often trigger passive coping or emotional withdrawal (Chen et al., 2024a). This asymmetry emphasizes the importance of fostering environments that cultivate challenge appraisals while minimizing perceptions of hindrance. This appraisal asymmetry is further clarified by evidence from healthcare and experimental psychology. Ma et al. (2018) showed that while challenge demands such as responsibility were positively correlated with healthcare quality indicators, their impact was significantly moderated by appraisal type. Specifically, when frontline workers appraised these demands as manageable and meaningful, they reported higher engagement and performance. In contrast, the same demands, when perceived as hindrances, led to greater emotional exhaustion and decreased quality of care. From a cognitive-affective perspective, Jamieson et al. (2018) demonstrated that appraisal orientation fundamentally alters physiological and psychological responses to stress. Their findings reveal that reframing stressors as challenges—not threats—mobilizes approach-oriented responses and preserves

motivational energy. These results reinforce the idea that challenge and hindrance appraisals activate distinct cognitive-affective pathways, with only the former supporting sustained engagement. By situating this asymmetry within both healthcare and experimental contexts, the present study strengthens appraisal-based stress theories and supports interventions aimed at modifying appraisal orientation rather than merely reducing job demands.

Fourth, the finding that job autonomy significantly predicts challenge appraisal extends self-determination theory into the JD-R framework. According to recent research, autonomy not only fulfills basic psychological needs but also promotes positive cognitive evaluations of work demands, thus enhancing intrinsic motivation and engagement (Chen et al., 2022a). This integration further validates the critical role of personal control in shaping adaptive appraisal processes within highly structured healthcare organizations. This integration further validates the critical role of personal control in shaping adaptive appraisal processes within highly structured healthcare organizations. In a large-scale study of Dutch healthcare professionals, Havermans et al. (2017) demonstrated that perceived autonomy significantly attenuated the relationship between a low psychosocial safety climate and stress outcomes. Notably, individuals with high job autonomy were more likely to appraise institutional stressors as manageable rather than threatening, reinforcing the appraisal-enhancing function of autonomy in demanding clinical environments. Complementarily, Lin et al. (2025) found that among Chinese nurses, work engagement served as a psychological channel linking professional calling to reduced turnover intention, with autonomy-fueled reappraisal playing a crucial role in strengthening this linkage. These findings underscore that job autonomy does not operate merely as a structural resource, but as a dynamic psychological condition that facilitates positive reinterpretation of complex demands. Embedding this perspective within the JD-R framework reinforces a cognitive-motivational model in which autonomy transforms external job features into motivational opportunities through appraisal mechanisms, thus deepening the integration of self-determination theory with real-world healthcare stress dynamics.

Fifth, the observed moderation effect of social support on the relationship between challenge appraisal and work engagement aligns with contemporary models emphasizing the resource-enhancing function of social networks. As recent studies show, social support may amplify the benefits of positive appraisals by providing emotional validation and instrumental assistance, thereby facilitating higher engagement levels under challenging conditions (Ginbeto et al., 2023). Conversely, its limited effect on hindrance appraisal suggests that support may be less effective in counteracting resource-draining stressors deeply embedded in systemic organizational structures. Yet, within the domain of challenge appraisal, social support exerts

its strongest influence by reinforcing perceptions of controllability and shared purpose. Gillman et al. (2023) demonstrated that both perceived social support and social identification significantly enhanced the likelihood of appraising work-related demands as challenges rather than threats. This effect was mediated through reduced perceived stress and improved emotional coherence, suggesting that social bonds do more than buffer distress they reshape appraisal trajectories toward motivationally constructive interpretations. Complementing this, Carbone et al. (2022) reviewed peer support practices among healthcare workers and concluded that structured interpersonal support not only stabilized emotional responses but also enhanced cognitive flexibility during crisis scenarios. Such interpersonal scaffolding allowed workers to sustain a constructive orientation toward demanding tasks and maintain engagement under volatile clinical conditions. These findings converge on the conclusion that social support functions less as a direct counterforce to structural strain, and more as a psychological amplifier that conditions the appraisal lens through which workers interpret and respond to occupational demands.

Furthermore, the findings contribute to the growing recognition that emotional regulation capacity serves as a critical boundary condition shaping the efficacy of both cognitive appraisal and social support mechanisms. As recent evidence indicates, healthcare professionals with higher emotion regulation abilities are more capable of reframing job demands and mobilizing support resources to sustain engagement, even under high-stress conditions (Wobeto et al., 2023). This highlights the need for integrating emotional regulation training into organizational interventions aimed at optimizing work engagement in complex healthcare environments. This highlights the need for integrating emotional regulation training into organizational interventions aimed at optimizing work engagement in complex healthcare environments. Evidence from acute care settings indicates that emotion regulation does not operate in isolation, but dynamically interacts with cognitive appraisal under fluctuating work pressures. In a qualitative study, Isbell et al. (2020) found that emergency department physicians and nurses frequently experienced conflicting emotional states when managing time-sensitive cases, and their regulation strategies particularly cognitive reappraisal significantly influenced their ability to maintain attentional focus and engage empathetically with patients. Importantly, the capacity to regulate emotion altered how demands were perceived and responded to in real time. Complementing this, Martin-Brufau et al. (2020) demonstrated that among medical residents, individuals who employed adaptive regulation strategies such as positive reappraisal and emotional distancing reported lower levels of burnout and greater perceived work meaning, even under high workload conditions. These findings reinforce the view that emotion regulation

is not merely a coping skill but a boundary condition that shapes how healthcare professionals cognitively interpret and behaviorally respond to complex demands. Within appraisal-based models of work engagement, this capacity functions as a moderator that conditions the psychological impact of both job characteristics and social inputs.

Finally, this study advances the broader integration of multilevel theoretical models in explaining healthcare worker engagement by simultaneously incorporating job demands-resources theory, cognitive appraisal theory, conservation of resources theory, and self-determination theory. The interaction between structural job features, cognitive evaluations, personal emotional regulation capacities, and external social support systems illustrates a dynamic, multi-pathway model of work engagement highly applicable to resource-constrained healthcare systems. Such integrative models recognize that engagement is not solely determined by static job characteristics but emerges from complex interactions between individual appraisal processes, emotional coping mechanisms, and organizational contexts (Taris et al., 2020). Such integrative models recognize that engagement is not solely determined by static job characteristics but emerges from complex interactions between individual appraisal processes, emotional coping mechanisms, and organizational contexts. This complexity has been underscored by meta-analytic and applied research in both psychological theory and clinical settings. Yeo and Ong (2024), in a comprehensive review of cognitive appraisal-emotion linkages, concluded that appraisal not only precedes emotion but systematically modulates its valence and intensity, thereby influencing motivational orientations toward work demands. Their findings reinforce that appraisal functions as a core mechanism through which structural and interpersonal conditions are psychologically encoded. Complementing this, Martin-Brufau et al. (2020) observed that among healthcare residents, those employing adaptive emotion regulation strategies such as cognitive reappraisal and emotional distancing were more likely to sustain engagement and report lower burnout, even under high workload. These effects were mediated by the appraisal lens through which stressors were interpreted, emphasizing appraisal' s embeddedness within broader multilevel regulatory systems. Together, these studies support a refined understanding of engagement as a context-sensitive outcome shaped by a constellation of job characteristics, evaluative schemas, and self-regulatory capacities an architecture well captured by the integrated JD-R, COR, SDT, and appraisal-based frameworks adopted in this study. These findings underscore the necessity for future engagement research to adopt holistic, interdisciplinary frameworks that fully capture the psychosocial ecology of healthcare work, particularly within fragile and under-resourced systems where conventional models may not fully apply.

5.4 Practical implications

The findings of this study generate several actionable recommendations for healthcare administrators and policymakers aiming to enhance work engagement among healthcare workers, particularly in rural and resource-constrained healthcare systems.

First, the differential effects of responsibility and time pressure suggest that healthcare organizations should focus on balancing job demands by enriching responsibility while alleviating excessive time pressure. As demonstrated by Schmitt et al. (2015), responsibility enhances intrinsic motivation when accompanied by sufficient temporal resources, whereas uncontrolled time pressure erodes engagement by overwhelming cognitive processing capacities. Therefore, optimizing work schedules and limiting administrative overload may enable healthcare professionals to derive motivation from their core clinical responsibilities.

Second, the significant role of resource inadequacy in predicting hindrance appraisal highlights the urgent need for system-level investments in rural healthcare infrastructure. According to Maganty et al. (2023), shortages of essential equipment, staffing, and medical supplies remain persistent barriers to sustainable healthcare delivery in underserved regions. Governments must prioritize resource allocation to rural hospitals to mitigate Hindrance demands that directly impair both care quality and staff engagement.

Third, the observed predictive role of job autonomy on challenge appraisal emphasizes the value of empowering healthcare workers through participative management structures. Han (2023) confirmed that autonomy-supportive work environments stimulate cognitive mastery over work demands, reinforcing healthcare workers' psychological ownership and commitment to patient care. Policymakers should thus promote decentralization of clinical decision-making to foster adaptive appraisal and work engagement.

Fourth, the mediating role of cognitive appraisal points to the need for organizational interventions that strengthen appraisal flexibility. As noted by Sinclair et al. (2020), cognitive-behavioral training programs can enhance healthcare workers' ability to reframe job stressors as opportunities for personal growth, thereby improving both engagement and well-being. Integrating cognitive appraisal modules into professional development curricula may thus serve as a cost-effective intervention for engagement enhancement.

Fifth, the moderating role of social support underscores the importance of cultivating supportive professional networks within healthcare teams. Evidence from Buljac-Samardzic et al (2020) suggested that peer support programs and mentorship structures buffer emotional strain and facilitate resource mobilization, thereby amplifying positive challenge appraisals.

Institutionalizing such programs can create resilient healthcare teams capable of sustaining engagement even under challenging conditions.

Sixth, the limited buffering effect of social support under hindrance appraisals emphasizes that structural reforms are indispensable for long-term engagement sustainability. As argued by Junaković and Macuka (2021), organizational-level hindrance factors such as bureaucratic complexity, role ambiguity, and politicized decision-making cannot be adequately mitigated through interpersonal support alone. Therefore, administrative streamlining and policy transparency are essential to complement micro-level engagement strategies.

Finally, as the analysis highlights, psychological resources such as job autonomy, cognitive appraisal, and social support emerge as central levers for enhancing engagement among township hospital staff. Given the observed strong mediating role of challenge appraisal and the moderating function of social support, healthcare administrators should prioritize psychological capital enhancement programs. Zhang et al. (2024d) indicated that interventions aimed at strengthening psychological capital including self-efficacy, optimism, resilience, and hope can directly augment cognitive appraisal processes and enable healthcare workers to better transform challenge demands into motivational experiences. Implementing such evidence-based psychological resource interventions would complement structural job redesign efforts, thus maximizing work engagement across diverse staff groups even within resource-constrained environments. The findings of this study generate actionable recommendations at multiple organizational levels to enhance work engagement among healthcare workers in township hospitals, particularly within resource-constrained rural healthcare systems.

5.4.1 For health administrative authorities (macro-system level)

At the policy-making level, resource inadequacy emerged as the most potent hindrance stressor directly impairing cognitive appraisal and diminishing healthcare worker engagement. This underscores the critical importance of macro-level resource allocation reform as the first policy priority. Health authorities must initiate system-wide infrastructure enhancement programs targeting persistent shortages in human capital, medical equipment, diagnostic technology, and pharmaceutical supply chains. As emphasized by He et al. (2024), rural healthcare systems globally continue to face severe deficits that undermine both service delivery quality and workforce sustainability. Establishing long-term rural infrastructure development funds and legally binding financial protection mechanisms would ensure consistent and equitable resource distribution favoring township hospitals. Moreover, dynamic allocation models that adjust funding formulas based on actual workload, patient complexity, and catchment population

indicators may enhance fiscal responsiveness to rural service demands (Ao et al., 2022).

In parallel, bureaucratic simplification policies should be enacted to address administrative overload as an indirect contributor to cognitive strain. Excessive documentation, rigid reporting requirements, and fragmented supervision structures elevate perceived hindrance demands without improving care quality. As argued by Pawelczyk et al. (2025), targeted regulatory streamlining can release valuable clinical time while mitigating unnecessary procedural burdens that fuel disengagement and burnout. Beyond structural interventions, psychological capital development should be institutionalized as a national healthcare workforce strategy. Psychological capital, encompassing resilience, optimism, hope, and self-efficacy, serves as a personal resource reservoir that buffers cognitive strain and sustains engagement even under high-demand conditions (Grundy et al., 2020). National health ministries should integrate comprehensive psychological capital enhancement programs into continuing professional education frameworks, particularly tailored for rural healthcare professionals who face chronic resource volatility. Evidence from Akinnusotu et al. (2023) demonstrates that psychological capital interventions not only reduce burnout rates but also enhance adaptive cognitive appraisal processes fundamental to sustaining long-term engagement. Furthermore, health authorities should encourage data-driven workforce forecasting systems to better anticipate staffing demands, minimize vacancy rates, and prevent workload saturation. Advanced predictive models incorporating demographic shifts, disease burden transitions, and technological advancement trajectories can improve macro-level workforce planning accuracy, ultimately reducing chronic exposure to both challenge and Hindrance demands (Zhou et al., 2025b).

Finally, intergovernmental coordination mechanisms should be strengthened to align rural development, public health, education, and workforce retention policies under unified strategic frameworks. Such cross-sectoral integration can address both material shortages and motivational deficits simultaneously, creating more resilient and engaged rural healthcare systems.

5.4.2 For tertiary hospital leading units (regional coordination level)

Tertiary hospitals, as regional coordinators and technical anchors within the healthcare system, play a central role in bridging resource gaps and enhancing the cognitive and emotional engagement of township hospital staff. Their intervention should extend beyond clinical supervision into structured capacity-building, cognitive empowerment, and emotional support programs.

First, tertiary hospitals should establish a standardized clinical autonomy delegation

framework that allows controlled transfer of decision-making authority to township hospitals. This framework must specify clear clinical boundaries, authorized diagnostic categories, and safety protocols, accompanied by scheduled remote consultations and second-opinion mechanisms. Macphee et al. (2012) have demonstrated that such empowerment-based leadership significantly increases responsibility appraisal, which directly activates positive cognitive evaluations and enhances intrinsic work engagement.

Second, tertiary hospitals should implement regional homogenized clinical training platforms to ensure skill consistency across township healthcare providers. Structured rotation programs could allow township physicians and nurses to receive short-term clinical attachments at tertiary hospitals while enabling senior specialists to conduct on-site mentorship in township facilities. As Arends et al. (2022) have shown, such bidirectional clinical exposure improves not only technical proficiency but also boosts healthcare workers perceived competence and resilience against complex work demands.

Third, a critical non-technical intervention involves the integration of cognitive flexibility and emotional regulation training into regional educational offerings. Sinclair et al. (2020) highlighted that healthcare workers who undergo cognitive-behavioral appraisal training exhibit greater ability to reframe job demands as developmental challenges while minimizing the perception of uncontrollable stressors. Tertiary hospitals are uniquely positioned to lead these interventions by leveraging their psychological expertise and training infrastructure.

Fourth, tertiary hospitals should coordinate the creation of regional peer support networks, including multidisciplinary reflection forums, monthly clinical case discussions, and confidential consultation hotlines. Weaver et al. (2014) demonstrated that peer-support structures serve as powerful resource amplifiers by creating safe spaces for sharing experiences, reducing emotional isolation, and fostering collective problem-solving cultures.

Fifth, tertiary hospitals can play a crucial role in administrative simplification taskforces by collaborating with township hospitals and local authorities to streamline bureaucratic procedures that often exacerbate hindrance appraisals. As Jain et al. (2020) emphasized, coordinated administrative restructuring can release frontline healthcare workers from excessive reporting burdens, allowing more cognitive capacity to focus on patient-centered care.

By adopting this integrated, multi-domain strategy, tertiary hospitals can move beyond their traditional supervisory role and become active architects of psychological safety, professional development, and engagement sustainability for township hospital personnel.

5.4.3 For township hospital administrators (local management level)

Township hospital administrators serve as the immediate managerial interface responsible for shaping healthcare workers' daily experiences of work demands, resources, and engagement. Based on the findings, several highly actionable interventions are recommended at this operational level.

First, administrators must actively engage in workload optimization and task redistribution to minimize excessive administrative overload that contributes to hindrance appraisal. As Schmitt et al. (2015) emphasize, while responsibility strengthens intrinsic motivation, unmanaged time pressure impairs cognitive processing and engagement. Township administrators should regularly audit task allocations to delegate non-clinical activities such as excessive reporting, inventory management, and bureaucratic documentation to dedicated administrative staff or introduce digital automation tools to reduce clinicians' cognitive burden.

Second, administrators should implement real-time workload monitoring systems to dynamically adjust work schedules based on patient inflow, staff availability, and procedural complexity. This allows early identification of acute workload peaks and more equitable task assignments (Zhou et al., 2025b). Additionally, flexible shift scheduling may help staff maintain work-life balance, thereby preserving cognitive and emotional capacity for positive appraisal processes.

Third, leadership should prioritize the creation of internal peer-mentorship programs that institutionalize social support mechanisms within township hospitals. As Paustian-Underdahl et al. (2023) suggested, formal peer coaching frameworks provide both emotional buffering and cognitive guidance, enabling staff to reframe stressful demands as development opportunities. Mentor-mentee pairings should be carefully matched based on specialty expertise and psychosocial compatibility to maximize relational safety.

Fourth, cognitive-behavioral interventions targeting appraisal flexibility training should be introduced at the facility level. Sinclair et al. (2020) demonstrated that such interventions significantly enhance healthcare workers' capacity to reframe uncontrollable job demands, improving resilience and preserving engagement. Township hospitals can collaborate with tertiary hospital psychological units to design low-cost, high-impact workshops focused on cognitive reappraisal, emotional regulation, and stress inoculation techniques.

Fifth, administrators should establish participatory governance mechanisms to involve frontline staff in key decision-making processes related to clinical protocols, staffing models, and quality improvement initiatives. As van Stormbroek et al. (2023) noted, inclusive

management structures foster psychological ownership, autonomy satisfaction, and intrinsic motivation, thereby reinforcing challenge-based appraisal pathways and sustainable engagement.

Sixth, administrators must develop early-warning burnout detection systems using brief, validated screening tools administered at regular intervals. By proactively identifying individuals at risk of emotional exhaustion or disengagement, targeted interventions can be deployed before cognitive depletion escalates to clinical burnout (Labrague et al., 2021).

Through these highly targeted and implementable strategies, township hospital administrators can directly engineer supportive work environments that reduce hindrance appraisals, strengthen challenge perceptions, and optimize healthcare worker engagement despite systemic resource limitations.

5.4.4 Targeting rural township health workers in China (comprehensive integration and optimization)

Rural township health workers in China are at a critical intersection of heavy clinical responsibilities, scarce resources, excessive administrative burdens, and emotional exhaustion. The results of this study confirm that responsibility is a positive and challenging demand, while insufficient resources, excessive time pressure, and bureaucratic complexity are powerful sources of obstructive stress. To help these frontline practitioners maintain high levels of work engagement, multidimensional and personalized strategies must be developed to address the psychological and organizational vulnerabilities inherent in rural practice environments.

First, cognitive appraisal flexibility training is urgently needed to enhance the ability of township health workers to transform work demands into personal development opportunities. Based on the strong mediating role of cognitive appraisal confirmed in this study, cognitive behavioral workshops focusing on reappraisal techniques, adaptive problem solving, and scenario-based reflection can help health workers cognitively distinguish growth-enhancing responsibilities from unchangeable structural deficiencies. Sinclair et al. (2020) showed that health workers who received cognitive reappraisal technique training showed higher resilience and lower burnout rates even under complex clinical and administrative challenges. Localized customized workshops for townships should be systematically carried out, combining specific clinical cases and administrative frustrations to transform cognitive flexibility into real-time clinical coping strategies.

Second, emotional regulation ability should be actively cultivated to prevent uncontrolled negative influences from transforming controllable stressors into emotional exhaustion. This

study found that insufficient resources and time pressure were the core triggers of obstructive evaluations, both of which weakened emotional stability over time. Mindfulness-based interventions, emotional coaching, and cognitive diffusion exercises showed significant effects in reducing emotional exhaustion among healthcare workers (Yang et al., 2024). Township hospitals can integrate short-term psychological construction courses and structured emotional coaching into daily handovers, thereby integrating emotional regulation practices into routine clinical work rather than treating them as isolated psychological interventions, and further strengthen the construction of clinical psychology specialties in township hospitals through medical alliances and medical communities.

Third, establishing a strong peer support microsystem remains the cornerstone of emotional buffering and joint problem solving. Studies have confirmed that social support significantly enhances challenging evaluations, suggesting that establishing relational safety in clinical teams can prevent psychological isolation and disengagement. Paustian-Underdahl et al. (2023) emphasize that peer networks serve not only as emotional safety nets but also as cognitive co-regulatory systems that encourage adaptive appraisals. Township hospitals should establish small peer support groups of 3-5 clinicians that conduct weekly case reviews, emotional assessments, and mutual coaching to enhance professional solidarity and problem-solving skills.

Fourth, increasing opportunities for participatory decision-making is essential to enhance autonomy and strengthen challenging appraisals, both of which were important predictors of engagement in this study. Van Stormbroek et al. (2023) emphasize that even at the micro-department level, shared governance structures can directly enhance the intrinsic motivation and perceived control of healthcare workers. Township managers should institutionalize monthly "frontline governance forums" to allow employees to make suggestions for process optimization, care pathway redesign, and administrative simplification, thereby translating cognitive responsibility into organizational improvements.

Fifth, the development of psychological capital must be a core element of employee resilience building. This study and a growing body of empirical evidence highlight the impact of psychological capital (including self-efficacy, optimism, resilience, and hope) on cognitive evaluation and long-term engagement (Alatawi et al., 2022). Township health workers should incorporate structured psychological capital growth modules into their continuing education system, using reflective diaries, personal strengths assessments, vision building exercises, and scenario-based resilience simulations to gradually build a lasting personal resource reserve.

Sixth, targeted clinical skills improvement remains critical to strengthening positive challenging evaluations, and township health workers should systematically participate in

rotational training programs, online continuing medical education courses, and collaborative practice networks to enhance clinical competence and confidence (Gao et al., 2024).

5.5 Limitations and future directions

While this study offers valuable insights into the mechanisms of work engagement among township healthcare workers within an extended JD-R framework, several limitations must be acknowledged to guide future research.

First, the cross-sectional design of this study restricts its ability to establish causal relationships among the examined variables. Although the hypothesized mediation and moderation effects were supported by theoretical reasoning and empirical data, longitudinal or experimental studies are warranted to verify the temporal and dynamic nature of these psychological processes, particularly the evolving role of cognitive appraisal under fluctuating job demands.

Second, reliance on self-reported questionnaire data may introduce common method variance and potential response biases. Although well-validated scales and anonymity measures were employed to mitigate these issues, future studies could incorporate multi-source data, such as supervisor assessments, objective workload indicators, or physiological stress markers, to enhance the robustness and objectivity of measurement.

Third, the sample was limited to township hospitals in Guangxi Province, which may constrain the generalizability of the findings. Regional disparities in healthcare resource allocation, organizational culture, and managerial practices across different provinces in China may lead to varying engagement mechanisms. Therefore, replication studies in broader geographic regions and across multiple levels of the healthcare system—including urban hospitals and community hospitals are needed to validate and refine the model's applicability.

Finally, although social support was found to moderate the relationship between challenge appraisal and work engagement, its non-significant moderating effect on hindrance appraisal suggests the presence of unmeasured buffering mechanisms. Future studies may explore alternative moderators such as leadership style, organizational justice, or professional identity to further delineate the boundary conditions under which hindrance demands impair engagement.

Taken together, these limitations offer valuable avenues for theoretical refinement and practical advancement in developing sustainable work engagement strategies for healthcare personnel operating in resource-constrained rural settings.

Chapter6: Conclusion

6.1 Re-examining core research questions and objectives in context

6.1.1 Summary of research challenges and objectives

The rapid expansion of China's primary healthcare system tried to resolve structural contradictions stemming from resource shortages and management lag, which constitutes the central challenge addressed by this study. Although national healthcare reforms and the "Healthy China" strategy have expanded the coverage and functional scope of primary healthcare networks, township hospitals while tasked with clinical services, preventive care, and public health responsibilities continue to operate under severe constraints, including workforce shortages, outdated facilities, limited performance incentives, and restricted career advancement opportunities. These challenges have not only subjected healthcare workers to intense psychological stress and professional burnout but have also undermined service quality and the sustainability of the hierarchical medical system. Recognizing these contradictions provided the practical impetus for this study's focus on the relationship between job demands, resources, and work engagement.

6.1.2 Knowledge gaps in existing research

Previous studies have largely neglected the township-level context, focusing predominantly on urban tertiary hospitals or high-resource environments. While these studies offer valuable theoretical insights into stress management and work motivation, their external validity remains untested in low-resource primary settings. Township health centers face unique conditions characterized by intertwined responsibilities and chronic resource constraints, which may alter the types of stressors encountered, coping strategies adopted, and mechanisms driving work engagement compared to urban institutions. This gap implies that classical models may require adaptation in rural contexts, providing the theoretical entry point for this study.

6.1.3 Limitations of the JD-R model

While the JD-R model remains a central framework for stress research, it inadequately

distinguishes between different types of job demands and underexplores psychological mechanisms (Bakker & Demerouti, 2007). Specifically, it fails to differentiate between challenge demands and hindrance demands, which have been shown to exert opposing effects on psychological outcomes and behaviors. Moreover, the model overlooks the critical role of cognitive appraisal in mediating stress effects; individuals' subjective interpretations of stressors largely determine whether they perceive stress as motivating or debilitating (Sinclair et al., 2020). By introducing cognitive appraisal as a mediating variable, this study sought to address this theoretical shortcoming.

6.1.4 Unintegrated role of multi-level social support

Another theoretical gap lies in the fragmented treatment of social support. Although prior literature acknowledges the importance of organizational and coworker support, it seldom examines the combined impact of external support sources—such as community and family—and their interaction with stress–cognition pathways. This study incorporates social support as a moderating mechanism, exploring its buffering and amplifying effects across different cognitive pathways and providing a novel lens for contextualizing the JD-R framework.

6.1.5 Research objectives and analytical innovations

In response to these challenges and gaps, this study set clear objectives and adopted an innovative analytical approach. It distinguishes between challenge and hindrance demand to examine their differential impacts, introduces cognitive appraisal to reveal the psychological mechanisms linking stress to engagement, and incorporates social support as a moderator to refine the overall framework. Ultimately, this study tests and modifies the applicability of the JD-R model in township health centers, contributing to cross-context theoretical generalization while offering empirical insights for workforce management and psychological interventions in primary healthcare. This response not only addresses existing research dilemmas but also systematically enriches and extends theory and practice.

6.2 Major findings and core contributions

6.2.1 Multi pathway relationships between stress, resources, cognition, and engagement

This study systematically elucidates the multi-pathway relationships linking stress, resources, cognition, and work engagement, marking the first empirical validation and contextual

extension of the JD-R model in China's township health centers. Using structural equation modeling, the study confirms the differentiated effects of challenge and hindrance demand and integrates cognitive appraisal and social support mechanisms into a refined stress–resource–engagement framework. Results indicate that challenge demand tend to foster positive cognitive appraisals that enhance work engagement, whereas hindrance demand induce negative appraisals that erode engagement. This finding not only validates the feasibility of stress bifurcation in primary care settings but also informs practical interventions: challenge demand should be leveraged as motivational forces, while hindrance demand must be mitigated through organizational reforms and managerial interventions.

6.2.2 Bridging role of work resources

The study further demonstrates the bridging role of work resources in linking stress to engagement, with effects particularly pronounced in low-resource contexts. Autonomy, control, and training opportunities directly enhance positive cognition and engagement while indirectly amplifying the beneficial impact of challenge demand. Notably, primary care workers exhibit heightened sensitivity to resource improvements compared to their urban counterparts; even modest enhancements—such as streamlined workflows or basic training—yield disproportionately large gains in motivation and engagement. This highlights the leverage effect of resource optimization in resource-constrained environments, offering a cost-effective management strategy for health systems facing chronic shortages.

6.2.3 Cognitive appraisal as a dual mediator

One of the study's key innovations lies in identifying the dual mediating role of cognitive appraisal. The same job demand can elicit diametrically opposite psychological and behavioral outcomes depending on appraisal: when construed as a challenge, stress motivates growth and engagement; when perceived as a hindrance, it triggers negative emotions and burnout, heightening turnover intentions. This nuanced understanding underscores the centrality of cognitive processes in stress dynamics and suggests that interventions should prioritize reshaping stress appraisals rather than merely reducing stress exposure.

6.2.4 Dual moderating effects of social support

The moderating role of social support introduces a novel dimension to the JD-R model. High levels of social support not only magnify the positive effects of challenge appraisals but also

buffer the negative consequences of hindrance appraisals, thereby acting as a stabilizing force within the stress–cognition–engagement pathway. This effect is particularly salient in township settings, where support networks extend beyond organizational boundaries to include colleagues, community structures, and family systems. The findings advocate for multi-level support strategies spanning institutional, interpersonal, and community domains—to holistically enhance psychological well-being and work engagement.

6.2.5 Overall contributions

In sum, this study integrates stress bifurcation, cognitive mediation, and social support moderation into the JD-R framework and validates this model within primary healthcare settings. By addressing the limitations of traditional theory in low-resource environments, the study offers a novel analytical lens for understanding rural healthcare workers' psychological mechanisms and provides actionable insights for optimizing workforce management and mental health interventions. Through mobilizing challenge stress, mitigating hindrance stress, optimizing resources, and building multi-level support systems, primary care institutions can enhance workers' job satisfaction, organizational commitment, and ultimately, healthcare quality and system sustainability.

6.3 Theoretical and practical implications

6.3.1 Theoretical contributions: contextualizing and extending the JD-R model

This study achieves a dual breakthrough in theory by contextualizing and extending the JD-R model. Traditionally validated in high-resource and structurally stable organizations, the JD-R framework is here applied to a resource-constrained, multi-task primary healthcare environment. The results affirm the model's foundational applicability while revealing its unique manifestations in low-resource settings. By integrating stress bifurcation and cognitive appraisal into a unified framework, this research provides fresh explanatory power for the differentiated stress effects observed in rural healthcare, thereby broadening the theoretical boundary of the JD-R model and setting the stage for cross-cultural and cross-sector investigations.

6.3.2 Methodological innovations

The study's methodological contributions are equally noteworthy. By incorporating both

mediating (cognitive appraisal) and moderating (social support) mechanisms into structural equation modeling, the research advances a multi-layered analytical approach to stress–engagement dynamics. This dual-mechanism integration enhances the model's precision and predictive capacity and offers a blueprint for future research designs, especially in complex real-world settings where psychological and behavioral mechanisms interact dynamically. Future scholars can build on this approach by employing longitudinal and multi-level designs to capture the temporal and hierarchical nature of stress–resource processes.

6.3.3 Practical value: actionable strategies for primary healthcare management

Practically, the study provides a multi-tiered intervention roadmap for optimizing workforce well-being and engagement in township health centers. Recommendations include systematically reducing hindrance demand through workflow optimization and role clarification; actively bolstering challenge appraisals via enhanced autonomy, training, and career pathways; and establishing comprehensive support networks encompassing organizational care, peer assistance, and community/family engagement. Such strategies can directly alleviate burnout, strengthen professional commitment, and improve service quality, ultimately informing policy initiatives aimed at stabilizing the rural healthcare workforce and enhancing public health outcomes.

6.3.4 Integrated contribution

Collectively, the theoretical refinement, methodological innovation, and practical strategies presented here significantly enrich the JD-R framework and offer transferable insights for both academic and policy domains. The study's multi-dimensional perspective holds relevance for cross-regional and cross-cultural applications, underscoring its potential to inform international debates on workforce resilience in primary healthcare systems.

6.4 Synthesis of research question responses

6.4.1 Comprehensive resolution of core research questions

This study systematically addressed its core research questions, confirming key theoretical assumptions while adapting them to the primary care context. Regarding how challenge and hindrance demand influence cognitive appraisal and work engagement, findings reveal divergent pathways: challenge demand evoke positive appraisals that enhance engagement,

whereas hindrance demand trigger negative appraisals that diminish motivation and heighten burnout. Importantly, field observations indicate that in township health centers—where tasks are multifaceted and resources scarce—challenge demand (e.g., heavy outpatient loads, emergency public health responses) are often perceived as opportunities for skill development and professional fulfillment, while hindrance demand (e.g., bureaucratic burdens, unclear policies, stalled promotions) are widely regarded as key drivers of emotional exhaustion and turnover intent.

6.4.2 Mechanisms of work resources and social support

In addressing how work resources shape engagement, the study demonstrates that resources exert both direct and indirect effects, amplifying positive appraisals and engagement. Primary care workers reported that access to basic equipment, flexible scheduling, and training opportunities reframed demanding tasks as developmental rather than oppressive. Moreover, cognitive appraisal emerged as a dual mediator, while social support acted as a dual moderator—magnifying the benefits of challenge appraisals and buffering the harms of hindrance appraisals. This multi-level support effect underscores the importance of organizational, peer, community, and familial networks in sustaining engagement amid structural constraints.

6.4.3 Contextual adaptation of the JD-R model

The JD-R model's applicability in township health centers is affirmed but requires contextual refinement. In resource-limited, high-demand environments, the detrimental impact of hindrance demand is intensified, while the protective effects of resources and support are magnified. These findings highlight the necessity of adapting classical frameworks to account for context-specific sensitivities—such as heightened responsiveness to incremental resource changes and greater reliance on social support—when applying them to rural healthcare settings.

6.4.4 Broader contributions

Ultimately, this study not only resolves its initial research questions but also generates new theoretical and practical propositions. By elucidating the interplay of stress types, cognitive mechanisms, and multi-level support systems, it offers a comprehensive framework for understanding and enhancing work engagement among rural healthcare workers. This framework identifies resource optimization, support enhancement, and positive cognitive

framing as pivotal levers for intervention, charting clear directions for future research and applied policy design.

6.5 Overall synthesis

6.5.1 Comprehensive theoretical and practical contributions

Anchored in the stress–resource–cognition–engagement nexus, this study offers the first systematic validation and extension of the JD-R model within China's township health centers, providing both a novel theoretical framework and actionable insights into the psychological mechanisms of rural healthcare workers. By distinguishing between challenge and hindrance demand, uncovering the dual mediating role of cognitive appraisal, and demonstrating the dual moderating role of social support, the study constructs an integrated model that elucidates previously unexplained variations in stress outcomes. Crucially, it reframes stress in primary care not as a unidimensional burden but as a dual-faceted force—harboring both risk and opportunity—thus offering a transformative perspective on workforce resilience.

6.5.2 Dual breakthroughs in theoretical development

The study achieves a twofold theoretical advance: expanding the JD-R model's structure and adapting its application to low-resource settings. While confirming the model's baseline applicability, the research highlights the need for contextual refinements incorporating cognitive and support dimensions to better capture the complexities of rural healthcare environments. This dual contribution enriches international JD-R scholarship and provides a new reference point for cross-cultural stress–engagement research.

6.5.3 Actionable implications for practice and policy

Practically, the findings yield a structured roadmap for workforce and mental health interventions. Moving beyond simplistic stress reduction, the study advocates for a paradigm shift toward *stress optimization*: minimizing hindrance demand, fostering positive challenge appraisals, and building multi-level support networks spanning organizational, peer, community, and family domains. By aligning resource allocation, workflow redesign, and career development opportunities, township health centers can alleviate burnout, enhance professional fulfillment, and improve service delivery, thereby strengthening the resilience and sustainability of primary healthcare systems.

6.5.4 Broader significance and global relevance

Ultimately, this study not only resolves its initial research inquiries but also introduces new academic and practical propositions. It bridges a longstanding knowledge gap in China's primary healthcare research, challenges assumptions underpinning international JD-R applications, and advances a contextualized model with broad relevance across resource-constrained settings worldwide. As future studies refine and scale this model, it holds promise for guiding global strategies to enhance frontline healthcare resilience and advance the equitable development of primary healthcare systems.

6.6 Limitations and future directions

6.6.1 Acknowledging limitations and identifying avenues for advancement

While this study makes significant contributions in validating theoretical models and elucidating mechanisms, several limitations provide opportunities for refinement in future research. First, the cross-sectional design precludes causal inference. Although structural equation modeling revealed complex relationships among stress, resources, cognition, and engagement, data collected at a single point in time cannot capture temporal dynamics or long-term effects. Future research should employ longitudinal designs to track changes over time or quasi-experimental interventions (e.g., resource enhancement or psychological support programs) to strengthen causal claims.

6.6.2 Sample representativeness and contextual diversity

Second, the study's data were drawn from township health centers in Liuzhou, which, despite covering multiple counties and offering valuable diversity, may limit generalizability. Given regional disparities in economic development, health policy implementation, and workforce composition across China, broader sampling across eastern coastal, central, and western regions—including areas with varying ethnic compositions and resource levels—is essential to test the robustness and scalability of the model.

6.6.3 Expanding theoretical scope and multi-level analysis

Third, although the study extends the JD-R model by incorporating stress bifurcation, cognitive appraisal, and social support, it omits macro- and meso-level factors such as organizational

climate, cultural values, leadership styles, and policy shifts. Literature suggests that such higher-order variables shape stress perceptions and resource utilization patterns, potentially altering stress–engagement pathways. Moreover, while the present study successfully differentiated between challenge and hindrance demand, it did not systematically investigate specific stress sources such as time pressure, responsibility load, or administrative burden—that are particularly salient in primary care settings. The lack of fine-grained source identification may constrain the model's explanatory power for certain stress dynamics. Future research should integrate qualitative assessments or mixed-method approaches to map these nuanced stress sources and examine their interactions within the broader stress–resource–engagement framework.

6.6.4 Methodological diversification

Fourth, reliance on self-report questionnaires, while psychometrically robust, introduces risks of social desirability and common method biases. Future research should triangulate data sources—combining supervisor ratings, peer evaluations, patient satisfaction metrics, and objective performance indicators (e.g., absenteeism, turnover). Incorporating psychophysiological measures (e.g., heart rate variability, cortisol levels) and qualitative methods (e.g., interviews, focus groups) would yield a more nuanced understanding of cognitive mechanisms and support dynamics in stress response.

6.6.5 Applied research and intervention testing

Finally, future research should transition toward applied intervention studies. Building on this study's identification of cognitive appraisal and social support as pivotal mechanisms, future work could develop and evaluate targeted programs—such as cognitive reappraisal training, stress management workshops, peer-support groups, and organizational support initiatives—using randomized controlled trials to assess effectiveness. Integrating interventions across policy, organizational, and community levels will be crucial for institutionalizing psychological support within primary healthcare systems and achieving sustainable impact.

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Annex A: Job Demand & Job Control Scale

Job Demand & Job Control Scale					
Please evaluate and judge the following 15 descriptions based on your actual feelings and experiences in your work, and mark the number that best fits. The criteria for evaluation and judgment are as follows: 1. Strongly Disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree					
Strongly Disagree 1		Disagree 2	Not sure 3	Agree 4	Strongly agree 5
	Job demands				
1	To what extent do you agree that your job requires working very hard?				
2	To what extent do you agree that your job requires working very fast?				
3	To what extent do you agree that your job requires long periods of intense concentration?				
4	To what extent do you agree that your job is very hectic?				
5	To what extent do you agree that you have too much work to do everything well on your job?				
6	To what extent do you agree that you are not asked to do an excessive amount of work at your job? (reverse scored)				
7	To what extent do you agree that you have enough time to get the job done? (reverse scored)				
8	To what extent do you agree that do you agree that you are free of conflicting demands that others make on your job? (reverse scored)				
9	How frequently does your job require working under time pressure?				
	Job Control				
1	To what extent do you agree that your job allows you to make a lot of decisions on your own?				
2	To what extent do you agree that you have a lot of say about what happens on your job?				
3	To what extent do you agree that you can determine the order in which your work is to be done on your job?				
4	To what extent do you agree that you can determine when a task is to be done on your job?				
5	To what extent do you agree that you can determine your own work rate on your job?				
6	To what extent do you agree that you have very little freedom to decide how you do your work on the job? (reverse scored)				

Source: Gonzalez Mulé and Cockburn (2017)

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Annex B: Challenge/Hindrance stressor and Appraisal Scale

	Challenge/Hindrance stressor and Appraisal Scale				
	Please evaluate and judge the following 20 descriptions based on your actual feelings and experiences in your work, and mark the number that best fits. The criteria for evaluation and judgment are as follows: 1. Never, 2. Occasionally, 3. Sometimes, 4. Often, 5. Very often				
	Never	Occasionally	Sometimes	Often	Very often
	1	2	3	4	5
1	Having to complete a lot of work.				
2	Having to work very hard.				
3	Time pressure.				
4	Having to work at a rapid pace to complete all of my tasks.				
5	Performing complex tasks.				
6	Having to use a broad set of skills and abilities.				
7	Having to balance several projects at once.				
8	Having to multitask your assigned projects.				
9	Having high levels of responsibility.				
10	A high level of accountability for your work.				
11	Administrative hassles.				
12	Bureaucratic constraints to completing work (red tape).				
13	Conflicting instructions and expectations from your boss or bosses				
14	Unclear job tasks.				
15	Conflicting requests from your supervisor(s).				
16	Inadequate resources to accomplish tasks.				
17	Conflict with peers.				
18	Disputes with coworkers.				
19	Office politics.				
20	Coworkers receiving undeserved rewards/promotions.				
	Please evaluate and judge the following 6 descriptions based on your actual feelings and experiences in your work, and mark the number that best matches. The criteria for evaluation and judgment are as follows: 1. Never, 2. Occasionally, 3. Sometimes, 4. Often, 5. Very often				
	Never	Occasionally	Sometimes	Often	Very often
	1	2	3	4	5
1	Working to fulfill the demands of my job helps to improve my personal growth and well-being.				
2	I feel the demands of my job challenge me to achieve personal goals and accomplishment.				
3	In general, I feel that my job promotes my personal accomplishment.				
4	Working to fulfill the demands of my job thwarts my personal growth and well-being.				
5	I feel the demands of my job constrain my achievement of personal goals and development.				
6	In general, I feel that my job hinders my personal accomplishment.				

Source: Cavanaugh et al. (2000)

The items included in each part and sub scale are as follows:

Scale 1

Challenge demand: includes demands such as workload, work space, time pressure, task complexity, accounting, and responsibility. Includes 1-10 questions.

Hindrance stresses: included demands such as administrative hassles, role ambiguity, role conflict, resource inaccuracies, interpersonal conflict, and organizational politics. Includes 10-20 questions.

Scale 2

Challenge proposals: Includes 1-3 questions. Hindrance admissions: Includes 4-6 questions.

Source: Cavanaugh et al. (2000)

Annex C: Social Support Rating Scale

Social Support Rating Scale		
Name:	Sex:	Age:
Educational Attainments:	Occupation:	Marital Status:
Address or Organization:	Date:	

Instructions: The following questions are designed to measure your support received in society. Depending on the fact, please finish the rating scale in accordance with the specific requirements of each issue. Thank you for your cooperation.

1.How many intimate friends do you have, from whom you can receive support and help? (Exclusive Choice)

(1) None

(2) 1~2

(3) 3~5

(4) no less than 6

2.Over the past year, you (Exclusive Choice)

(1) stay away from family, and live alone

(2) often move the residence, and most of time live together with strangers

(3) live together with students, colleagues or friends

(4) live together with family

3.With your neighbors, you (Exclusive Choice)

(1) have a speaking acquaintance and never care about each other

(2) maybe have a little concern when meeting trouble

(3) are deeply concerned by some of them

(4) are deeply concerned by most of them

4.With your colleagues, you (Exclusive Choice)

(1) have a speaking acquaintance and never care about each other

(2) maybe have a little concern when meeting trouble

(3) are deeply concerned by some of them

(4) are deeply concerned by most of them

5.Obtain support and help from family members (Draw "√" in the suitable box)

	none	rarely	normally	full support

couple
parents
children
siblings
others (for example, sister-in-law)

6.In the past, when you encounter difficulties, what is the source that you ever received either economic support or practical problem-solving help?

(1) no source

(2) the following source (more than one answer is permitted)

A. spouse

B. other family members

C. friends

D. relatives

E. colleagues

F. companies

G. official or semi-official organizations, such as, parties, leagues and trade union

H. unofficial organizations, such as, religion, social group and etc.

I. others (please list)

7.In the past, when you encounter difficulties, what is the source that you ever received comfort and caring?

(1) no source

(2) the following source (more than one answer is permitted)

A. spouse

B. other family members

C. friends

D. relatives

E. colleagues

F. companies

G. official or semi-official organizations, such as, parties, leagues and trade union

H. unofficial organizations, such as, religion, social group and etc.

I. others (please list)

8.What is the way of talking when you are in trouble? (Exclusive Choice)

(1) never complain to anyone

(2) only complain to 1 oR² persons who have a close relationship with

(3) will talk to the friend who takes the initiative to inquiry

(4) take the initiative to talk their own troubles in order to get support and understanding

9.What is the way of seeking help when you are in trouble? (Exclusive Choice)

(1) just rely on myself, and do not accept the help of others

(2) rarely ask someone for help

(3) sometimes ask someone for help

(4) ask family, friends or organizations for help when facing troubles

10.Organized activities for groups (such as, party and youth league organizations, religious organization, trade union, student union and etc.), you . (Exclusive Choice)

(1) never attend

(2) occasionally attend

(3) often attend

(4) take the initiative to attend and are active with

Source: Huang et al. (2023)

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Annex D: Job Autonomy Survey

Job Autonomy Survey						
Please evaluate and judge your actual situation using the following three descriptions based on your actual feelings and experiences, and mark the number that best matches. The criteria for evaluation and judgment are as follows: 1.Very inaccurate, 2. Most of it is inaccurate, 3. Slightly inaccurate, 4. I don't know, 5. Slightly accurate, 6. Most accurate, 7. Very accurate						
Very inaccurate 1	Most of it is inaccurate 2	Slightly inaccurate 3	I don't know 4	Slightly accurate 5	Most accurate 6	Very accurate 7
1	I decide how to do the work myself.					
2	When completing tasks, this job gives me the opportunity to use my personal creativity or judgment.					
3	This job provides me with many opportunities to independently and freely complete work tasks.					

Source: Liu et al. (2007)

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Annex E: Utrecht Work Engagement Scale

Never	Hardly	Seldom	Occasionally	Often	Very frequent				Always		
0	1	2	3	4	5				6		
1	In my work, I feel like I'm bursting with energy.				0	1	2	3	4	5	6
2	I think the purpose of my work is clear and meaningful.				0	1	2	3	4	5	6
3	When I work, time always flies by.				0	1	2	3	4	5	6
4	When working, I feel strong and full of vigor.				0	1	2	3	4	5	6
5	I am passionate about my work.				0	1	2	3	4	5	6
6	When I work, I forget everything around me.				0	1	2	3	4	5	6
7	My work inspired me.				0	1	2	3	4	5	6
8	When I get up in the morning, I want to go to work.				0	1	2	3	4	5	6
9	When I get up in the morning, I want to go to work. When work is stressful, I feel happy.				0	1	2	3	4	5	6
10	I am proud of the work I have been engaged in.				0	1	2	3	4	5	6
11	I am proud of the work I have done. I am immersed in my work.				0	1	2	3	4	5	6
12	I can work continuously for a long time at once.				0	1	2	3	4	5	6
13	For me, my job is challenging.				0	1	2	3	4	5	6
14	I will reach a state of selflessness while working.				0	1	2	3	4	5	6
15	Even if I feel mentally fatigued while working, I can recover quickly.				0	1	2	3	4	5	6
16	I feel like I can't do without work.				0	1	2	3	4	5	6
17	In work, even if things don't go smoothly, I can always persevere.				0	1	2	3	4	5	6

Scoring method: The long form work engagement scale consists of three subscales: Vigor, Dedication, and Absorption, with a total of 17 questions. The total or average scores of the items included in each subscale can be calculated separately. The items included in each subscale are as follows:

1.Vigor: 6 questions, including questions 1, 4, 8, 12, 15, and 17.

2.Dedication: 5 questions in total, including questions 2, 5, 7, 10, and 13.

3.Absorption:6 questions, including questions 3, 6, 9, 11, 14, and 16.

Source: Schaufeli et al. (2002)