

New Pathways for Digital Health Technology Interventions for Workplace Anxiety

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Abstract. This study focuses on exploring new paths of digital health technology (DHT) intervention for workplace anxiety in the context of artificial intelligence. By exhaustively analyzing the current situation and causes of workplace anxiety and combining the latest advances in current artificial intelligence and digital health technology, this study successfully constructed a DHT-based workplace anxiety intervention model. The empirical results show that the model can accurately identify, scientifically assess and effectively alleviate anxiety symptoms in the workplace, significantly improving participants' negative emotions such as irritability and exhaustion, as well as significantly enhancing their emotion regulation ability. This study not only introduces an innovative approach to the field of workplace mental health intervention, but also provides strong support for improving employee mental health and promoting sustainable development of enterprises.

Keywords: digital health technology; workplace anxiety; emotion regulation; artificial intelligence.

1. Introduction

Workplace anxiety has become a widespread concern in society, significantly affecting individual mood, work efficiency and teamwork, and posing a serious challenge to personal health and business effectiveness^[1]. ADP China market research reveals that 20% of Shanghai's workforce suffers from anxiety due to daily work stress, which is the highest among China's first-tier cities, far exceeding that of Beijing, Guangzhou, and Shenzhen (see Figure 1). Given the importance of workplace anxiety to corporate sustainability, it is critical to explore effective intervention strategies. Under the framework of the "Healthy China 2030" strategy, digital health technology (DHT), as the core of innovation^[2], is leading the new trend of mental health interventions. DHT integrates cutting-edge technologies to provide a new way to accurately identify, scientifically assess, and effectively alleviate workplace anxiety, and shows great potential to optimize the work environment and enhance employee well-being. It shows great potential in optimizing work environment and enhancing employee well-being. This study focuses on the innovative application of DHT in the context of artificial intelligence, and aims to construct targeted intervention strategies and research frameworks to provide novel perspectives on workplace anxiety prevention and intervention, and to promote the psychological health of employees and the harmonious development of enterprises.

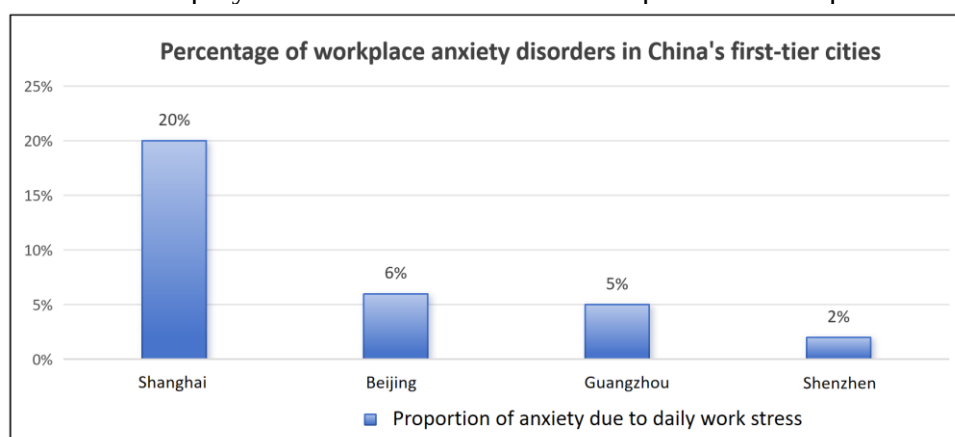


Figure 1. Percentage of workplace anxiety disorders in China's first-tier cities^[3]

2. Analysis of the current situation and causes of workplace anxiety

2.1. Definition and classification of workplace anxiety

Workplace anxiety refers to the emotions of tension, uneasiness and worry felt by individuals in their professional activities, which may be caused by factors such as job stress, career uncertainty, interpersonal relationships or organizational changes^[4]. Anxiety in the workplace manifests itself in two forms: state anxiety and trait anxiety. State anxiety is usually associated with a specific work environment, such as tight work deadlines or high-intensity tasks, while trait anxiety reflects an individual's long-term psychological tendencies^[5]. The popularity of digital work environments and telecommuting has added new dimensions to workplace anxiety, such as technology anxiety and feelings of social isolation. The causes of workplace anxiety are multifaceted, including individual personality traits, coping strategies, the work environment, and broader socioeconomic factors. An in-depth understanding of workplace anxiety is essential for developing effective management strategies and interventions, which not only help to maintain employees' psychological well-being, but are also key to enhancing organizational effectiveness.

2.2. Epidemiological characteristics of workplace anxiety

Workplace anxiety, as a prominent topic in the field of mental health in modern society, has attracted extensive attention and in-depth research in the academic world for its widespread existence and specific distribution pattern. According to the report "Workplace People 2023: Global Workforce Perspectives" released by ADP, the prevalence of workplace anxiety has reached an impressive level globally, with more than half of the workforce suffering from it, a statistic that not only highlights the widespread impact of workplace anxiety, but also reveals its severity as a global mental health challenge.

In China, the prevalence of workplace anxiety is even more pronounced, especially among the younger population, particularly Generation Z. The report shows that as many as 84% of Chinese people suffer from workplace anxiety. According to the report, as many as 84% of Chinese Gen Z workers experience mental anxiety at least twice a week, a rate much higher than the global average (see Figure 2), revealing that workplace anxiety is not only highly prevalent in China, but also shows a significant trend toward youthfulness. The intensification of this trend may be closely related to the socio-economic pressures, uncertainty of career development, and rapidly changing workplace environments that Gen Z is facing.

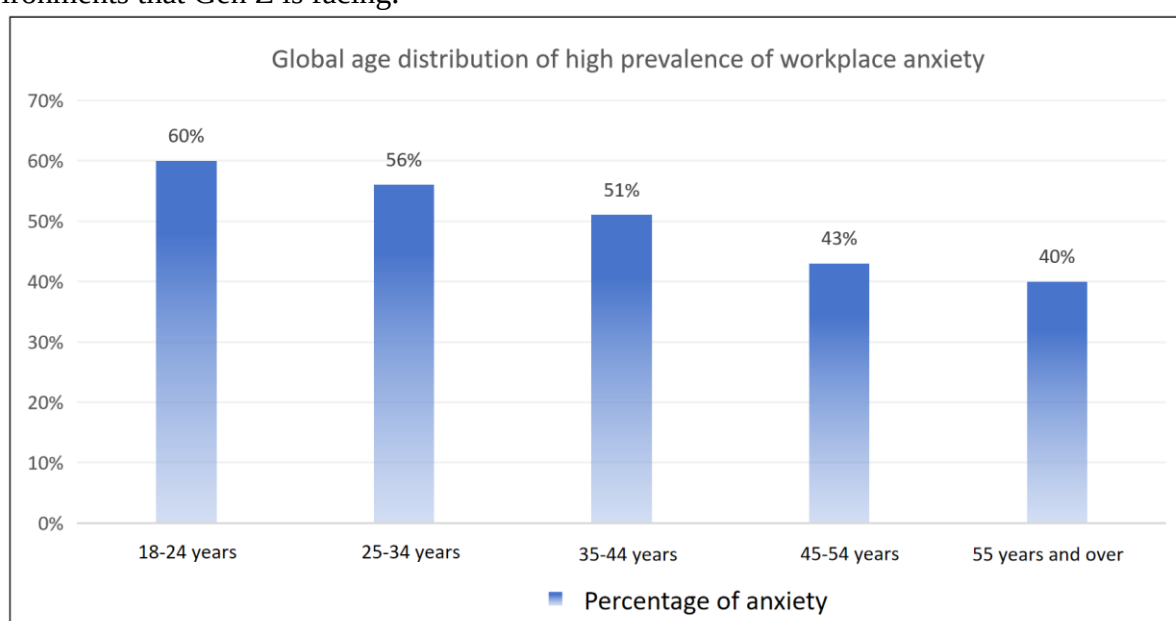


Figure 2. Global age distribution of high prevalence of workplace anxiety^[6]

Further observation reveals that workplace anxiety varies significantly across industries. The European Union (EU) and the World Health Organization (WHO) jointly published the European Framework Guidelines for Psychosocial Risk Management^[7], which covers ten dimensions and dozens of specific risk items, such as overwork, role conflict and job insecurity. When an individual faces two or more risks, he or she is defined as being at high risk of workplace anxiety. According to statistics, the proportion of high-risk groups is highest in the life services industry, while the transportation industry is relatively low, but the proportion of high-risk in each industry is no less than 14%. The life service industry, consulting industry and Internet industry ranked the top three in terms of the proportion of high-risk groups (see Table 1). Life service practitioners are prone to mental health problems due to their long working hours, the need to respond instantly to customer needs and solve customer problems, and the dual pressure of high-intensity physical or mental labor and emotional labor. Complex interpersonal relationships and communication barriers also exacerbate workplace anxiety in these industries. The causes of workplace anxiety are diverse and complex, and require the attention of all sectors of society to take effective measures to address them.

Table 1. Statistics on the percentage of high-risk population by industry^[8]

Sector	Life service industry	Consulting/Human resources	Internet/Software	Electronics/communications	Finance/Banking	Real Estate/Construction	Energy	Transportation
Percentage	34.74%	21.10%	20.31%	17.16%	16.62%	15.46%	14.81%	14.75%

2.3. Analysis of the causes of workplace anxiety

The causes of workplace anxiety are intricate and complex, covering multiple dimensions such as work pressure, interpersonal relationships, career development and personal factors. Under the background of intensified market competition, the high-intensity work pressure faced by workplace people becomes the main cause of anxiety. Meanwhile, disharmony in interpersonal relationships, especially competition among coworkers and communication barriers between supervisors and subordinates, also exacerbate anxiety. In terms of career development, the uncertainty of career prospects, the pressure for promotion, and the challenges of career transition all have a significant impact on workplace anxiety^[9]. Individual factors such as personality traits, coping strategies, and mental health status also play an important role in the development of workplace anxiety. Although interventions for workplace anxiety include a variety of approaches such as psychological counseling, medication, and mental health education, all of these measures have limitations. Counseling resources are limited, medication has variable long-term effects and may have side effects, and mental health education lacks targeted interventions. Therefore, it is urgent to explore more effective and targeted intervention strategies for workplace anxiety.

2.4. Limitations of traditional intervention methods

The current means of intervention for workplace anxiety, although covering a variety of ways such as psychological counseling, medication and mental health education, all face significant limitations. Although psychological counseling is effective for specific groups of people, its scarce resources make it difficult to meet the growing demand, and the lack of uniform standards for evaluating its effects leads to significant differences in the effectiveness of interventions among individuals. Although medication can alleviate anxiety symptoms in the short term, long-term dependence and side effects are prominent, limiting its widespread use. Although mental health education is dedicated to popularizing mental health knowledge, its content generally lacks specificity, making it difficult to effectively deal with the complexity of workplace anxiety in different occupational contexts. In addition, these approaches often fail to take individual differences into account, resulting in uneven

intervention outcomes. Given the prevalence and severity of workplace anxiety, there is an urgent need to develop more efficient, precise, and personalized intervention strategies to make up for the shortcomings of traditional methods and to provide more comprehensive and effective psychological support for workers.

3. Overview of the development of artificial intelligence and digital health technologies

3.1. Basis of artificial intelligence technology

Artificial Intelligence (AI) technology, as a core branch of computer science, focuses on exploring, developing and optimizing theoretical frameworks, methodological systems and technical means to simulate, enhance and even surpass human intelligence. Among them, machine learning, as a key technology, relies on algorithms and statistical models to empower computer systems to learn from data and continuously optimize. In particular, deep learning, as the deepening and expansion of machine learning, uses deep neural networks to parse complex data, showing excellent learning and generalization performance. In the field of healthcare, the application of AI has great potential, such as the deep learning-driven medical image analysis system, which can assist doctors in accurately detecting tumors and improve diagnostic accuracy; at the same time, machine learning algorithms have also achieved remarkable results in the prediction of diseases and the formulation of personalized treatment plans, etc., and provide a solid support for accurate medical treatment through the in-depth excavation of patients' genetic data, clinical records, and other information, not only greatly improving the efficiency and quality of medical services, but also improving the quality of healthcare services. This not only greatly improves the efficiency and quality of medical services, but also promotes the in-depth development of medical research.

3.2. Progress of digital health technology

Digital health technology (DHT), as a product of the deep integration of biotechnology and information technology, is leading health management and disease prevention and control towards a new era. This technology is based on the profound understanding of human life system from macro to micro, from appearance to essence, and realizes the cognitive leap from "material knowledge" to "constructive knowledge". Through high-precision sensors, cloud computing and big data analysis, DHT is able to capture and deeply excavate health data in all aspects, covering basic physiology to complex biomolecular information, and ensure immediate data transmission and efficient storage, laying the cornerstone for personalized health management. The popularization of wearable devices, mobile health apps and telemedicine enables medical services to break through geographical restrictions and realize convenient and efficient health monitoring and consultation. Meanwhile, the rise of semiconductor synthetic biology and digital twin technology has injected new vitality into DHT, with the former precisely regulating biological systems through engineering means, opening up new paths for drug R&D and biomanufacturing; and the latter constructing virtual biological models, realizing accurate simulation and prediction of life systems, and providing a scientific basis for personalized healthcare (see Figure 3).

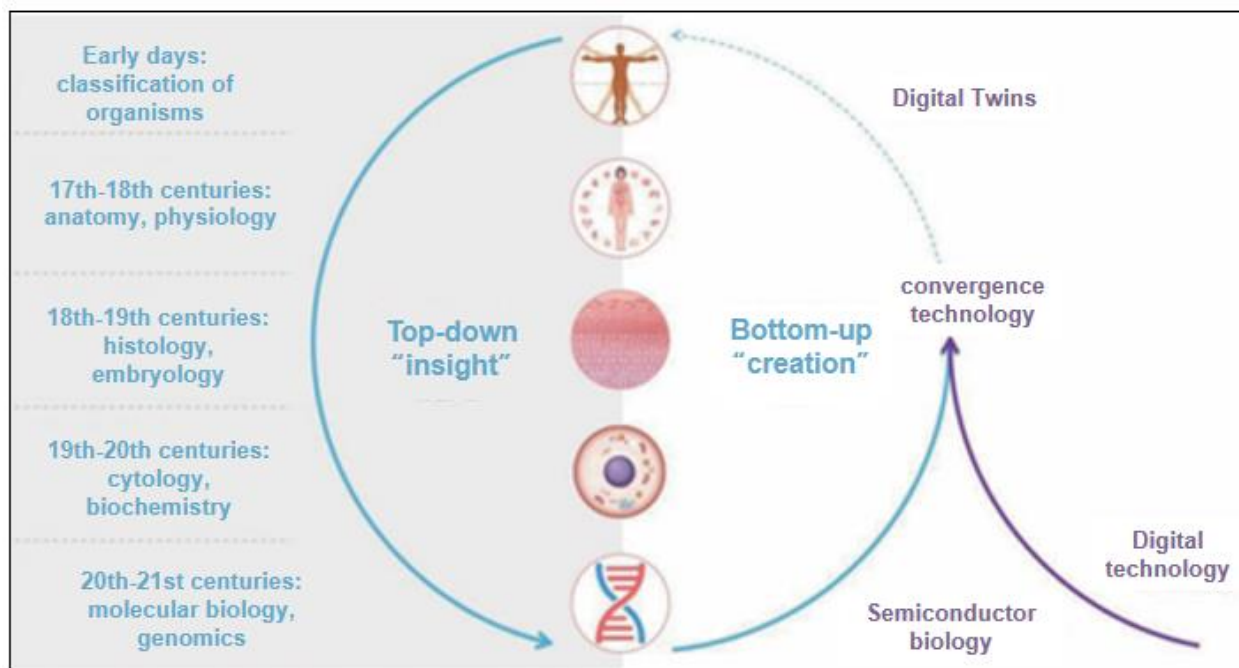


Figure 3. The evolution of digital health technology

3.3. Exploring the integration of artificial intelligence and digital health in workplace anxiety management

The deep integration of artificial intelligence (AI) technology and digital health technology (DHT) has become a research hotspot in the field of workplace anxiety management in the context of the current rapid development of science and technology. AI, as the core of computer science, demonstrates powerful data processing and analysis capabilities through machine learning, deep learning and other technologies; whereas DHT utilizes high-precision sensors, cloud computing and big data analysis to achieve comprehensive capture and deep mining of health data, providing a solid foundation for personalized management of workplace anxiety. This integration not only enables AI to analyze the physiological, behavioral and environmental information of the workforce, accurately identify signs of anxiety and provide early warnings, but also realizes the convenience and efficiency of health monitoring and consulting through wearable devices, mobile health apps and other tools, breaking through geographical restrictions and ensuring instant transmission and efficient storage of data. More importantly, this integration promotes the innovation of workplace anxiety management mode. By constructing virtual biological models and applying semiconductor synthetic biology and other technologies, researchers have been able to explore the physiological and psychological mechanisms of workplace anxiety in depth, which provides the basis for the development of scientific and reasonable intervention strategies. At the same time, AI also assists doctors in diagnosing and treating diseases, improving the accuracy and efficiency of medical decision-making, and providing more comprehensive and personalized mental health services for people in the workplace. With the continuous progress of technology and the expansion of application, the integration of AI and DHT will bring more innovations and breakthroughs in workplace anxiety management and continue to lead the development of the field.

4. Theoretical framework and applied practice of digital health technology in workplace anxiety intervention

4.1. Theoretical foundation construction

The theoretical framework and model of digital health technology intervention in workplace anxiety deeply integrates the essence of psychology, sociology and information science when

constructing its theoretical foundation. At the psychological level, the framework reveals the psychological mechanisms of workplace anxiety, especially the close connection between cognitive behavioral theories and anxiety thinking patterns; the sociological perspective focuses on the complex impact of workplace environment and social support on individual mental health; and information science provides strong technical support for the framework, covering the cutting-edge applications of big data analysis and artificial intelligence algorithms in health monitoring.

On this basis, the framework identifies the key factors of workplace anxiety, such as work pressure, interpersonal relationship and career development, and uses smart wearable devices to collect physiological data, such as heart rate and sleep quality, combined with semi-structured interviews to collect and obtain information about the psychological state, to construct an individualized anxiety assessment model. The model deeply analyzes the complex associations between data through machine learning algorithms to predict anxiety risk. In addition, the framework incorporates digital intervention strategies such as APP-based relaxation training, cognitive restructuring exercises, and workplace situation training simulated by virtual reality technology, aiming to enhance the individual's coping ability and psychological resilience, and at the same time, emphasizes the personalization and dynamic adjustment of the technology, and continues to optimize the program based on the feedback of the intervention effect. This theoretical framework not only realizes the organic integration of multidisciplinary theories, but also keeps up with the latest development of digital health technology, which provides a scientific guidance path for the effective intervention of workplace anxiety.

4.2. Intervention model design

The digital health technology intervention model, which integrates research findings from psychology and information science, provides a structured management program for workplace anxiety. The model is refined into three consecutive phases of identification, strategy selection, and action implementation from the cause, through to the outcome of emotion regulation, aiming to enhance an individual's ability to self-regulate anxiety. In the identification stage, the model uses smart devices to collect user data, which is analyzed by machine learning algorithms to identify signs of anxiety. In the strategy selection phase, based on the assessment results, the model customizes a personalized intervention plan for the user, including cognitive restructuring and behavioral change techniques. In the action implementation phase, the model provides immediate feedback and support by monitoring the user's physiological and behavioral responses in real time to help the user execute the intervention strategy. In addition, the effect monitoring and feedback mechanism within the model ensures continuous optimization of the intervention to adapt to the user's changing needs, thus enhancing the precision and effectiveness of workplace anxiety interventions (see Figure 4). The construction of this model not only provides a new path for the application of technology in the field of mental health, but also opens up new horizons for the prevention and treatment of workplace anxiety.

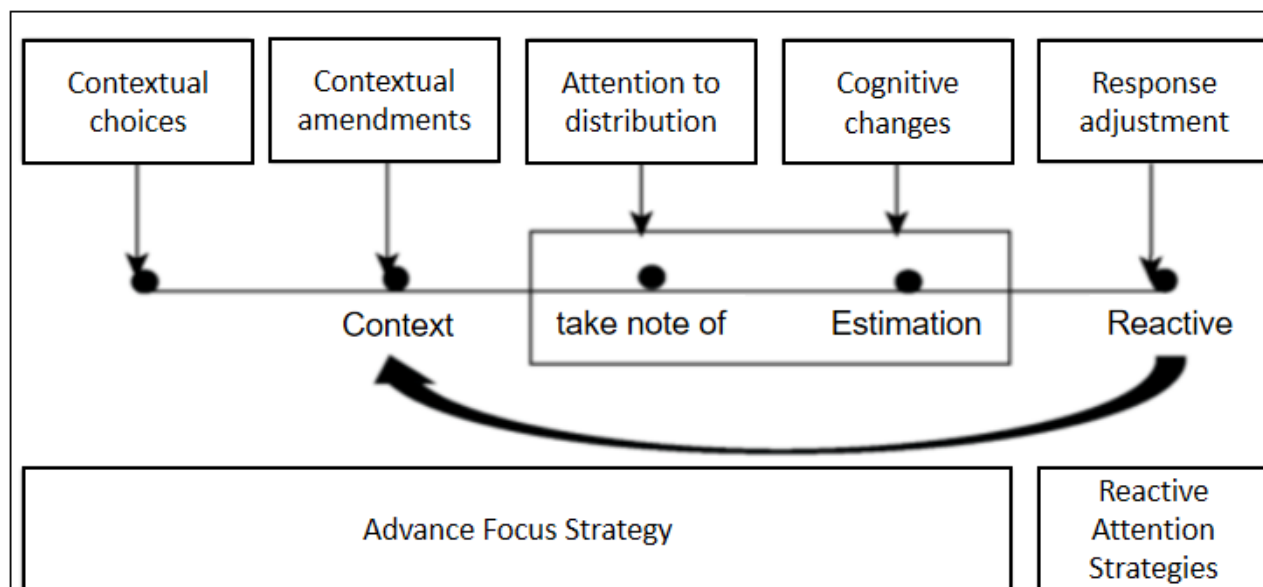


Figure 4. Flowchart of the intervention model

4.3. Application examples

Digital health technology intervention models have demonstrated strong potential and wide adaptability in practical applications, relying on key technologies such as machine learning, heart rate variability (HRV) monitoring and virtual reality (VR) to provide a variety of innovative solutions for workplace anxiety management. Salesforce utilizes machine learning algorithms in conjunction with HRV monitoring technology to accurately predict the impact of work stress on employees' Cisco provides real-time feedback through its developed health apps, helping employees adjust cognitive biases, learn and master relaxation and stress management skills, so that they can better manage their emotions in their daily work. Deloitte innovatively uses VR technology to simulate the Deloitte innovatively adopts VR technology to simulate the work environment and implement anxiety exposure therapy, so that employees can gradually adapt to and overcome the fear of work pressure in the virtual environment, which significantly improves their ability to cope with pressure^[10]. These successful application examples not only validate the practical utility of digital health technology in workplace anxiety intervention, but also lay a solid foundation for further promoting and deepening the application of this technology in the field of workplace mental health in the future, which indicates that it has a broad development prospect in promoting employees' mental health and enhancing work performance.

5. Conclusion

This study focused on the integration of artificial intelligence and digital health technology, and deeply explored its intervention effect on workplace anxiety. The empirical results show that the technology demonstrates significant advantages in accurate identification, scientific assessment and alleviation of anxiety symptoms, and in particular, it has a positive impact on the improvement of emotional state and the enhancement of emotional regulation. Based on this, this study suggests that the government should increase investment in research and development, and promote the development of relevant standards and regulations; enterprises should actively introduce digital health technology to build an intelligent mental health service system; and individuals should improve their ability to apply the technology in order to achieve effective self-management of mental health. At the same time, the study also recognizes the current limitations, such as the limited sample size and short intervention period. Future studies need to further expand the sample base, extend the intervention period, and strengthen interdisciplinary collaboration in order to comprehensively assess the long-term effects of interventions and explore more diversified intervention strategies. With the continuous

advancement of technology and the expansion of application areas, digital health technology will play a more important role in improving human mental health and building a healthy workplace environment.

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