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Progress in the Application of Future Thinking in Health Management of Patients with Chronic and Mental Illnesses

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Abstract: *This paper reviews the application and research progress of future thinking in managing diabetes, obesity, substance addiction, and mood disorders. It explores how future thinking can enhance health decision-making, self-management, and mental well-being. Suggestions for future research directions are also provided. This review aims to offer insights into effectively applying future thinking in chronic and mental illness health management strategies.*

Keywords: *Future thinking, Health management, Delay discounting, Decision making, Psychological intervention*

1. Background

Chronic and mental illnesses have become major challenges in global health management [1-2], and patients often require long-term self-management and behavioral interventions due to their high prevalence, vulnerability to relapse, and complexity of management[3]. However, the phenomenon of delay discounting (DD), in which future rewards depreciate in value with the degree of delay, leads patients to impulsively choose smaller immediate rewards in the immediate future over long-term future delayed gains[4], hindering adherence to healthy behaviors. Meanwhile, impaired prospective memory (PM) leads to forgetfulness, which reduces medication adherence and makes disease management ineffective[5]. Future thinking promotes behavioral change in patients with chronic diseases and substance addictions by simulating or envisioning personal events that may occur in the future[6], helping individuals adjust future plans[7], optimize decision-making[8], regulate emotions[9], and prospective memory[10], and helps them resist the temptation of instant gratification in unsupervised home environments, such as unhealthy diets, sedentary behaviors, or addictive substances, and choose healthy behaviors with delayed benefits, such as anxiety and depression, in effectively managing negative emotions and fostering positive expectations for the future[11-12]. And guiding patients with mood disorders, such as anxiety and depression, to effectively regulate their negative emotions and enhance their positive expectations for the future[13]. Therefore, this paper will introduce the concept of future thinking and its intervention application and effect in the management of chronic diseases and mental illnesses, with a view to providing reference for the optimization of health management strategies for chronic diseases and mental illnesses.

2. Introduction of future thinking

2.1. Definition of future thinking

Future thinking is similar to the concepts of mental stimulation, episodic foresight, and pre-experiencing[14].Tulving first introduced the term mental time travel. He divided memory into two categories: semantic memory and episodic memory. Semantic memory refers to the general understanding of events, whereas episodic memory pertains to an individual’s personal experiences.

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Episodic memory is a uniquely human capability that enables mental time travel, allowing individuals to voluntarily recall past events or envision potential future scenarios within their minds[15]. Based on Tulving's theory, Suddendorf and Corballis[16] proposed that mental time travel is an important cognitive ability in human evolution, including the mental reconstruction of past personal events (situational memory) and the mental construction of future events. Its study further expanded the evolutionary explanation of this cognitive ability by arguing that it enables humans to optimize decision-making in complex environments by predicting future situations and enhances their survival adaptability.

On this basis, Atance and O'Neill first proposed the concept of episodic future thinking (EFT) in 2001, which is a mental simulation of an individual's possible future events by projecting the self into the future, allowing the individual to experience an event in advance[17]. The introduction of this concept makes future thinking no longer just a perception of the concept of time, but also a psychological process that is closely related to the self and future behavior. Subsequently, scholars began to pay attention to the neural basis of future thinking. Schacter[18] founds that imagining the future and recalling the past share similar neural networks in the brain, especially in the prefrontal lobe and the hippocampus, which proved that future thinking constructs hypothetical scenarios that may occur in the future by reorganizing and integrating past experiences in the memory system from a neuroscientific point of view. Another studynot only supports this view, but also further expands the emotion regulation and goal-oriented functions of future thinking, stating that by simulating positive future outcomes, individuals can improve their ability to cope with stress and enhance their motivation to achieve goals by concretizing future situations[19] . Thus, it is clear that future thinking is not only a part of the human cognitive process, but also an effective tool for individuals to adapt to the environment, optimize decision-making, and regulate emotions and behaviors.

2.2. Research paradigms of future thinking in the field of health management

The most common research paradigms for future thinking in the health management of people with chronic and mental illnesses include the situational future thinking (EFT) and the best possible self (BPS) paradigms.

2.2.1. Episodic Future Thinking (EFT) paradigm

Episodic Future Thinking (EFT) is one of the most commonly used interventions for improving delay discounting[11]. By guiding individuals to vividly and specifically imagine a particular scenario of a future event[20], EFT helps individuals anticipate positive outcomes, reduce preferences for immediate gratification, and focus more on long-term health benefits, enabling healthier decision-making[21]. In practice, participants are instructed to imagine scenarios based on given prompts or situations, such as imagining the scenario of “successfully losing 10 kilograms and attending a family gathering one year later” Participants describe details of the event, including its time, location, participants, surrounding environment, and emotional reactions such as excitement, happiness, or enthusiasm. This process activates neural circuits related to future planning[22], enhancing the motivational and emotional engagement of future thinking. Participants are typically required to imagine events occurring at multiple time points, such as one month, six months, and one year in the future, to strengthen the continuity of their future time perspective. EFT is often combined with delay discounting tasks, where participants rate the likelihood and significance of imagined events. Before or during the tasks, the highest-rated events are presented as recordings or written descriptions. This approach evaluates how EFT influences decision-making tendencies and behavioral changes by assessing participants’ choices between immediate rewards and larger delayed rewards. Individuals with lower delay discounting rates are more likely to delay immediate gratification in favor of long-term benefits, demonstrating stronger self-control and greater adherence to long-term health plans[23].

2.2.2. Best Possible Self (BPS) Paradigm

Best Possible Self (BPS) paradigm is an intervention method based on positive future thinking, guiding individuals to envision themselves achieving their best possible state in the future. This method helps individuals focus on positive aspects of the future, enhance positive emotional experiences, and stimulate intrinsic behavioral motivation. It is particularly effective for alleviating negative emotions in patients with anxiety and depression and improving their psychological well-being[24]. In practice, participants are required to engage in daily exercises over a specified period, such as one week to one month. During these exercises, they are asked to imagine and write down detailed descriptions of achieving their best possible state in various aspects of life over a certain future timeframe, such as one

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year or five years. Participants describe their envisioned performance in areas such as living conditions, work achievements, and health outcomes. This process helps individuals concretize positive future visions, making the envisioned positive states clearer and more achievable[25].

3. Application of Future Thinking in Chronic Disease Management

3.1. Enhancing Long-Term Self-Management in Diabetes

Self-management is key to controlling the progression of diabetes, yet it remains a significant challenge for patients. Factors such as high delay discounting[26] and impaired prospective memory[5] contribute to poor self-management in areas such as dietary habits, exercise routines, and medication adherence. Future thinking has been shown to improve prospective memory and reduce delay discounting[27]. For instance, in an intervention for improving medication adherence in diabetic patients, participants were asked to imagine, in detail, successful medication-taking scenarios at a future time point and focus on the positive aspects of these scenarios. One example would be: "One week later, I am taking a dance class with my teacher and other friends, enjoying the learning process, and during a break, I take my medication." Results from a 6-10 week EFT intervention showed that patients had fewer instances of forgetting to take medication, demonstrated better execution ability, and exhibited improved medication adherence. Other health behaviors, such as diet and exercise, also improved[28]. Given that chronic disease self-management requires multiple decisions in daily life, another study evaluated delay discounting after a 6-month EFT intervention without using EFT cues during the evaluation. It found that delay discounting still significantly decreased, suggesting that future thinking effectively reduces delay discounting, helping individuals focus more on long-term health benefits[29]. The impact on individuals' thinking patterns is not limited to the immediate period of engaging in future thinking, but rather is long-term and sustained. Moreover, future thinking can also have the same effect in home environments. A study randomly assigned adults with prediabetes to an EFT group or a control group, with participants in the EFT group performing daily future thinking training and delay discounting tests at home using an app, in addition to laboratory interventions. The results showed that the EFT group exhibited a significant reduction in delay discounting rates in both laboratory and home settings, while the control group showed no significant changes[30]. This proves that even outside the laboratory environment, patients can maintain self-management through future thinking, which aligns with the fact that chronic disease management is often carried out independently at home.

These studies indicate that future thinking is a powerful tool to promote lifestyle improvements and enhance self-management in diabetic patients. By guiding patients to imagine their future health status and making these scenarios concrete, future thinking can improve prospective memory, reduce forgetfulness, and decrease delay discounting. It inspires a desire and pursuit of long-term health, magnifies long-term benefits, and reshapes individuals' understanding of disease management. As a result, in the face of immediate gratification that is detrimental to health, patients are more likely to choose healthy eating, maintain exercise routines, and take their medication on time, ultimately achieving better self-management and treatment outcomes.

3.2. Promoting Healthy Dietary Decisions in Obese Patients

Obesity is typically associated with uncontrolled eating behaviors and excessive intake of high-calorie foods[31]. Changing dietary habits is currently recognized as a key goal in obesity treatment, yet such changes are difficult to achieve and maintain. Self-regulation plays a crucial role in success[32]. Future thinking helps individuals make long-term goals more concrete and perceivable, increasing their significance in individual cognition, while also reducing impulsive decisions triggered by the temptation for immediate gratification[33]. One study demonstrated through a randomized controlled trial that EFT can reduce delay discounting in obese patients, leading to a decreased pursuit of immediate gratification and a reduction in energy intake[34]. Another study further introduced a comparison between an EFT group and an EFT health goal group. The health goal group was asked to link imagined future events with personal health goals, such as: "After successfully losing weight, I put on new clothes this morning and looked great." The results showed that both the EFT and EFT health goal groups significantly reduced delay discounting. When linking future thinking with personal health goals, participants showed a greater reduction in the desire for fast food compared to when they were simply imagining the future[35]. Integrating artificial intelligence technology, another study showed synthetic photos of participants' future selves after weight loss and weight gain before performing a food choice task. This vivid and detailed image of their future self made obese participants more likely

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to choose lighter foods and make healthier dietary decisions[36].

Therefore, future thinking has a significant positive impact on obesity management. By guiding patients to imagine future scenarios in which they have achieved their ideal weight or health status, future thinking enhances their intrinsic motivation to adopt healthy eating habits and lifestyles. It reduces impulsive decisions, strengthens self-regulation, and reduces the impact of delay discounting. This helps obese patients reduce cravings for fast food and excessive energy intake when making dietary decisions, optimize food choices, and ultimately achieve weight management goals.

4. Intervention Applications of Future Thinking in Patients with Mental Disorders

4.1. Reducing Impulsive Decision-Making in Patients with Substance Use Disorders

Substance use disorders, including smoking, alcohol, and drug addiction, often fail to be managed due to the impulsive use of addictive substances and a lack of resistance to temptation[37]. Research has shown that future thinking can reduce an individual's preference for immediate gratification, lower delay discounting, and ultimately decrease the demand for addictive substances, thus promoting resistance to temptation and enhancing self-management[38]. For instance, in smokers, nicotine-dependent individuals with a desire to quit were divided into an EFT group and a control group. The EFT group was asked to imagine positive autobiographical events occurring at five future time points (1 day, 1 week, 1 month, 3 months, and 1 year), while the control group recalled positive events from the previous day. Results showed that smokers in the EFT group had significantly lower delay discounting and a substantial reduction in cigarette consumption during self-management tasks[39]. This suggests that future thinking can effectively change smokers' decision-making preferences, enhance self-control, and encourage long-term health benefits over short-term smoking pleasure. In a study on heroin addicts, a 2 (heroin withdrawal group, healthy group) × 2 (pre-test, post-test) future thinking intervention showed that future thinking improved both financial and heroin-related intertemporal decisions, with a more significant impact on the heroin withdrawal group compared to the healthy group[40]. This indicates that future thinking has a positive effect on intertemporal decisions and is more effective for individuals who prioritize immediate rewards over long-term benefits. Furthermore, after one week of episodic future thinking for alcohol-dependent individuals undergoing formal alcohol use disorder treatment, their alcohol demand index decreased, showing a trend toward reduced future alcohol use[41].

It is important to note that in interventions involving future thinking for substance use disorder patients, participants are typically individuals who are willing to quit the addictive substance, as these individuals are more motivated to manage their health and disease. By introducing positive future thinking, these individuals are encouraged to form positive expectations of their future health at critical moments of craving for addictive substances, thereby enhancing their motivation and restoring self-control. Therefore, while future thinking is an effective intervention for substance use management, its most suitable subjects are patients who have a desire to manage their addiction but struggle to quit on their own. On the other hand, for individuals with poor delay discounting ability and a lack of motivation to quit, further research is needed to assess the effectiveness of future thinking interventions.

4.2. Enhancing Positive Expectations in Patients with Mood Disorders

Studies have found that patients with schizophrenia, depression, anxiety, and other mood disorders exhibit abnormalities in future thinking, mainly manifested as a lack of specificity and detail in their imagined future scenarios[42]. Schizophrenia patients tend to envision a negative and generalized future, with little concrete information about what might happen[43]. Similarly, in patients with depression, future thinking is generally less specific, with a negative emotional bias toward the future—expecting more sadness and less joy than they actually experience[44]. These abnormalities suggest that effective interventions could involve suppressing negative future thinkings in mood disorder patients and promoting vivid, concrete positive imaginings. One study was conducted in two phases: In the generation phase, participants were asked to vividly imagine potential feared events (e.g., public speaking), including the details and emotional experiences. In the suppression phase, participants were randomly assigned to either a suppression group or a control group. The suppression group was instructed to distract themselves by thinking of unrelated matters whenever they encountered cues related to the feared event. The control group had no specific instructions. The results showed that

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suppressing fear-based future thinkings not only reduced the memory of these events but also significantly lowered anxiety levels[45]. This suggests that suppressing imagined future fears can effectively reduce their psychological impact, thereby alleviating anxiety. Similarly, promoting positive future thinkings has also shown significant effects. Another study used the best possible self (BPS) imagining technique, where individuals with depressive tendencies were asked to imagine and write about their ideal future selves for seven consecutive days. Each day's theme focused on a different life area (e.g., intimate relationships, educational achievements, hobbies, family life, career, social life, and physical/mental health). The results showed that positive emotions in the participants increased significantly, while depression and feelings of hopelessness decreased[46]. This indicates that BPS interventions can enhance depressive individuals' expectations of a positive future, thus improving their mental health. Furthermore, in a variation of the BPS intervention, participants were also asked to write about "three good things" that happened during the day and their reasons. The control group engaged in future-oriented thinking about humanity and recalled past memories. The results showed that both groups experienced a reduction in depressive symptoms, but the experimental group showed more significant improvements in depression, positive emotions, and resilience[47].

Additionally, future-directed therapy (FDT)[48] and solution-focused brief therapy techniques, such as the “miracle question”[49], have been shown to have positive effects on patients with depression by helping them understand and shift their thinking patterns, leading to noticeable improvements in emotional states and quality of life.

These studies focus on the tendencies of chronic mood disorder patients to have negative and generalized future thinkings and demonstrate the importance of correcting such abnormalities in improving emotional well-being. By guiding patients to construct more positive and specific future scenarios, it helps adjust emotional expectations, rebuild positive outlooks on the future, and effectively promote mental health.

5. Conclusion

5.1. Summary

This paper introduces the concept of future thinking, its research paradigms, and its effects in the health management of patients with chronic conditions such as diabetes, obesity, substance addiction, and mood disorders. Based on the existing research, we can summarize that in the management of chronic and mental health conditions, future thinking plays a role in the following key areas.

5.1.1. Reducing Delay Discounting

The primary intervention goal is to reduce delay discounting, helping patients prioritize long-term health benefits over immediate gratification. This approach reconstructs patients' understanding of disease self-management, stimulates intrinsic motivation, and promotes autonomous health behaviors, leading to improved health outcomes.

5.1.2. Improving Prospective Memory

Future thinking helps reduce forgetfulness-related non-adherence to medical instructions, improving execution ability and compliance, thus enhancing the implementation of self-management behaviors.

5.1.3. Facilitating Cognitive Shifts

Future thinking helps to suppress negative, generalized future thinkings, reduce anxiety and worry, and focus on positive, pleasant future expectations. This cognitive shift enhances mental well-being, enabling patients to better cope with challenges and stress.

5.2. Future Directions

5.2.1. Disease Prevention in High-Risk Populations

Future thinking is not only applicable to patients already diagnosed with chronic diseases like diabetes but also effective in preventing individuals at high risk (e.g., pre-diabetic patients) from developing Type 2 diabetes[21]. Thus, future thinking could serve as a preventive intervention, helping delay or prevent disease progression and improving overall population health.

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5.2.2. Post-Hospital Management Integrated with Mobile Health

Future thinking can be seamlessly integrated into clinical settings, particularly in health education and behavioral interventions. Healthcare providers can tailor personalized future positive scenarios related to patients' diseases and health states, guiding them to engage in regular future thinking exercises. Mobile platforms, such as apps or WeChat mini-programs, could facilitate continuous post-discharge future thinking training, tracking disease-related metrics and offering real-time feedback. With data analysis and feedback mechanisms, patients can better understand their health status, which would enhance their self-management motivation and adherence, optimize the sustainability of health interventions, reduce medical burdens, and promote long-term health behaviors.

5.2.3. Intervention for Addicts Lacking Withdrawal Motivation

While future thinking has shown significant effects in patients with addiction who already have withdrawal motivation, its impact on severe addicts with low motivation and poor delay discounting ability remains underexplored. Future studies could investigate the gradual introduction of future thinking during different stages of addiction treatment, combined with short-term medical treatment and pharmacological support, to help addicts envision positive life scenarios post-withdrawal. Furthermore, combining future thinking with psychological interventions, such as cognitive-behavioral therapy (CBT) or motivational interviewing (MI), may enhance internal motivation and improve withdrawal outcomes.

5.2.4. Uncovering the Mechanisms behind Future Thinking

Currently, much of the research on future thinking focuses on its practical applications, with its underlying mechanisms yet to be fully understood. The lack of clarity on how future thinking works makes it difficult to tailor precise interventions based on individual differences. Future research could employ brain imaging techniques to explore the specific mechanisms of future thinking, providing more scientific support for its practical applications.

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