# Advances in Health Behavior Interventions for Patients Undergoing Gastrointestinal Polypectomy Based on the Transtheoretical Model

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**Abstract: Gastrointestinal polypectomy is a common minimally invasive procedure for colorectal polyps, and its long-term success critically depends on patients' sustained adherence to postoperative health behaviors. However, in clinical practice, patients frequently exhibit poor dietary compliance, low medication adherence, and missed follow-up appointments, while traditional health education often shows limited effectiveness. The Transtheoretical Model (TTM), a stage-based theory integrating cognitive and behavioral perspectives, posits that individuals progress dynamically through five stages of behavior change: precontemplation, contemplation, preparation, action, and maintenance. This progression is facilitated by core constructs including decisional balance, self-efficacy, and processes of change. In recent years, TTM-based interventions have been increasingly applied to key health behaviors among patients after gastrointestinal polypectomy—such as dietary management, medication adherence, smoking and alcohol cessation, and follow-up compliance—demonstrating promising effects in advancing stage progression, enhancing self-efficity, and improving clinical outcomes. This article systematically reviews the theoretical foundation of TTM, its applicability in this population, intervention formats, evidence of effectiveness, and existing challenges. We propose that future efforts should focus on developing culturally adapted assessment tools, integrating multi-behavior interventions, leveraging digital health technologies, and conducting high-quality pragmatic trials to advance a precise and sustainable post-polypectomy health management system.**

**Keywords: Transtheoretical Model; Endoscopic Polypectomy; Health Behavior Interventions; Adherence; Self-Efficacy**

## 1. Background

With the accelerating global population aging, malignant tumors have become one of the leading threats to public health in China. National mortality surveillance data indicate that cancer accounts for nearly one-quarter of all deaths among Chinese residents [1]. According to the 2022 statistics on digestive tract cancers in China, there were approximately 1.10 million new cases and 698,000 deaths from esophageal, gastric, and colorectal cancers combined, representing 22.8% of all cancer incidence and 27.1% of cancer-related mortality. Among these, colorectal, gastric, and esophageal cancers rank as the 2nd, 4th, and 6th most common cancers by incidence, respectively. The prognosis differs markedly between early- and late-stage disease: the 5-year survival rates for advanced esophageal, gastric, and colorectal cancers range from 10%–30%, 20%–40%, and 50%–60%, respectively, whereas early-stage digestive tract cancers exhibit survival rates exceeding 90%. In recent years, advances in endoscopic technologies have led to a gradual increase in the detection of early-stage cancers and precancerous lesions, offering new therapeutic opportunities for patients [2]. Currently, endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) are the primary endoscopic treatment modalities. Compared with conventional surgery, both techniques are minimally invasive, associated with shorter procedural times, and result in fewer postoperative complications. However, patients undergoing these procedures often experience anxiety or distress due to limited understanding of their condition and the endoscopic process, which may impair postoperative recovery [3]. Additionally, varying degrees of postoperative pain are

 

common. Therefore, appropriate therapeutic and nursing strategies are essential to promote healthy behaviors, enhance surgical success, reduce complication risks, alleviate patient suffering, shorten hospital stays, and improve nursing satisfaction [4].

The development of gastrointestinal cancers is strongly associated with poor dietary and lifestyle habits. In this context, integrating structured behavior change theories to guide intervention strategies has emerged as a key approach to enhancing patients' self-management capabilities. The Transtheoretical Model (TTM), developed by Prochaska and DiClemente in the 1980s, is a stage-based theory that integrates cognitive and behavioral perspectives to facilitate health behavior change [5]. TTM-based interventions have been widely applied in smoking cessation, weight management, and medication adherence for chronic conditions, demonstrating promising results compared to conventional approaches. In recent years, researchers have begun exploring the use of TTM in health behavior interventions for patients with gastrointestinal disorders [6]. However, research in this area—particularly among patients undergoing endoscopic treatment for digestive tract diseases—remains in its early stages, with limited comprehensive synthesis of how TTM is operationalized, the intervention formats used, and the strength of evidence supporting its effectiveness. Therefore, this article aims to systematically review the current progress in TTM-based health behavior interventions for patients receiving endoscopic treatment for digestive tract diseases. We analyze the theoretical applicability of TTM in this population, summarize intervention strategies and delivery formats, evaluate reported outcomes, and identify existing challenges, with the goal of informing the development of a scientific, precise, and scalable behavior intervention framework.

## 2. Theoretical Basis of the Transtheoretical Model

The Transtheoretical Model of Behavior Change (TTM), also known as the Stages of Change Model, was developed by Prochaska and DiClemente in the 1980s through a comparative analysis of leading psychotherapeutic approaches to identify common mechanisms underlying intentional behavior change.TTM is a theoretical framework that describes how individuals progress through a series of motivational stages—precontemplation, contemplation, preparation, action, and maintenance—toward sustained health behavior change. Rather than focusing primarily on social or biological determinants, TTM emphasizes intrapersonal cognitive processes, such as decisional balance and self-efficacy, and integrates core constructs from multiple behavior change theories into a dynamic, stage-based model to guide tailored interventions [7]. The TTM framework comprises four key components:

1) The Stages of Change constitute the central framework of the Transtheoretical Model, conceptualizing behavior change as a dynamic process that progresses through five distinct stages: precontemplation, contemplation, preparation, action, and maintenance [8].

2) The Processes of Change in the TTM comprise ten specific cognitive and behavioral strategies that facilitate individuals' progression through the stages of change [9]. These processes—such as consciousness raising, self-reevaluation, and counterconditioning—not only provide practical methods for reducing unhealthy behaviors and adopting healthier alternatives, but also serve as key mechanisms that explain how interventions translate into actual behavior change. As such, they form the operational foundation for designing and implementing multi-level, TTM-based health behavior interventions.

3) Self-efficacy, a core construct of Social Cognitive Theory, refers to an individual's belief in their capability to successfully perform a specific behavior in a given context. It is distinct from general self-confidence, as it is domain-specific and closely tied to perceived behavioral control. Self-efficacy is shaped primarily by mastery experiences, vicarious learning, verbal persuasion, and physiological states—not by environmental incentives, which relate more to outcome expectations. Extensive evidence shows that self-efficacy is a strong predictor of physical activity and other health behaviors; individuals with higher self-efficacy are more likely to initiate, persist in, and recover from setbacks in behavior change efforts.

4) Decisional balance, a core construct of the TTM, refers to the relative evaluation of the perceived benefits and costs associated with changing a specific health behavior. It plays a critical role in determining whether an

 

individual progresses toward behavior change [10]. Generally, individuals in earlier stages perceive more cons than pros, while those in later stages report higher pros relative to cons.Perceived benefits encompass anticipated positive outcomes—such as improved health, enhanced self-esteem, or social approval—that motivate change. In contrast, perceived barriers include anticipated obstacles—such as time constraints, discomfort, or fear of failure—that inhibit action [11].

In practice, the strength of TTM-based interventions lies in their stage-matched approach: by accurately assessing an individual's current stage of change and tailoring strategies to shift the decisional balance while enhancing self-efficacy, clinicians can effectively promote the adoption and maintenance of healthy behaviors, ultimately supporting health recovery and long-term well-being.

## 3. Application Status of Health Behavior Intervention Based on TTM

### 3.1 Intervention Research Based on the Trans-Theoretical Model in China

A growing body of evidence supports the effectiveness of interventions grounded in the Transtheoretical Model (TTM) across diverse chronic conditions. Ai Xin demonstrated that TTM-based nursing significantly reduced blood glucose levels in patients with type 2 diabetes compared to conventional care, while also enhancing self-efficacy and quality of life across psychological, physical, and social domains [12]. Huang developed a TTM-informed health education program for women with polycystic ovary syndrome; a randomized controlled trial showed significant improvements in health-promoting lifestyles, knowledge, attitudes, practices, and quality of life at both 3 and 6 months, outperforming standard health education [13]. Zhang reported that TTM-guided stratified behavioral management effectively facilitated stage progression to action among patients with knee osteoarthritis, with rapid improvements in self-efficacy and joint symptoms that continued to strengthen over time [14]. Similarly, Hu found that TTM-based health education significantly lowered HbA1c levels in patients with systemic lupus erythematosus, while improving glycemic self-management behaviors, maintenance of healthy actions, and patient satisfaction [15]. In stroke survivors during the recovery phase, Hu observed marked improvements in health behaviors, self-efficacy, and self-care capacity following TTM-based education [16]. Zhang further showed that collaborative nursing informed by TTM significantly increased exercise adherence and tolerance in patients with hypertensive heart disease, leading to enhanced self-efficacy, quality of life, and nursing satisfaction—outcomes superior to those of conventional nursing [17]. Notably, Yang Cheng conducted a randomized controlled trial (n=60) in patients with chronic renal failure and found that an integrated intervention combining the Health Belief Model with the TTM significantly improved self-efficacy scores, promoted stage transitions in behavior change, and increased medication adherence , offering a promising strategy to bolster self-management and treatment compliance [18].

### 3.2 Intervention Research Based on the Trans-Theoretical Model Abroad

Internationally, the Transtheoretical Model (TTM) has demonstrated effectiveness not only in modifying unhealthy lifestyle behaviors but also in supporting recovery across a range of chronic conditions. For instance, Emine Kaplan Serin found that a TTM-based walking intervention significantly improved physical activity adherence among patients with type 2 diabetes, leading to reductions in BMI and blood pressure, as well as favorable metabolic outcomes [19]. In Japan, Tomoko Okayama implemented a dyadic dietary intervention grounded in the TTM for adolescent girls and their mothers, which resulted in significantly improved bone mineral density among the adolescents. Furthermore, Katie Ekberg applied the TTM to assess readiness for hearing rehabilitation in older adults and reported that the model enables audiologists to develop personalized rehabilitation plans aligned with clients' needs, attitudes, preferences, and psychological readiness for behavior change [7].

## 4. Applicability of the Transtheoretical Model (TTM) in Patients with Gastrointestinal Diseases

The application of the Transtheoretical Model (TTM) among patients undergoing endoscopic treatment for gastrointestinal diseases is both theoretically sound and clinically relevant, as

 

evidenced by the following three key aspects.

### 4.1 Strong Alignment between Disease Characteristics and Behavioral Change Needs

Endoscopic therapy is frequently employed for early-stage neoplasms, polyps, and precancerous conditions such as Barrett's esophagus. Although minimally invasive, these procedures necessitate long-term behavioral modifications to prevent disease recurrence [20]. For instance, following gastric endoscopic submucosal dissection (ESD), patients must adhere strictly to proton pump inhibitor (PPI) therapy, avoid spicy or irritating foods, abstain from smoking, limit alcohol intake, and attend scheduled endoscopic surveillance [21].

### 4.2 Plasticity and Stage-Specific Nature of Behavior Change

Clinical observations indicate that many patients show limited interest in health-promoting behaviors prior to surgery but begin contemplating change postoperatively after receiving risk-related counseling from clinicians. However, without concrete action plans, their adherence often fluctuates [22]. The TTM addresses this challenge by identifying an individual's current stage of change and delivering tailored support—such as targeted education, skills training, or environmental restructuring—to help translate awareness and intention into sustained behavior change.

### 4.3 Significant Psychosocial Influences and the Integrative Strength of TTM

Gastrointestinal disorders are frequently associated with psychological stress, anxiety, and maladaptive lifestyle patterns [23]. The TTM provides a comprehensive framework that integrates cognitive appraisal (decisional balance), affective processes (dramatic relief), and environmental strategies (stimulus control), thereby addressing patients' multifaceted needs throughout recovery. Notably, during the postoperative maintenance phase, symptom remission may lead to complacency; thus, reinforcing self-efficacy and relapse prevention strategies becomes particularly critical [24].

In summary, the TTM—through its dynamic, individualized, and integrative approach—offers a robust theoretical foundation and an actionable pathway for promoting health behavior change in patients undergoing gastrointestinal endoscopic treatment.

## 5. Challenges and Future Research Directions

Health behavior interventions grounded in the Transtheoretical Model (TTM) hold considerable promise for patients undergoing gastrointestinal endoscopic therapy; however, their implementation faces multiple challenges related to theoretical localization, clinical translation, and sustained long-term effectiveness.

A key limitation lies in the inadequate reliability, validity, and cultural adaptation of existing stage-of-change assessment tools. Most current instruments were developed within Western cultural contexts and have not been sufficiently validated for Chinese populations. Moreover, there is a lack of standardized measures tailored specifically to post-endoscopic health behaviors—such as dietary adherence, medication compliance, smoking cessation, and follow-up attendance—thereby limiting the precision of TTM-based interventions.

Intervening on multiple co-occurring behaviors presents additional complexity. Patients are often required to manage several interrelated health behaviors simultaneously, yet most TTM applications focus on single behaviors and fail to account for the dynamic interactions among them in real-world settings. Furthermore, healthcare providers' capacity to effectively implement TTM remains limited. The model requires competencies in stage identification, motivational interviewing, and tailored counseling—skills that few nurses or clinicians have acquired through formal training, which hinders large-scale adoption. Digital delivery modalities—such as WeChat and mobile health applications—introduce ethical and data security concerns, particularly regarding the collection, storage, and use of sensitive behavioral data, raising significant privacy issues. To address these gaps, it is imperative to develop and rigorously validate culturally adapted TTM assessment and intervention tools. Chinese-language stage-of-change scales should be designed in alignment with local linguistic conventions, cultural norms, and the healthcare environment, followed by large-scale validation of their reliability, construct validity, and predictive validity. In parallel, integrated multi-behavior intervention models should be explored. Combining TTM with complementary

 

frameworks—such as Social Cognitive Theory and the Theory of Planned Behavior—may enhance ecological validity. Deeper integration with digital health technologies is also warranted: leveraging artificial intelligence, natural language processing, and wearable sensors could enable the development of intelligent TTM-based systems capable of delivering high-precision, low-cost, and widely accessible interventions. High-quality pragmatic research is equally critical. Multicenter, large-sample, long-term randomized controlled trials should assess not only behavioral adherence but also hard clinical outcomes—including disease recurrence and hospital readmission rates—accompanied by cost-effectiveness analyses to inform policy decisions. Finally, strengthening TTM-related competencies among clinical teams is essential.

## 6. Conclusion

Endoscopic therapy is a cornerstone in the management of early gastrointestinal neoplasia and precancerous lesions. Its long-term efficacy depends not only on the technical quality of the procedure but also critically on patients' sustained adherence to recommended postoperative health behaviors. In clinical practice, however, suboptimal dietary habits, poor medication adherence, and inadequate follow-up attendance remain common, highlighting the need for scientifically grounded, systematic, and individualized behavioral interventions.

The Transtheoretical Model (TTM), with its stage-based, process-oriented framework that integrates cognitive and behavioral determinants of change, offers a robust theoretical foundation for addressing these challenges. Existing evidence suggests that TTM-based interventions can effectively facilitate progression through stages of change, enhance self-efficacy, and improve clinical adherence. Notably, in key domains such as post-procedure surveillance, appropriate proton pump inhibitor (PPI) use, and dietary modification, TTM-guided strategies have demonstrated greater promise than conventional health education approaches. Nevertheless, research in this area remains nascent, facing challenges including inadequate cultural adaptation of stage-assessment instruments, limited integration of multiple co-occurring health behaviors, and insufficient evidence on long-term behavioral and clinical outcomes. Future efforts should focus on developing and validating culturally adapted TTM-based assessment and intervention tools tailored to the linguistic, cognitive, and healthcare context of Chinese patients. Concurrently, integrating artificial intelligence, natural language processing, and wearable technologies could enable precise, real-time, and scalable behavioral support. Large-scale, multicenter pragmatic randomized trials with extended follow-up are needed, using hard clinical endpoints—such as disease recurrence and hospital readmission—as primary outcomes, complemented by cost-effectiveness analyses. Equally important is strengthening the capacity of healthcare teams through structured training in TTM-informed counseling, including stage assessment and motivational interviewing, embedded within continuing professional education and endoscopy specialty curricula.

In summary, the strategic integration of the Transtheoretical Model into comprehensive post-endoscopic care—supported by theoretical refinement and digital health innovation—holds significant potential to establish an efficient, sustainable, and scalable health behavior support system. Such an approach could ultimately enhance patients' quality of life and long-term prognosis.

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