

Postprint: Conceptual Model of Information Framing Effects Across Stages of Health Behavior Change

Authors: Cao Jindan, Wang Chongliang

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Abstract

Information framing effects exert a pervasive influence on individuals' decision-making regarding behavior change; however, research examining the impact of information framing on the behavior change process remains limited. To ascertain the application value of information framing effects within this process, this study provides an in-depth investigation into the mechanisms underlying the emergence of framing effects in this context and their influence on various stages of behavior change. Using health behavior change as an example and situated within the stage-based behavior change framework based on the Trans-theoretical Model, this study identifies moderating factors and mediating variables in the generation of framing effects through an analysis of the mechanisms by which these effects arise. It further explores how information framing influences the decision-making tendencies of individuals at different change stages and how such tendencies subsequently affect the progression of behavior change. The study proposes a conceptual model of information framing effects at different stages of health behavior change, thereby providing a scientific basis for enhancing information intervention strategies for undesirable behavior change and improving individual health management levels.

Full Text

Preamble

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A Study on the Conceptual Model of Information Framing Effects in Different Stages of Health Behavior Change

Cao Jindan, Wang Chongliang

School of Public Health, Jilin University, Changchun 130021

Abstract

[Purpose/Significance] Information framing effects exert a universal influence on individual decision-making in behavior change, yet research on how information framing impacts the behavior change process remains limited. To determine the practical value of framing effects in this context, this study explores in depth the generation of framing effects and their influence mechanisms across various stages of behavior change. **[Method/Process]** Using health behavior change as an example and drawing on the stage-based behavior change framework of the Transtheoretical Model, this study analyzes the mechanisms underlying framing effects, identifies moderating factors and mediating variables, and examines how information framing influences decision-making tendencies among individuals at different change stages and how these tendencies subsequently affect the behavior change process. **[Result/Conclusion]** The study proposes a conceptual model of information framing effects across different stages of health behavior change, providing a scientific basis for improving information intervention strategies for unhealthy behavior modification and enhancing individual health management.

Keywords: Transtheoretical Model; Framing Effects; Behavior Change; Behavioral Decision-Making; Need for Cognition

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Changing unhealthy behaviors and cultivating healthy habits are crucial for healthy living and hold significant importance for personalized health management and quality of life improvement. In recent years, the Transtheoretical Model (TTM) has been increasingly applied in behavior change research across various disciplines [1-4] and has begun to attract attention in user studies within information science and library science. Existing research demonstrates that applying TTM to divide individual behavior change processes into distinct stages reveals differences in information needs, information seeking, and information utilization among individuals at different stages. Tailored information interventions based on these differences have shown promising effectiveness, making this a highly prospective approach to health behavior intervention [5]. However, current research perspectives remain relatively narrow, focusing primarily on information capability interventions for individuals at different stages and communication based on stage-specific information needs [5]. Future research could explore more micro-level mechanisms through which information elicits individual identification and generates stronger behavioral intentions, enabling more nuanced and effective interventions.

2. The Relationship Between Behavior Change, Information, Cognition, and Decision-Making

The Transtheoretical Model posits that the essence of individual behavior change is a decision-making process [6], suggesting that factors influencing

decision-making may also affect behavior change to some extent. This section examines the relationship between behavior change stages, change processes, and decision-making.

2.1 Health Behavior Change Stages and Change Processes

Behavior is not only a continuously evolving dynamic process but also a malleable one that can be shaped through learning into new patterns. In the late 1970s, Professor J.O. Prochaska of the University of Rhode Island proposed the Transtheoretical Model, which was subsequently refined by J.O. Prochaska, W.F. Velicer, and others. This model effectively captures the dynamic and plastic nature of behavior change and has been widely embraced by health behavior researchers as a comprehensive approach to stage-based behavior change [10].

The Transtheoretical Model conceptualizes health behavior change as a holistic, complex, gradual, and dynamic process. Current research typically divides this process into five stages: precontemplation, contemplation, preparation, action, and maintenance [12]. These stages reflect the temporal sequence of behavior change, representing how individuals progress through different phases when modifying behavior. The model identifies ten change processes that serve as important methods and strategies to facilitate health behavior change, guiding individuals from one stage to the next through cognitive, affective, and behavioral strategies. These processes operate at two levels: cognitive (or experiential) and behavioral (or environmental). The cognitive processes include: consciousness raising (actively seeking new information and obtaining understanding and feedback about problem behaviors), dramatic relief (emotional changes, typically involving intense emotional experiences related to problem behaviors), self-reevaluation (reassessing problem behaviors emotionally and cognitively), environmental reevaluation (considering and assessing how problems affect physical and social environments), and social liberation (recognizing alternative problem-free lifestyles in society). The behavioral processes include: counterconditioning (substituting problem behaviors with alternative behaviors), helping relationships (trusting, accepting, and utilizing support from others during behavior change), self-liberation (choosing and committing to change, including believing in one's ability to change), stimulus control (controlling situations and other triggers that elicit problem behaviors), and reinforcement management (altering contingencies that control or maintain problem behaviors) [13].

Individuals at different change stages typically emphasize different processes. Generally, cognitive processes occur more frequently in the early stages (precontemplation, contemplation, preparation), while behavioral processes are more common in later stages (action and maintenance) (see Table 1). The integration of change processes and change stages ultimately explains individual behavior change [15].

2.2 Decision Balance in Health Behavior Change Process

A key concept in the Transtheoretical Model is that individual stage transitions and cognitive shifts are continuously influenced by decision-making and self-efficacy, with multiple elements interacting to form an integrated whole [11]. Decision balance represents an individual's relative weighing of the pros and cons of change, including both positive and negative aspects [11]. Before deciding whether to change behavior, individuals consider the advantages and disadvantages of changing, weighing them before making a decision. If the perceived benefits outweigh the costs, this positively reinforces behavior change; conversely, individuals may resist change. This trade-off is termed decision balance.

In the Transtheoretical Model, decision balance is divided into two dimensions: perceived benefits and perceived barriers. Perceived benefits represent reasons for behavior change or favorable outcomes anticipated from change, while perceived barriers represent obstacles to change. However, in reality, individuals weigh additional factors beyond perceived benefits and barriers when making behavior change decisions, including self-efficacy, internal and external temptations, and other elements. To clarify the dimensions comprising decision balance, this study incorporates Protection Motivation Theory to supplement the original construct, forming a broader conceptualization of decision balance.

Protection Motivation Theory proposes that information from the environment and within the individual triggers two interactive cognitive processes: threat appraisal and coping appraisal, which together form protection motivation and generate corresponding behaviors. Threat appraisal includes internal rewards (self-satisfaction or positive feelings experienced when engaging in unhealthy behaviors), external rewards (environmental factors that reinforce unhealthy behaviors), severity of health threats, and susceptibility to threats. Coping appraisal includes self-efficacy, response efficacy, and response costs. These seven factors interact to influence behavior change, with response efficacy, self-efficacy, severity, and susceptibility as positive factors, and internal rewards, external rewards, and response costs as negative factors [16].

This study adopts Protection Motivation Theory's framework, reconceptualizing decision balance as the outcome of weighing threat appraisal against coping appraisal. Specifically, it replaces the original model's perceived benefits and barriers with the more precisely defined response efficacy and response costs; retains self-efficacy from the Transtheoretical Model; uses internal and external rewards to specify the dimensions of temptation; and incorporates the theory's unique factors of health threat severity and susceptibility.

2.3 Decision-Making and Information Framing Effects

The relationship between information, cognition, decision-making, and behavior change is illustrated in Figure 1 [Figure 1: see original paper]. Newly acquired health information can significantly influence individuals' cognition regarding

health issues, including health literacy, misconceptions, commitment to change, methods adopted, and persistence throughout the change process, ultimately affecting the effectiveness and progression of health behavior change. According to framing effect theory and existing research, how information is presented represents another important factor causing cognitive differences. Therefore, this study argues for the necessity of incorporating framing effects into health behavior change research.

The concept of framing effects was first introduced by A. Tversky and D. Kahneman [17] in 1981 through their research on the “Asian disease problem,” which demonstrated that decision preferences could be reversed depending on how options were described—a phenomenon considered a cognitive bias in psychology [18]. The study presented a hypothetical scenario in which the United States faced an Asian disease outbreak that would claim 600 lives, with only two treatment options (A and B) available. They constructed “positive/survival frames” and “negative/mortality frames” for participants to choose from (see Figure 2 [Figure 2: see original paper]) [17]. Despite identical substantive meaning, 72% of participants chose option A under the survival frame, while 78% chose option B under the mortality frame. This demonstrates that individuals’ thinking is influenced by different frames (e.g., varying presentations), leading to different choices—a phenomenon termed framing effect [19]. Subsequent research has confirmed the universality of framing effects and their significant impact on individual decision-making [20-22].

As research has progressed, new types of framing effects have been identified and categorized. Among these, valence-based framing effects (positive vs. negative frames) are the most widely applied. I.P. Levin further classified these into risky choice framing, attribute framing, and goal framing [21], as shown in Table 2 [23]. This classification is now commonly used in the field. Information framing effects for behavior change fall under goal framing. On one hand, behavior change requires individuals to form positive decisions and intentions based on cognition; on the other hand, actual behavior change represents the practical value of intervention. However, previous research has predominantly relied on cross-sectional surveys, often equating behavioral decisions with actual behavior. In behavior change research, there has been insufficient analysis from a cognitive process perspective or longitudinal assessment from a stage-change viewpoint. The question of how framing effects influence decision-making across different stages of health behavior change to ultimately promote behavior change remains underexplored.

3. Framing Effects and Cognitive Attributes

3.1 Moderating Variables of Framing Effects

The mechanisms underlying framing effects remain inconclusive, with multiple theories attempting explanations from cognitive or emotional perspectives, predominantly the former. As shown in Table 3, major theoretical explanations

include:

Table 3. Common Theoretical Explanations of Framing Effects

Theory	Proponents & Year	Core Explanation
Prospect Theory	A. Tversky & D. Kahneman, 1979	After processing information, individuals assign different utility values to options based on value and weighting functions, ultimately selecting the option with maximum expected utility
Fuzzy-Trace Theory	V.F. Reyna & C.J. Brainerd, 1991	Individuals have a preference for gist-based processing, making choices based on simplified information
Probabilistic Mental Models	G. Gigerenzer, U. Hoffrage & H. Kleinbölting, 1991	When facing complex problems, individuals construct mental models using probability and environmental information
Equate-to-Differentiate Model	Shu Li, 1994	Decision-makers first “equate” outcomes on dimensions with small differences, then “differentiate” based on larger differences
Dual-Systems Theory	T. McElroy & J.J. Seta, 2003	Two interconnected but distinct systems in human information processing; outcomes depend on which system dominates
Cognitive-Affective Tradeoff Model	C. Gonzalez, 2005	Decision-making involves two goals: minimizing cognitive effort and maximizing positive affective experience

Despite numerous theories, a relatively unified view emerges: differences in information processing (such as degree of cognitive effort and depth of processing) likely cause varying decision tendencies. Therefore, this study focuses on two attributes affecting information processing depth: need for cognition (NFC) and cognitive load (CL), which explain when information framing effects occur. Additionally, research has identified several cognitive attributes that moderate the relationship between information framing and health behaviors, explaining which frame (positive or negative) is more effective under specific cognitive

conditions. These include beliefs about risk and uncertainty, motivational orientation, consideration of future consequences (CFC), and self-efficacy.

3.1.1 Need for Cognition

Need for cognition refers to an individual's tendency to engage in and enjoy effortful cognitive tasks [29]. Research has demonstrated its moderating role in various information processing contexts, including complex problem-solving [30], choice deferral under information overload [31], and cognitive effort expenditure [32]. Framing effect research shows that individual differences in information processing lead to varying effects of positive/negative frames. Individuals high in need for cognition tend to think more deeply and process received information more thoroughly, facilitating better understanding. Therefore, this study hypothesizes that individuals with high need for cognition may be less susceptible to information framing effects.

3.1.2 Cognitive Load

Cognitive load refers to the total amount of information imposed on working memory [33], including both the information itself and perceived interrelationships among information elements. Early cognitive load research focused primarily on education, exploring how reducing cognitive load could enhance learning efficiency. More recently, researchers have examined how externally imposed cognitive load affects cognition, finding that increased load promotes acceptance of negative information [34] and risk aversion [35]. This study posits that during cognitive processing, increased cognitive load not only affects information processing efficiency but also requires greater cognitive effort, leading individuals to prefer more easily acceptable information. The hypothesis is proposed that higher cognitive load increases susceptibility to information framing effects.

3.1.3 Beliefs About Risk and Uncertainty

According to prospect theory, when individuals perceive high-risk or uncertain behavioral consequences as losses, they are more likely to take risks (e.g., cancer screening, HIV testing that might confirm fatal disease). Conversely, when outcomes are perceived as gains, they are more likely to engage in preventive behaviors (e.g., regular exercise, dietary improvement). Research shows that individuals' risk and uncertainty beliefs determine which frame better motivates specific behaviors [36]. A meta-analysis revealed that for preventive behaviors (e.g., smoking cessation, physical activity), positive frames were more motivating than negative frames, while for detection behaviors, frame differences were less pronounced [37], suggesting other psychological factors may be involved.

3.1.4 Motivational Orientation

Research has investigated individuals' tendencies toward achieving favorable outcomes versus avoiding unfavorable ones, such as approach/avoidance motivation [38-39]. Studies have also examined sensitivity to information framing for positive versus negative events [40]. Findings indicate that individuals with approach motivation are more sensitive to positively framed health information, while those with avoidance motivation respond better to negatively framed information. These hypotheses have been confirmed across various health domains,

including oral health [41-42], HPV vaccination [43], and physical exercise [44]. Additionally, subjective experiences such as regulatory fit and “feeling right” may underlie the match between motivation and frame [45]. When individual motivation aligns with framed information, regulatory fit and feeling right occur, influencing information evaluation [46]. Information producing regulatory fit and feeling right generates stronger framing effects.

3.1.5 Consideration of Future Consequences

Consideration of future consequences refers to the degree to which individuals are influenced by immediate versus distant outcomes of behavior [47], representing a stable individual difference. Individuals low in CFC are sensitive to short-term outcomes, while those high in CFC focus on long-term results. For behaviors with risky short-term outcomes (e.g., screening tests), low CFC individuals respond strongly to negative frames. In contrast, high CFC individuals are more likely to ignore short-term risks and focus on safer long-term outcomes, responding better to positive frames. These hypotheses have been confirmed in studies on colorectal cancer and Type 1 diabetes screening [48].

3.1.6 Self-Efficacy

Self-efficacy refers to individuals’ expectations about their capability to perform a behavior, representing self-evaluation of behavioral capacity [49]. J.V. Riet’s research across multiple behavioral domains, including skin cancer screening [50] and smoking cessation [51], found that high self-efficacy individuals were more persuaded by negative than positive information, while low self-efficacy individuals showed little difference. The interpretation is that when high self-efficacy individuals perceive high threat, they are more likely to take protective action, and negative frames convey greater threat. Self-efficacy level determines whether perceived threat translates into coping behavior or avoidance.

3.2 Mediating Variables of Framing Effects

Although emotion-based theories of framing effects are not mainstream, their importance in decision-making has been extensively validated. Affect has been widely recognized as a mediating mechanism [23], with emotional scales commonly categorizing feelings into positive and negative affect [52]. Representative research shows that positive affect enhances framing effects while negative affect diminishes them; positive frames are more effective for individuals in negative emotional states, whereas negative frames are more persuasive for those in positive states [53]. Since this research was based on risk information framing, and the cognitive structures of risky choice, attribute, and goal framing effects are relatively independent [54], further empirical evidence is needed regarding whether affect influences other types of valence-based framing similarly. Health communication research demonstrates that positive frames achieve higher information acceptance than negative frames, mediated by positive affect; conversely, negative frames generate greater negative affect, which increases health behavior intention [55]. Integrating the cognitive-affective tradeoff model, this study proposes that affect mediates the process from framed information to decision-

making.

4. Information Framing Effects in the Health Behavior Change Process

Existing framing effect models typically treat framing as a short-term, cross-sectional phenomenon. Based on theoretical analysis and prior research, this study argues that in the context of behavior change, framing effects operate continuously alongside a series of decisions throughout the change process, exhibiting a longitudinal trend. Furthermore, J.O. Prochaska proposed that the most promising health behavior change interventions should be personalized, interactive, and matched to individuals' change stages [11], a notion increasingly supported by research. Therefore, this study presents a conceptual model of information framing effects in the health behavior change process to clarify relationships among relevant factors, guide future empirical research, and identify which individuals with specific cognitive attributes at particular change stages are most susceptible to which framing effects and through what mechanisms. This will help determine optimal intervention strategies.

The model addresses: how cognitive attributes moderate the relationship between framed information and generalized decision balance; the dimensional structure of generalized decision balance; and the mediating role of generalized decision balance between change processes and change stages (see Figure 3 [Figure 3: see original paper]).

As shown in Figure 3, change stages represent the temporal sequence of behavior change, reflecting its dynamic nature and delineating the sequential order through which individuals progress. Any individual undergoing health behavior change can be classified into one of five stages: precontemplation, contemplation, preparation, action, or maintenance. Change processes reflect cognitive activities occurring at specific stages, through which individuals assess their situations. As cognition deepens, individuals confront a trade-off comprising multiple factors—generalized decision balance. Decision balance serves as a crucial mediator for transitioning between change processes and stages, representing the key to health behavior change. Multiple factors influence decision balance, which in turn directly affects behavior change progression. Among these, the framing of received information significantly impacts decision balance: even when information is substantively identical, positive or negative framing produces different decision tendencies. Specifically, after receiving a particular frame, individuals experience differential emotional impacts, moderated by various cognitive attributes (need for cognition and cognitive load moderate whether framing effects occur; risk beliefs, motivational orientation, CFC, and self-efficacy moderate whether positive or negative frames are more influential). These influences affect generalized decision balance, which includes threat appraisal (external rewards, internal rewards, severity, susceptibility) and coping appraisal (response efficacy, self-efficacy, response costs). The outcome of decision balance influences behavior and stage transitions: when positive fac-

tors dominate, individuals are more likely to advance to the next stage; when negative factors dominate, individuals may stagnate or regress.

Conclusion

Extensive research demonstrates that information framing significantly influences health behavior decision-making. Current studies predominantly employ cross-sectional designs, using attitudes and intentions to reflect framing effects on behavior change—appropriate for short-term or one-time behaviors (e.g., vaccination, disease screening). However, for long-term behavior change requiring sustained effort, whether framing-induced decision tendencies produce actual behavior change remains inadequately established. This study argues for longitudinal investigation of the entire behavior change process, analyzing how individuals at each stage respond to framed information from cognitive and attribute perspectives, and evaluating progression through change stages to clarify framing effects' practical value. Based on this analysis, this study reconceptualizes the relationships among framed information, individual cognition, decision-making, and behavior change.

Key contributions include: (1) Incorporating need for cognition and cognitive load as moderators, given that most framing theories address cognitive processing depth. Need for cognition represents a stable personality trait related to cognitive effort, while cognitive load affects processing efficiency and effort investment. (2) Proposing that decision balance mediates the relationship between change processes and change stages, with self-efficacy as a key component. Drawing on Protection Motivation Theory, decision balance is reconceptualized as comprising threat appraisal and coping appraisal across seven dimensions. (3) While previous research established links between health behavior decisions and framing effects, it focused on short-term behaviors, with limited attention to how framing influences decision tendencies and actual behavior change in long-term health behavior modification. Based on TTM, this study proposes that behavior change decisions are not one-time events but a series of decision-making activities throughout the process. The model suggests evaluating framing effects' intervention value by assessing whether framed information promotes stage progression. It also addresses the question of how repeated framing effects influence decisions [56] by proposing that individuals' change stages should determine the timing of reframing, enabling investigation of framing effects when stages remain unchanged versus when they have shifted.

In summary, this study constructs a theoretical model of information framing effects in the behavior change process, proposing hypotheses about how framing effects operate at different stages and theoretically explaining how they promote behavior change. The aim is to enhance understanding of information's role in health behavior change and provide scientific reference for developing intervention strategies that foster healthy behavior habits.

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Author Contributions

Cao Jindan: Topic selection, research framework design, paper revision;
Wang Chongliang: Research protocol refinement, paper writing.

Note: Figure translations are in progress. See original paper for figures.

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