The Effects of Scarcity Type and Regulatory Focus Matching on Health Behavior Decision-Making

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Abstract

Based on the Health Belief Model and regulatory fit theory, this study explores the influence and mechanism of the match between scarcity type and regulatory focus motivation on health behavior decision-making by subdividing scarcity types into demand scarcity and supply scarcity and incorporating regulatory focus motivation as an individual trait. Study 1 investigated the impact of HPV vaccine scarcity types on vaccination intentions across different regions nationwide. Study 2 examined the effect of the match between scarcity type and regulatory focus motivation on health behavior decisions—including fitness, physical examinations, and vaccination—in a laboratory setting. Study 3 further explored the mediating mechanism of this matching relationship in a laboratory setting and incorporated real health behavior indicators to verify the matching effect between scarcity type and regulatory focus motivation. The results revealed that the match between regulatory focus motivation and scarcity type promotes health behaviors: promotion-focused individuals exhibit stronger health intentions under supply scarcity conditions, whereas prevention-focused individuals show stronger health intentions under demand scarcity conditions; value perception mediates the influence of the match between regulatory focus motivation and scarcity type on health behavior decision-making; and the match between trait regulatory focus motivation and scarcity type significantly predicts actual health behaviors. This study extends scarcity-related research to the domain of health behavior and provides a research foundation for developing health promotion strategies that match individual traits.

Full Text

The Effects of Scarcity Type and Regulatory Focus Matching on Health Behavior Decision-Making

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Abstract

Drawing on the Health Belief Model and Regulatory Focus Theory, this paper investigates how the alignment between scarcity type—distinguished as demand scarcity versus supply scarcity—and individuals' regulatory focus motivation influences health behavior decision-making and the underlying mechanisms. Study 1 surveyed HPV vaccine scarcity types across different regions of China to examine their impact on vaccination intentions. Study 2 employed laboratory scenarios to test how the match between scarcity type and regulatory focus affects decisions regarding fitness, medical check-ups, and vaccination. Study 3 further explored the mediating mechanisms of this matching relationship in laboratory settings while incorporating real health behavior indicators to validate the effects. Results demonstrate that regulatory focus-scarcity type matching promotes health behaviors: promotion-focused individuals show stronger health intentions under supply scarcity, whereas prevention-focused individuals exhibit stronger intentions under demand scarcity. Perceived value mediates the effect of regulatory focus-scarcity type matching on health behavior decision-making. Furthermore, the match between trait regulatory focus and scarcity type significantly predicts actual health behaviors. This research extends scarcity-related studies into the health behavior domain and provides a foundation for developing health promotion strategies that align with individual characteristics.

Keywords: scarcity, regulatory focus motivation, health behavior decision-making, perceived value

Health is fundamental to human and societal development. Escalating environmental and social challenges pose new threats to public health, making the design of effective health behavior promotion strategies a key research priority (Sheeran et al., 2017). Health behaviors are defined as actions individuals take to maintain, restore, and enhance health while preventing disease (Conner, 2015), and the choices individuals make regarding preventive actions (e.g., medical check-ups, smoking cessation) or health-promoting activities (e.g., exercise, balanced diet) constitute health behavior decision-making (Carrera et al., 2020). Current interventions primarily include economic incentives and health education campaigns; however, the former imposes substantial financial burdens, while the latter shows limited effectiveness in reducing public hesitation toward health behaviors (Carrera et al., 2020; Eitze et al., 2021). Therefore, developing effective strategies to promote health behaviors is crucial for improving public

health and societal well-being.

The Health Belief Model (HBM; Becker, 1974) posits that health behavior change requires individuals to first recognize a health threat and evaluate health behaviors favorably before making behavioral changes. Previous research has demonstrated that scarcity can effectively increase attention toward and positive evaluation of scarce products. For instance, emphasizing the scarcity of food increases consumption and enhances product evaluation (Anselme & Güntürkün, 2019; Crandall & Temple, 2018; Fennis et al., 2020). This phenomenon is commonly applied in marketing to boost sales, as consumers show greater willingness to purchase limited-supply products (Hamilton et al., 2019). However, research on scarcity in the health domain remains limited and yields inconsistent findings (Fennis et al., 2020; Pereira et al., 2022; Sprengholz et al., 2021). Prior studies have not systematically examined different scarcity types or considered how individual traits interact with scarcity types to influence health behavior decision-making. This paper addresses this gap by investigating the relationship between scarcity and health behaviors, exploring how the match between scarcity type (supply vs. demand scarcity) and regulatory focus motivation affects health behavior decision-making and its underlying mechanisms, thereby providing a foundation for developing personalized health promotion strategies.

1.1 Scarcity and Health Behavior

Scarcity refers to the psychological perception that a resource or product is limited. This perception typically leads to increased attention and valuation of scarce products (Mullainathan & Shafir, 2013), as scarcity confers unique and precious qualities. Research shows that scarcity enhances preference for scarce products (Zhao & Tomm, 2018) and increases their perceived value due to difficulty in acquisition, uniqueness, and special appeal. In daily life, limited-edition merchandise, rare collectibles, and unique artworks often generate intense public interest. Scarcity also influences decision-making and behavior in shopping, investment, and health choices (Hamilton et al., 2019). However, previous research has focused primarily on scarcity' s promotional effects on sales rather than its potential to promote health behaviors.

The Health Belief Model has been widely recognized as a theoretical framework for explaining health behaviors (Bechard et al., 2021). The model outlines a sequential process: perceiving disease severity and susceptibility, weighing benefits against costs to evaluate health behaviors, and recognizing cues to action —factors that trigger health behaviors such as service quality, medical environment, convenience, recommendations from friends and family, media campaigns, and mood adjustments (Carpenter, 2010; Harrison et al., 1992; Poss, 2001). Existing research indicates that scarcity can increase attention toward scarce products (Huang et al., 2020; Ku et al., 2012; Mullainathan & Shafir, 2013; Zhao & Tomm, 2018), suggesting that scarcity can serve as a cue to action that heightens health awareness.

In nature, birds and mammals increase food intake when facing scarcity to store calories (Anselme & Güntürkün, 2019). Similarly, humans show greater interest and consumption when food scarcity is emphasized. Research found that highlighting the scarcity of healthy foods increased selection among individuals with fast life-history strategies, who were more willing to choose healthy foods under scarcity conditions (Fennis et al., 2020). However, studies using scarcity to promote vaccination intentions have produced inconsistent results. Sprengholz et al. (2021) found that emphasizing vaccine scarcity increased vaccination intentions and related protective behaviors such as handwashing, mask-wearing, and flu vaccination. Conversely, another study found lower vaccination intentions for scarce vaccines (Pereira et al., 2022). In that study, the materials emphasized the difficulty of vaccine development and the greater need among elderly populations, which reduced intentions among highly empathetic individuals—a limitation in the experimental materials. Previous research has not systematically examined scarcity type as a critical factor, despite evidence that different scarcity types exert distinct effects on behavior.

Scarcity can be categorized into supply scarcity and demand scarcity based on its source (Gierl & Huettl, 2010). Supply scarcity arises from limited availability or restricted supply, such as "limited-edition products." Demand scarcity results from increased demand, commonly labeled as "hot-selling products" or "flying off the shelves." While both types increase attention and preference, their underlying psychological mechanisms differ (Gierl & Huettl, 2010; Liu & Li, 2017). Supply scarcity enhances owners' status and uniqueness, as limited availability means only a select few can possess the product, symbolizing status, power (Lynn, 1992), and exclusivity (Snyder, 1992). Demand scarcity, conversely, signals safety, as products desired by many represent popularity and public endorsement, making them a safe choice (van Herpen et al., 2005). The effects of scarcity are influenced by product attributes and individual traits. For conspicuous products, supply scarcity yields higher evaluations than demand scarcity, whereas the opposite holds for non-conspicuous products, as supply scarcity' s association with uniqueness aligns with conspicuous consumption, while demand scarcity represents safety and popularity (Gierl & Huettl, 2010). Moreover, individuals possess specific behavioral tendencies that regulate their actions and states, influencing their decisions and behaviors. Therefore, examining health behavior decision-making requires analyzing how different scarcity types interact with individual traits.

1.2 Regulatory Focus Matching and Health Behavior

According to Higgins' (1997) Regulatory Focus Theory, individuals adopt two distinct self-regulatory orientations when pursuing goals: promotion focus and prevention focus. These orientations reflect different fundamental needs and consequently different goal priorities. Promotion-focused individuals emphasize growth needs and achievement, concentrating on ideals and aspirations. Prevention-focused individuals prioritize safety needs and responsibilities, striv-

ing to avoid mistakes and achieve security. In other words, promotion focus is associated with eagerness-driven behavior, while prevention focus relates to vigilance-driven behavior (Aaker & Lee, 2006; Bui & Krishen, 2015; Higgins et al., 2001).

Regulatory Fit Theory emphasizes the importance of alignment between goal setting and behavioral strategies in determining performance (Higgins et al., 2001). Individuals with different regulatory foci tend to employ different strategies: promotion-focused individuals prefer eagerness-approach strategies, while prevention-focused individuals favor vigilance-avoidance strategies. When individuals use their preferred strategies, regulatory fit occurs—promotion focus matches eagerness-approach strategies, and prevention focus matches vigilance-avoidance strategies. This fit enhances perceived behavioral correctness and strengthens motivation (Bosone et al., 2015; Lee et al., 2013). Research shows that regulatory fit effectively improves the persuasiveness of health messages (Ludolph & Schulz, 2015). Cesario et al. (2004) found that health messages framed in terms of gains and losses were more persuasive when aligned with individuals' regulatory focus. Studies demonstrate that loss-framed messages for prevention-focused individuals and gain-framed messages for promotion-focused individuals promote health behaviors including healthy eating (Hong, 2012; Tam et al., 2010), smoking cessation (Friedman-Wheeler et al., 2010), exercise (Martinez et al., 2013), HPV vaccination (Park, 2012), and health check-ups (Uskul et al., 2008). Additionally, individuals show greater attention and preference for products that match their regulatory focus (Chernev, 2004; Florack & Scarabis, 2006; Hassenzahl et al., 2008).

Conceptually, different scarcity types align with the two regulatory foci. Supply scarcity enhances status and uniqueness, while demand scarcity generates safety through public endorsement. Prevention-focused individuals, who tend toward vigilance and error avoidance, may avoid products with supply-limited uniqueness due to the lack of reference from others' choices. Such "extreme" choices may violate prevention-focused tendencies toward risk aversion, stability, and caution. Instead, these vigilant individuals are more likely to choose the "safer" demand-scarce option, perceiving it as secure and error-proof. Promotion-focused individuals, conversely, are more likely to view supply-scarce products as opportunities. When a product is widely owned, its value as a status symbol diminishes, reducing desire among progress-oriented individuals. Overall, promotion focus aligns with supply scarcity characteristics, while prevention focus aligns with demand scarcity. When health product scarcity matches individuals' motivational traits, they recognize the product' s value and protective benefits, increasing acceptance and participation intentions. We therefore hypothesize that different scarcity types (supply vs. demand vs. abundance) interact with regulatory focus (promotion vs. prevention) to influence health behaviors, with supply scarcity-promotion focus and demand scarcity-prevention focus matches being most effective.

H1: Under supply scarcity conditions for health resources, promotion-focused

individuals are more willing to choose health behaviors; under demand scarcity conditions, prevention-focused individuals are more willing to choose health behaviors.

1.3 Perceived Value

In a world of abundant choices, people frequently face decision-making situations. Some goods or services become particularly special and valuable due to scarcity (Lei et al., 2020). This scarcity captures special attention and interest, thereby increasing perceived value. Imagine entering a boutique displaying a series of limited-edition watches, each with a unique design. You might perceive these watches as more valuable than ordinary ones because their scarcity occupies a special place in your mind. According to Brock's (1968) commodity theory, scarcity increases valuation of difficult-to-obtain products by stimulating interest and demand. Research demonstrates that emphasizing scarcity rather than abundance changes attitudes and preferences, significantly increasing perceived product value (Wu et al., 2012).

The Health Belief Model posits that when considering health products or behaviors, individuals evaluate perceived value by assessing protective effects against potential costs (Bechard et al., 2021). If a health product is scarce, people pay more attention to it, and scarcity increases perceived value, making them more likely to choose it. Regulatory Fit Theory suggests that decision environments matching individuals' goals increase perceived value (Aaker & Lee, 2006). Different scarcity types convey distinct signals, influencing perceived value and final choices. Promotion-focused individuals show higher perceived value for supply-scarce products matching their goal pursuit, while prevention-focused individuals show higher perceived value for demand-scarce products matching their goals, leading to health behavior choices under matching conditions.

We therefore propose: **H2:** Individuals perceive higher value and are more likely to choose health behaviors when scarcity type matches regulatory focus. Perceived value mediates the effect of regulatory focus-scarcity type matching on health behavior decision-making.

1.4 Research Framework

To test these hypotheses (see research model in Figure 1 [Figure 1: see original paper]), we conducted three studies. Study 1 used a questionnaire survey to collect nationwide data on HPV vaccination intentions, differentiated scarcity types, and measured regulatory focus to preliminarily explore the matching effect. Study 2 employed scenario experiments to manipulate scarcity types and included fitness, medical check-up, and virtual vaccine scenarios to test the matching effect on health intentions. Study 3 further examined the mediating mechanism and validated the matching effect with real health behavior indicators through scenario experiments where participants read scarcity manipulation materials and regulatory focus priming tasks on computer, reported

trait regulatory focus, perceived value, health intentions, and control variables, then were randomly assigned to different scarcity conditions for actual healthy food choices.

2.1 Research Purpose

Study 1 aimed to preliminarily investigate the effect of matching between HPV vaccine scarcity type (supply vs. demand vs. abundance) and regulatory focus (promotion vs. prevention) on health behavior intentions in a real-world context. Based on vaccine supply and reservation status displayed on appointment applets, we classified cities by scarcity type and examined its interaction with regulatory focus on vaccination intentions. We hypothesized that promotion-focused individuals would show stronger vaccination intentions under supply scarcity, while prevention-focused individuals would show stronger intentions under demand scarcity.

2.2.1 Participants

We recruited 403 participants online, each receiving 2 RMB compensation. Four participants failed attention checks and were excluded, leaving a final sample of 399 participants (303 females, 96 males; Mage = 28.08 ± 6.09 years).

2.2.2 Research Design

This study employed a 3 (scarcity type: supply scarcity, demand scarcity, abundance) × 2 (measured regulatory focus: promotion, prevention) between-subjects design, with health behavior intention as the dependent variable. Using G*Power 3.1, we calculated that a 3$×$2 between-subjects design with a medium effect size* f* = 0.25 and 90% statistical power required 206 participants (Faul et al., 2007). We used vaccine appointment applets (Yue Miao, Ganlanzhi HPV 9-valent, Dingxiang Yisheng) to query local vaccine reservation and supply status, classifying cities into supply scarcity (no reservation information available), demand scarcity (interface showing high reservation numbers, vaccine shortage, or "hot reservation in progress"), and abundance (sufficient vaccine supply with available reservation information). We distributed questionnaires to 48 cities across 9 provinces (Guangxi, Guizhou, Ningxia, Qinghai, Shanghai, Tibet, Xinjiang, Yunnan) [FIGURE:2-1].

2.2.3 Procedure

Participants first reported local 9-valent HPV vaccine availability, then indicated their vaccination intention, completed the trait regulatory focus measure, and finally provided demographic information (gender, age, monthly income, education level).

2.2.4 Materials

1. **Local 9-valent HPV vaccine availability** ("Can you get vaccinated in your area?")
2. **Vaccination intention** (Liu et al., 2022): Measured using the Net Promoter Score (NPS) scale (0-10 points), where 0-6 = unwilling, 7-8 = uncertain, 9-10 = willing.
3. **Regulatory focus motivation**: Measured using the Chinese version of the Regulatory Focus Questionnaire (RFQ) adapted by Yao et al. (2008), comprising 10 items: 4 prevention focus items (e.g., "Compared to most people, do you usually fail to get what you want from life?" ; $\alpha = 0.74$) and 6 promotion focus items (e.g., "Do you often do well at the various things you try to do?" ; $\alpha = 0.73$). Items were rated on a 5-point scale (1 = never, 5 = always). The scale showed good reliability in this study (Cronbach' s $\alpha = 0.80$).

Results

We conducted ANOVA with scarcity type and regulatory focus as independent variables and vaccination intention as the dependent variable, controlling for age, income, and education. Results showed a significant main effect of scarcity type ($F(2, 390) = 3.63$, $p = 0.027$, $\mathrm{p}^2 = 0.018$, 90% CI [0.001, 0.043]), no significant main effect of regulatory focus ($F(1, 390) = 0.26$, $p = 0.61$, $\mathrm{p}^2 = 0.001$, 90% CI [0.000, 0.011]), and no significant main effects of control variables (all $p > 0.05$). The interaction between scarcity type and regulatory focus was significant ($F(2, 390) = 3.29$, $p = 0.038$, $\mathrm{p}^2 = 0.017$, 90% CI [0.001, 0.040]). Simple effects analysis revealed that promotion-focused individuals showed significantly higher intentions in the abundance condition ($M = 8.99$) than in supply scarcity ($M = 8.24$) and demand scarcity ($M = 8.29$) conditions ($p < 0.05$). No significant differences emerged for prevention-focused individuals across scarcity conditions ($p > 0.05$) [FIGURE:2-2].

2.4 Discussion

Study 1 classified scarcity types based on regional HPV vaccine availability and measured regulatory focus to examine their matching effect on vaccination intentions. Consistent with our hypotheses, neither scarcity type nor regulatory focus showed significant main effects, suggesting that only the matching condition influences health intentions. However, we did not find a significant matching effect, though prevention-focused participants showed higher intention scores under demand scarcity than promotion-focused participants, aligning with our predictions. Demand-scarce vaccines represent a choice made by the majority, signaling safety and quality—characteristics valued by prevention-focused individuals who prioritize safety and error avoidance.

This study was conducted during the late pandemic period when public vigilance toward "viruses" and "vaccines" was exceptionally high, potentially explaining

the universally high vaccination intentions. Additionally, scarcity classification relied on applet information, which may involve subjective judgment or information errors, necessitating cautious interpretation. Future studies will manipulate scarcity types in laboratory conditions and examine additional health scenarios (fitness, medical check-ups) to investigate the matching effect on health behaviors.

3.1 Research Purpose

Study 2 further examined the matching effect between scarcity type and regulatory focus in experimental scenarios. We manipulated and measured scarcity, assessed regulatory focus, and tested the matching effect on health behavior intentions across different health contexts (fitness, medical check-ups, vaccination).

3.2.1 Participants

We recruited 280 participants through posters. After excluding 9 participants who failed attention checks, 271 valid responses remained (171 females, 100 males; Mage = 24.78 ± 3.50 years).

3.2.2 Research Design

This study used a 3 (health scenario: fitness, medical check-up, vaccine) × 3 (scarcity type: supply scarcity, demand scarcity, abundance) × 2 (measured regulatory focus: promotion, prevention) mixed design, with health scenario as a within-subjects factor and health behavior intention as the dependent variable. Using G*Power 3.1, we calculated that a 3$×3×$2 mixed design with medium effect size* f* = 0.25 and 90% power required 60 participants (Faul et al., 2007).

3.2.3 Procedure

Participants were randomly assigned to scarcity type conditions. They first read health behavior materials (fitness, medical check-up, vaccine) under different scarcity scenarios, then reported perceived scarcity, scarcity type perception, health behavior intention, trait regulatory focus, control variables, and demographics.

3.2.4 Materials

1. **Health behavior materials**: Self-developed scenarios for fitness, medical check-up, and virtual vaccine contexts.
2. **Scarcity manipulation** (adapted from Ku et al., 2012): For medical check-up scenarios:
   - *Supply scarcity*: "Basic check-up: Limited scheduling available, only 2 appointment slots remain."

- *Demand scarcity*: "Basic check-up: 2,134 people have already booked, few slots remain."
- *Abundance*: "Basic check-up: Sufficient appointment slots available."

3. **Regulatory focus motivation**: Same RFQ as Study 2 (prevention $\alpha = 0.77$, promotion $\alpha = 0.81$; overall Cronbach' s $\alpha = 0.84$).
4. **Scarcity manipulation check**: Three items (Liu & Li, 2017) assessing perceived scarcity, supply scarcity, and demand scarcity (e.g., "Did you perceive scarcity of this check-up?" "Do you think this is supply scarcity (caused by insufficient supply)?" "Do you think this is demand scarcity (caused by high demand)?").
5. **Health behavior intention**: NPS scale (Liu et al., 2022) as in Study 1.
6. **Control variables**: Emotion Report Form (Li et al., 2020) measuring positive ("happy," "pleased" ; $\alpha = 0.91$) and negative ("sad," "anxious," "annoyed," "afraid" ; $\alpha = 0.87$) emotions on 7-point scales.

3.3.1 Manipulation Check

We averaged participants' scarcity, supply scarcity, and demand scarcity ratings across health materials. One-way ANOVA with scarcity type as the independent variable showed significant differences ($F(2, 270) = 1162.49$, $p < 0.001$). Both supply scarcity ($M = 5.94$) and demand scarcity ($M = 5.97$) conditions showed significantly higher perceived scarcity than the abundance condition ($M = 2.09$, $p < 0.001$), with no difference between the two scarcity conditions. Participants in the supply scarcity condition perceived higher supply scarcity ($M = 5.62$) than those in demand scarcity ($M = 4.25$, $p < 0.001$), while demand scarcity participants perceived higher demand scarcity ($M = 5.74$) than supply scarcity participants ($M = 3.85$) and abundance participants ($M = 2.44$, $p < 0.001$), confirming successful manipulation [TABLE:3-1].

3.3.2 Effects of Scarcity Type-Regulatory Focus Matching on Health Behavior Intentions

Repeated measures ANOVA with health material as the within-subjects factor and scarcity type and regulatory focus as between-subjects factors revealed a significant main effect of health material ($F(2, 265) = 29.08$, $p < 0.001$, $\mathrm{p}^2 = 0.099$, 90% CI [0.112, 0.244]), with vaccine intentions significantly higher than fitness and check-up intentions ($p < 0.001$). The health material × scarcity type interaction was not significant ($F(4, 265) = 0.48$, $p = 0.75$, $\mathrm{p}^2 = 0.004$, 90% CI [0.000, 0.016]), nor was health material × regulatory focus ($F(2, 265) = 0.013$, $p = 0.98$, $\mathrm{p}^2 < 0.001$, 90% CI [0.000, 0.002]). However, the three-way interaction was significant ($F(4, 265) = 8.10$, $p < 0.001$, $\mathrm{p}^2 = 0.058$, 90% CI [0.047, 0.160]).

Neither scarcity type nor regulatory focus showed significant main effects ($p > 0.05$), but their two-way interaction was significant ($F(2, 265) = 16.72$, $p < 0.001$, $\mathrm{p}^2 = 0.112$, 90% CI [0.056, 0.170]).

Simple effects analysis of the three-way interaction showed: - **Fitness scenario**: Promotion-focused participants showed higher intentions under supply scarcity than demand scarcity ($F(1, 267) = 26.97$, $p < 0.001$, $p^2 = 0.092$, 90% CI [0.044, 0.150]). Prevention-focused participants showed higher intentions under demand scarcity than supply scarcity ($F(1, 267) = 29.08$, $p < 0.001$, $p^2 = 0.098$, 90% CI [0.048, 0.157]). No differences emerged in the abundance condition ($F(1, 267) = 0.07$, $p = 0.788$, $p^2 < 0.001$, 90% CI [0.000, 0.011]). - **Check-up scenario**: Promotion-focused participants showed higher intentions under supply scarcity than demand scarcity ($F(1, 267) = 8.44$, $p = 0.004$, $p^2 = 0.031$, 90% CI [0.006, 0.072]). Prevention-focused participants showed marginally higher intentions under demand scarcity than supply scarcity ($F(1, 267) = 3.89$, $p = 0.050$, $p^2 = 0.014$, 90% CI [0.000, 0.047]). No differences appeared in the abundance condition ($F(1, 267) = 0.98$, $p = 0.323$). - **Vaccine scenario**: No significant differences emerged for regulatory focus or scarcity type ($p > 0.05$) [FIGURE:3-1, FIGURE:3-2].

3.4 Discussion

Study 2 examined the matching effect across different health scenarios. In fitness and check-up scenarios, prevention-focused participants showed higher health intentions under demand scarcity, while promotion-focused participants showed higher intentions under supply scarcity, consistent with hypotheses and prior research (Latimer et al., 2008). Previous scarcity-vaccination research yielded inconsistent results: some found scarcity increased intentions (Pereira et al., 2021), while others found it decreased intentions, with empathy as a mediator (Pereira et al., 2022). Sprengholz et al. (2021) found perceived vaccine scarcity increased intentions and protective behaviors. However, our Studies 1 and 2 found no significant effects of scarcity or scarcity type on vaccination intentions. The vaccine scenario in Study 2 showed universally high intentions across scarcity conditions, consistent with Study 1. The global pandemic likely heightened attention to disease and vaccine information, creating a ceiling effect (Liu & Wang, 2021). Therefore, Study 3 excluded vaccine materials and focused on fitness and check-up scenarios.

4.1 Research Purpose

Study 3 examined the robustness of the matching relationship in a laboratory setting, investigated its mediating mechanism, and incorporated real health behavior indicators. The study had two parts: Part 1 involved computer-based tasks where participants reported trait regulatory focus, completed situational regulatory focus priming, read health materials (fitness and check-up) under different scarcity types, and reported control variables. Part 2 involved actual healthy food choices, where participants were randomly assigned to scarcity conditions and chose between healthy and unhealthy foods.

4.2.1 Participants

We recruited 232 participants through posters. After excluding 2 who failed attention checks and 2 who failed regulatory focus manipulation checks, 228 valid responses remained (123 females, 105 males; Mage = 23.20 ± 1.75 years).

4.2.2 Research Design

Part 1 used a 2 (health material: fitness/check-up) × 3 (scarcity type: supply/demand/abundance) × 2 (manipulated regulatory focus: prevention/promotion) mixed design, with health material as a within-subjects factor and health behavior intention as the dependent variable. Using G*Power 3.1, we calculated that a 2$×3×$2 mixed design with medium effect size* f* = 0.25 and 90% power required 72 participants (Faul et al., 2007).

Part 2 used a 3 (scarcity type: supply/demand/abundance) × 2 (regulatory focus: prevention/promotion) between-subjects design with actual healthy food choice as the dependent variable. Power analysis indicated 206 participants were needed for 90% power with medium effect size $f = 0.25$ (Faul et al., 2007).

4.2.3 Procedure

Participants were randomly assigned to one of six conditions (3 scarcity types × 2 regulatory focus primes). In Part 1, participants first reported trait regulatory focus to ensure it wouldn' t affect the manipulation, then completed regulatory focus priming tasks and manipulation checks. Next, they read scarcity-primed health materials (fitness and check-up scenarios) and reported perceived scarcity, scarcity type perception, health behavior intention, perceived value, control variables, and demographics.

In Part 2, after completing computer tasks, participants were guided to a table at the back of the room for actual food selection. The table displayed two plates (one healthy food, one unhealthy food) of identical size and color (white flat plates). Participants were randomly assigned to a scarcity scenario and chose between equally priced but calorically different foods: healthy options (apple, 300 kJ/100g; peach, 200 kJ/100g) and unhealthy options (spicy snack, 1821 kJ/100g; sandwich cookie, 2027 kJ/100g). Their selection served as part of their participant compensation, to be collected at the exit, with assistants recording their choices.

We manipulated scarcity degree and type of healthy foods while keeping unhealthy foods (two packs each of spicy snacks and sandwich cookies) constant. In the supply scarcity condition, one apple and one peach were presented with the instruction: "The fruit is limited supply, so only a few remain." In the demand scarcity condition, one apple and one peach were presented with four confederates queued at the exit, and the instruction: "Many people choose the fruit, so only a few remain." In the abundance condition, two apples and two peaches were presented with the instruction: "Both products are fully stocked."

4.2.4 Materials

1. **Trait regulatory focus**: Same as Study 2.
2. **Regulatory focus manipulation**: Participants helped a mouse navigate a maze to either "eat cheese" (promotion) or "avoid the owl" (prevention) [FIGURE:4-1, FIGURE:4-2].
3. **Manipulation check**: Participants answered what the mouse' s goal was: A) get cheese, B) avoid the owl, or C) don' t know. Two participants answered incorrectly and were excluded (Duan et al., 2013; Friedman-Wheeler et al., 2010; Geng & Jiang, 2017).
4. **Health materials**: Same fitness and check-up scenarios as Study 2.
5. **Scarcity manipulation**: Same as Study 2.
6. **Scarcity and scarcity type perception**: Same manipulation checks as Study 2.
7. **Health behavior intention**: Same NPS measure.
8. **Perceived value**: Adapted from Dodds (1991), one item measured perceived value of health behaviors ("I think this gym is worth participating in") on a 7-point scale (1 = strongly disagree, 7 = strongly agree).
9. **Control variables**: BMI, hunger level (1-7), food preference ratings for each option (1-7), and the same emotion scale as Study 1.

4.3.1 Manipulation Check

Averaging across health materials, one-way ANOVA showed significant differences in perceived scarcity across conditions ($F(2, 227) = 361.84$, $p < 0.001$). Both supply scarcity ($M = 6.02$) and demand scarcity ($M = 6.13$) conditions showed higher perceived scarcity than abundance ($M = 1.93$, $p < 0.001$), with no difference between scarcity conditions. Participants in the supply scarcity condition perceived higher supply scarcity ($M = 5.91$) than those in demand scarcity ($M = 5.32$, $p < 0.001$), while demand scarcity participants perceived higher demand scarcity ($M = 5.75$) than supply scarcity ($M = 4.57$) and abundance ($M = 2.05$, $p < 0.001$), confirming successful manipulation [TABLE:4-1].

4.3.2 Effects of Scarcity Type-Regulatory Focus Matching on Health Behavior Intentions

Repeated measures ANOVA with health material as the within-subjects factor, scarcity type and manipulated regulatory focus as between-subjects factors, and positive/negative emotions and trait regulatory focus as covariates showed no significant main effect of health material ($F(1, 219) = 1.96$, $p = 0.58$, $\mathrm{p}^2 = 0.009$, 90% CI [0.000, 0.040]) or covariates (all $p > 0.05$). The health material × scarcity type interaction was not significant ($F(2, 219) = 1.45$, $p = 0.236$, $\mathrm{p}^2 = 0.013$, 90% CI [0.000, 0.036]), but health material × regulatory focus was significant ($F(1, 219) = 7.74$, $p = 0.006$, $\mathrm{p}^2 = 0.034$, 90% CI [0.006, 0.082]). Promotion-focused participants showed higher overall intentions than prevention-focused participants ($F(1, 219) = 4.39$, $p = 0.037$, $\mathrm{p}^2 = 0.020$, 90%

CI [0.001, 0.060]). The three-way interaction was significant ($F(2, 219) = 7.96$, $p < 0.001$, $p^2 = 0.068$, 90% CI [0.006, 0.083]).

Simple effects analysis revealed: - **Fitness scenario**: Prevention-focused participants showed higher intentions under supply scarcity than promotion-focused participants ($F(1, 224) = 8.36$, $p = 0.004$, $p^2 = 0.036$, 90% CI [0.007, 0.084]). No difference emerged under demand scarcity ($p = 0.221$). Promotion-focused participants showed higher intentions than prevention-focused participants in the abundance condition ($F(1, 224) = 15.67$, $p < 0.001$, $p^2 = 0.065$, 90% CI [0.023, 0.123]). - **Check-up scenario**: Prevention-focused participants showed higher intentions under demand scarcity than promotion-focused participants ($F(1, 224) = 4.14$, $p = 0.043$, $p^2 = 0.018$, 90% CI [0.000, 0.057]). Promotion-focused participants showed higher intentions than prevention-focused participants in the abundance condition ($F(1, 224) = 26.57$, $p < 0.001$, $p^2 = 0.106$, 90% CI [0.050, 0.172]). No difference emerged under supply scarcity ($p > 0.05$) [FIGURE:4-3].

4.3.3 Mediating Role of Perceived Value

Correlation analysis showed that fitness perceived value correlated significantly with fitness intention ($p < 0.01$), and check-up perceived value correlated significantly with check-up intention ($p < 0.01$) [TABLE:4-3].

We used PROCESS macro v3.2 (Model 7) to test mediation (Fang et al., 2017), with dummy-coded independent and moderator variables (abundance as reference). For fitness perceived value ($F(5, 222) = 2.95$, $p = 0.013$), the scarcity type × regulatory focus interaction significantly predicted fitness value ($F(2, 222) = 6.307$, $p = 0.002$). For fitness intention ($F(3, 224) = 70.61$, $p < 0.01$), fitness value significantly predicted intention ($b = 0.89$, $p < 0.001$, 95% CI [0.76, 1.01]). Relative mediation analysis showed that for promotion-focused individuals under supply scarcity, fitness value significantly predicted intention (95% CI [-1.03, -0.27]), while for prevention-focused individuals under demand scarcity, the 95% bootstrap CI [-0.51, 0.76] contained zero. The relative direct effect was significant ($F(2, 224) = 3.22$, $p = 0.042$).

For check-up perceived value ($F(5, 222) = 5.45$, $p < 0.001$), the interaction significantly predicted value ($F(2, 222) = 7.51$, $p < 0.001$). For check-up intention ($F(3, 224) = 56.93$, $p < 0.001$), check-up value significantly predicted intention ($b = 0.082$, $p < 0.001$, 95% CI [0.69, 0.94]). Relative mediation analysis showed that promotion-focused individuals under supply scarcity (95% CI [-0.89, -0.27]) and prevention-focused individuals under demand scarcity (95% CI [0.26, 1.29]) both showed significant mediation. The relative direct effect was significant ($F(2, 224) = 5.25$, $p = 0.006$) [TABLE:4-4].

4.4.1 Binary Logistic Regression for Health Behavior

We screened variables for inclusion in binary logistic regression. Continuous variables (hunger level, age, positive emotions, trait regulatory focus) showed no significant relationships with food choice ($p > 0.05$) and were excluded. Categorical variables (gender, education, income, scarcity scenario, manipulated regulatory focus) were tested via chi-square; family income and manipulated regulatory focus showed no significant relationship with food choice ($p > 0.05$). Multicollinearity testing via linear regression showed all VIFs < 5, indicating no multicollinearity.

Given the time gap between regulatory focus manipulation and actual food choice, we used trait regulatory focus as the predictor. The model with scarcity scenario, trait regulatory focus, and covariates (apple preference, peach preference, cookie preference, spicy snack preference, gender, education, negative emotions, manipulated regulatory focus) was statistically significant ($^2 = 61.07$, $p < 0.001$) with good fit ($^2 = 13.23$, $p > 0.1$). Compared to abundance, supply scarcity reduced healthy food choice (OR = 0.15, B = -1.89, $p = 0.009$). Relative to prevention focus, promotion-focused individuals were more likely to choose healthy food under supply scarcity (OR = 34.66, $B = 3.55$, $p = 0.003$). Relative to promotion focus, prevention-focused individuals were more likely to choose healthy food under demand scarcity (OR = 34.66, $B = 3.55$, $p < 0.05$). Apple preference positively predicted healthy choice (OR = 1.65, $B = 0.50$, $p = 0.01$), while cookie preference (OR = 0.58, B = -0.55, $p = 0.001$) and negative emotions (OR = 0.48, B = -0.73, $p = 0.012$) negatively predicted healthy choice [TABLE:4-5, TABLE:4-6, FIGURE:4-4].

4.5 Discussion

Study 3 had two parts. Part 1 manipulated regulatory focus and scarcity, examining perceived value as a mediator. The match between manipulated scarcity type and regulatory focus significantly predicted health intentions. Specifically, in the check-up scenario, prevention-focused individuals under demand scarcity showed higher intentions than promotion-focused individuals, with perceived value mediating this effect—consistent with our hypothesis that matching increases perceived fit and value, promoting health behaviors. Part 2 examined actual healthy food choices, demonstrating that trait regulatory focus-scarcity type matching predicted real health behavior: prevention-focused individuals chose healthy foods more under demand scarcity, while promotion-focused individuals did so under supply scarcity. This validates our hypotheses and enhances external validity.

5 General Discussion

Three studies confirmed that regulatory focus-scarcity type matching promotes health behaviors. Prevention-focused individuals show higher health intentions and decision-making under demand scarcity, while promotion-focused individu-

als show higher intentions under supply scarcity. We further demonstrated that perceived value mediates this effect. Using real vaccination scenarios, imagined health contexts, and actual food choices, we validated the matching effect on both health intentions and behaviors. These findings expand regulatory fit theory' s application and demonstrate an economical, non-coercive approach to promoting health behaviors, providing a foundation for health interventions and nudges.

5.1 The Impact of Scarcity on Health Behavior Decision-Making

Research on scarcity and health has primarily focused on negative effects. Economic scarcity often leads to unhealthy decisions (De Bruijn & Antonides, 2022), with low-income individuals forgoing medical insurance or treatment due to cost considerations (Lusardi et al., 2015). Resource scarcity limits long-term, rational decision-making. Our proposed matching effect does not suggest that scarcity itself improves health behaviors—scarcity of essential public resources creates social and health problems. Instead, we refer to creating perceived scarcity of health products through simple measures. Scarcity mindset theory posits that scarcity creates a "tunneling" effect on attention (Mullainathan & Shafir, 2013): scarcity increases focus on scarce resources (e.g., hungry individuals attend more to food; poor individuals focus on money-related cues). Thus, scarcity messaging for gyms can attract participants, increase exercise intentions, and improve physical fitness; scarcity messaging for check-ups can enhance health awareness, enable early disease detection, reduce severe disease rates, and protect lives and property (Gunn et al., 2019). Our findings apply to health-promoting and disease-preventing products, using scarcity attributes to increase public attention and preference, and further enhancing value perception through regulatory focus-scarcity type matching to boost health decisions.

Dual-system theory (Tversky & Kahneman, 1974) proposes that decisions rely on System 1 (fast, unconscious, effortless) and System 2 (slow, deliberate, resource-intensive). System 1 often leads to convenient, hedonistic, unhealthy choices, and health policymakers aim to counteract these effects (Polak, 2013). However, research shows we can harness System 1 to habitualize healthy behaviors through awareness campaigns. Brief psychological interventions for high-caries-risk youth immediately improved dental health awareness and oral health (Wide et al., 2018). Seatbelt promotion significantly reduced injury and mortality rates, enhancing safety awareness (Ataee et al., 2017). Handwashing campaigns effectively reduced disease transmission (Saei Ghare Naz et al., 2018). Self-care awareness promotion positively impacted breast cancer screening and anemia prevention (Seshan et al., 2018). When safety knowledge becomes ubiquitous, it enhances health awareness, making health decisions habitual and unconscious—changes driven by System 1 that simplify and expedite healthy choices. When health products become highly attractive, decisions rely on System 1' s intuition and emotion, triggering choices before

considering long-term benefits. Our scarcity-labeled health products became salient, attracting attention and eliciting desire, craving, or dissatisfaction, with System 1' s emotions and intuition driving selection of scarce health products. Regulatory focus-scarcity type matching further enhanced this attention and preference, nudging health decisions—consistent with nudge theory' s advocacy for non-coercive, low-cost, effective interventions (Thaler & Sunstein, 2008).

5.2 Effects of Promotion and Prevention Focus on Health Behavior

Previous research links promotion focus to risk-taking, unethical behavior, and risky actions (Gino & Margolis, 2011). However, Study 3 found promotion-focused individuals showed higher health intentions than prevention-focused individuals in abundance conditions for both fitness and check-up scenarios, and Study 1 showed higher vaccination intentions among promotion-focused individuals in abundance conditions. According to regulatory focus theory (Higgins, 1997), promotion-focused individuals are more action-oriented, pursue gains, and perceive potential benefits. Research shows promotion-focused individuals consider nutritional content when choosing foods, which doesn' t significantly affect prevention-focused individuals' choices (Pillai et al., 2019). We infer that promotion-focused participants showed higher intentions because they perceived potential benefits in the health materials. Additionally, Pula et al. (2014) found promotion-focused individuals emphasize naturalness and price, while prevention-focused individuals prioritize emotions, convenience, and familiarity. The ubiquity and familiarity of HPV vaccines may have affected vaccination intentions, with prevention-focused individuals possibly showing caution-driven reluctance.

Previous research shows prevention-focused individuals adopt avoidance behaviors in health-threatening contexts: higher preventive behaviors during COVID-19 (handwashing) (Luo et al., 2020), fewer sexual partners (Rodrigues et al., 2021), higher health threat perception (Rodrigues et al., 2022), greater health concern (Zou & Scholer, 2016), better medical adherence (Avraham et al., 2016), cancer screening participation (Ferrer et al., 2017), smoking cessation maintenance (Fuglestad et al., 2013), condom use with non-regular partners (Evans-Paulson et al., 2021; Rodrigues et al., 2021), greater behavioral control (Lemarié et al., 2019), and less anxiety after protective measures during COVID-19 (Rodrigues et al., 2022). However, our materials did not convey health threats, potentially explaining why prevention-focused participants didn' t show higher intentions than promotion-focused participants.

5.3 Effects of Scarcity Type-Regulatory Focus Matching on Health Behavior Decision-Making

Research shows that gain/loss message frames matching regulatory focus improve health intentions (Cesario et al., 2004): loss frames for prevention focus

and gain frames for promotion focus enhance health behaviors. Our findings extend this by demonstrating that situational matching promotes decision-making. Results show that adapting scarcity types to regulatory focus orientations concentrates attention and preference, increases perceived value of health products, and promotes health behavior decisions—validated in actual food choices. This supports the beneficial effects of message frame-regulatory focus matching on health promotion (Latimer et al., 2008), who found that emphasizing positive outcomes increased intentions for promotion-focused individuals, while emphasizing negative consequence avoidance increased intentions for prevention-focused individuals.

Research consistently shows scarcity increases attention to scarce products. Mismatches between resources and needs create scarcity perception, driving acquisition behaviors. Food shortage or hunger experiences increase portion sizes, value attribution, and high-calorie food selection to compensate for caloric deficits (Crandall & Temple, 2018). Scarce product labels trigger desire for ownership (Park et al., 2020). Demand scarcity (popularity) triggers prevention-focused individuals' ownership intentions and value attribution, as mass selection signals quality endorsement that aligns with their error-avoidance needs. Luxury goods symbolize rarity and status; emphasizing health product rarity signals quality and preciousness, aligning with promotion-focused individuals' pursuit of excellence and uniqueness. Thus, supply scarcity messaging increases promotion-focused individuals' perceived value and selection of health products. Fennis et al. (2020) found that scarce healthy foods attracted fast life-history strategists, while abundant healthy foods attracted slow strategists. Our research matches individual regulatory focus with scarcity types, validating the matching effect on health behaviors. Since regulatory focus is malleable and can be manipulated through emotions, recall, and framing (Berezowska et al., 2018), it can be effectively integrated into health promotion strategies.

5.4 Research Significance

The Health Belief Model is a widely validated theoretical framework explaining health behaviors through processes including: perceived disease susceptibility and severity; evaluation of health behavior benefits and costs; and cues to action including medical environment, service quality, and campaigns. Our scarcity manipulation of health resources increased attention to scarce health products, created behavioral cues, and combined with individuals' regulatory focus to evaluate gains/losses: prevention-focused individuals evaluated demand-scarce products as more aligned with their avoidance goals, perceiving mass-endorsed products as safe and error-proof, thus valuing health products more and adopting health behaviors; promotion-focused individuals evaluated supply-scarce products as aligned with their advancement goals, perceiving exclusive products as symbolizing excellence and uniqueness, thus attributing higher value and adopting health behaviors. While previous HBM applications remained correlational (Bechard et al., 2021; Carico et al., 2021; Tam et al., 2023), our study provides

empirical support. We also expand scarcity theory' s practical applications, explore scarcity type characteristics, harness scarcity' s positive effects, and extend regulatory fit theory to health behavior research, offering new perspectives.

Practically, leveraging nudge techniques to enhance public health represents a promising application (He et al., 2018). Our findings on scarcity type-regulatory focus matching provide new nudge and intervention foundations. Health organizations can better understand product characteristics, match them to individual traits, improve product fit, and enhance health promotion effectiveness.

5.5 Limitations and Future Directions

First, Study 1 classified scarcity types using vaccine applets, which may have timeliness and accuracy limitations. Future research could use medical system data, actual production/distribution information, and local vaccination rates to improve reliability. Second, although we used real health behavior indicators, these weren' t naturally occurring behaviors. Future field studies should validate the matching effect to increase external validity. Third, research shows personality traits like conscientiousness, neuroticism, and openness correlate with exercise intentions and behaviors (Villaron et al., 2017). Future studies could explore how health information matching interacts with different personality traits to influence health behaviors.

Key Findings: 1. Scarcity type-regulatory focus matching promotes health behavior decision-making: prevention-focused individuals prefer health behaviors under demand scarcity, while promotion-focused individuals prefer them under supply scarcity. 2. Perceived value mediates the promoting effect of scarcity type-regulatory focus matching on health behavior decision-making.

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[All other references remain exactly as provided in the original text, preserving all formatting, DOIs, and details.]

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