An Analysis of Consumer Medication Adherence Behavior: Based on a Two-Stage Theoretical Model

Authors: Shen Manqiong, Jiancai Liao, Haizhong Wang, Wang Haizhong

Date: 2024-01-18T00:00:00+00:00

Abstract

Whether individual health behavior change exhibits stage-based characteristics is currently a focal point of debate. Medication adherence behavior, as a key indicator affecting medical outcomes, exerts significant influence on individuals' physical and mental health. Previous research reviews on medication adherence levels have predominantly adopted a medical perspective, focusing on medication adherence behaviors for specific diseases. However, against the backdrop of marketization in the healthcare industry, few studies have examined the impact of information processing modes and psychological processes on consumer medication adherence behavior from a consumer perspective. Simultaneously, existing research also lacks theoretical classification and discussion of adherence behaviors. Based on a two-stage theoretical model, this paper reviews the influencing factors affecting consumer medication adherence behavior in the marketing domain, systematically examines intervention strategies, and proposes future research trends and prospects. Theoretically, this contributes to understanding individual medication adherence behavior from the perspective of health behavior change stages, thereby enriching stage theories in the health domain. Practically, it facilitates a better understanding of consumer psychological health and behavioral patterns, and provides marketing insights for chronic disease management.

Full Text

Preamble

Research on Consumer Medication Adherence Behavior: A Two-Stage Theoretical Model

SHEN Manqiong[1], LIAO Jiancai[2], WANG Haizhong[3]
(1 School of Management, Guangdong University of Technology, Guangzhou

510520, Guangdong, China)
(2 Department of Marketing, Aalto University School of Business, P.O. Box 21230, FI-00076 Aalto, Finland)
(3 School of Business, Sun Yat-sen University, Guangzhou 510275, China)

Abstract: Whether individual health behavior change occurs in stages remains a contentious issue in current research. Medication adherence, as a critical indicator influencing healthcare outcomes, significantly impacts individual physical and mental well-being. Previous literature reviews on medication adherence have predominantly adopted a medical perspective, focusing on adherence behaviors related to specific diseases. However, against the backdrop of healthcare industry marketization, few studies have examined how information processing modes and psychological processes influence consumer medication adherence behavior from a consumer perspective. Moreover, existing research lacks theoretical classification and discussion of adherence behavior. Drawing upon a two-stage theoretical model, this review examines marketing-related factors influencing consumer medication adherence, synthesizes intervention strategies, and proposes future research directions. Theoretically, this contributes to understanding individual medication adherence behavior through the lens of health behavior change stages, enriching stage theories in the health domain. Practically, it enhances comprehension of consumer mental health and behavioral patterns while providing marketing insights for chronic disease management.

Keywords: medication adherence, consumer behavior, healthcare marketing, behavioral intervention

Medication adherence represents a critical topic in healthcare, directly affecting consumer health and well-being. Medication adherence level refers to the degree to which consumers follow or adopt recommendations from individuals or organizations regarding drug acquisition (purchase) and proper use (Bowman et al., 2004). These drugs include prescription medications, over-the-counter drugs, and health examination products or services. The World Health Organization (WHO) notes that chronic diseases such as diabetes, cardiovascular disease, and cancer account for over 70% of all disease burden, and whether patients follow medical advice regarding timely and proper medication use has become a crucial factor affecting quality of life and life expectancy (Desai et al., 2016). Concurrently, as healthcare reforms and marketization progress, pharmaceutical companies increasingly recognize the importance of the pharmaceutical market (Agarwal et al., 2020). Internet healthcare platforms such as Ali Health, JD Health, Ping An Good Doctor, and Chunyu Doctor have become integrated into consumers' daily lives.

With healthcare industry marketization, pharmaceutical information dissemination and communication have become ubiquitous, making it imperative to understand medication adherence levels from a consumer perspective. This necessity stems from several factors: First, consumers' drug purchasing and usage processes constitute consumption activities, and non-adherence during this process can render disease treatment ineffective or inefficient. Second, for

enterprises and organizations, low medication adherence means consumers fail to persist in purchasing and taking medications, resulting in losses for pharmaceutical companies. According to Cutler et al. (2018), the annual cost of medication non-adherence reaches $100–290 billion in the United States, €12.5 billion in Europe, and approximately AUD 7 billion in Australia. Finally, consumer non-adherence generates increased consumption of public services, such as more frequent hospital visits, raising public healthcare expenditures.

Given that non-adherence or low adherence has become a significant constraint on consumer health, this paper integrates influencing factors across both stages based on a two-stage theoretical model and proposes corresponding interventions to advance domestic research in this field. This study overcomes the limitation of fragmented current research by developing an integrated model based on the two-stage model of health behavior change, examining both drug acquisition and drug-taking phases from cognitive and therapeutic construction perspectives. Potential contributions include: (1) Providing a two-stage integrated model based on medication adherence concepts and definitions to reveal influencing factors, synthesize intervention strategies, and propose future research directions, facilitating exploration, understanding, and intervention of individual medication adherence behavior through health behavior change stages. (2) Moving beyond traditional medical theoretical frameworks to examine medication adherence from consumer group and consumer psychology perspectives, revealing research dynamics and progress in consumer behavior. (3) Advancing and enriching stage theories in the health domain, where researchers hold inconsistent views on whether behavior is stage-based or non-stage-based. This study synthesizes influencing factors and intervention strategies across different stages of health behavior change in medication adherence contexts, contributing to health action stage theory. (4) Offering significant practical implications. COVID-19 has posed tremendous threats to global health, sounding alarms about health behaviors. This research helps understand post-pandemic consumer behavior and provides marketing insights for chronic disease management.

Received: March 29, 2023
*Funded by: National Natural Science Foundation of China Youth Project (72102076); National Natural Science Foundation of China General Project (72072191); National Natural Science Foundation of China Key Project (71832015)
Corresponding author: WANG Haizhong, email: wanghzh@mail.sysu.edu.cn

2 Two-Stage Theoretical Model

In recent years, stage theories of health behavior change have gained increasing attention in research and health promotion. Developed from social cognitive theory, stage theory posits that consumer health behavior is not a continuous process but a multi-stage process (Schwarzer, 2008a; 2008b). Stage theory main-

tains that individuals progress through a series of qualitatively distinct, ordered stages when deciding on, initiating, and maintaining health-related behaviors (Brug et al., 2005). Individuals in the same stage face common barriers, while those in different stages encounter different obstacles (Weinstein et al., 1998). Unlike traditional continuous health behavior theories such as the Theory of Reasoned Action (Weinstein, 1993) and Theory of Planned Behavior (TPB; Conner & Sparks, 2005), which view behavior as resulting from intention and treat health behavior change as a linear function of variables, stage theories do not treat individual health behavior change linearly. Current stage theories include the Precaution Adoption Process Model (PAPM), Transtheoretical Model (TTM), I-Change Model, and Health Action Process Approach (HAPA). PAPM assumes at least six stages from unawareness to maintenance, TTM hypothesizes five stages from precontemplation to maintenance, and the I-Change Model assumes health behavior change involves pre-motivational, motivational, and action stages. HAPA divides health behavior change into motivational and volitional stages. Thus, while these theories propose that health behavior change involves different psychological processes across stages, they share the common view that different cognitive components play important roles at different stages. The intention-behavior relationship is not linear but should match interventions to stage characteristics.

In medication adherence research, comparative analysis between two-stage models (such as HAPA) and traditional multi-stage models (such as PAPM and TTM) reveals significant advantages and applicability of the former. First, regarding operability, HAPA focuses on motivational and volitional stages, enabling research to concentrate on factors influencing consumers' medication-taking intention (motivational stage) and maintenance of medication-taking behavior (volitional stage) (Schwarzer, 2008b). This simplified approach reduces the number of stages, thereby decreasing complexity in understanding and intervening in medication behavior, allowing researchers to more clearly identify intervention points (Schwarzer, 2008b) and improving intervention operability. For example, interventions can enhance motivation through patient education and strengthen maintenance through reminder systems. Second, regarding intervention evaluation, the simplified stage structure facilitates easier assessment of interventions (Luszczynska & Schwarzer, 2005). In contrast, multi-stage models like PAPM and TTM typically encompass multiple stages from awareness to action to maintenance. Overly specific distinctions may reduce focus on critical transition points (Prochaska & DiClemente, 1983), making it relatively difficult to design stage-specific interventions and evaluate their effects (Weinstein et al., 1998). Third, regarding cultural and environmental adaptability, two-stage models demonstrate significant advantages. HAPA's simplified framework adapts easily across different cultural and environmental contexts, particularly within various healthcare systems (Schwarzer & Luszczynska, 2008). Moreover, two-stage models apply to various types of medication adherence issues, whether long-term or short-term treatment (Luszczynska & Schwarzer, 2005). Multi-stage models' complexity may require greater consideration of specific cultural

and environmental factors, limiting model adaptability and potentially making them more suitable for specific behavior change contexts (Glanz et al., 2008). Overall, in medication adherence behavior, HAPA's two stages better align with the drug acquisition awareness stage and drug-taking treatment stage, providing a more generalizable summary of consumer medication adherence behavior across both stages. This theory is both intuitive and facilitates targeted intervention design. Therefore, this study uses HAPA's two-stage theory as its foundation to synthesize and summarize consumer medication adherence behavior across both stages.

According to the two-stage theory of health action processes, health behavior change divides into two stages (Schwarzer, 2008a; 2008b). The motivational stage's primary task involves forming health action intentions, while the volitional process represents a post-intentional stage. The volitional stage refers to individuals' reactive processes regarding effort and maintenance of health behaviors (Schüz et al., 2007). The motivational stage describes what we want to do, whereas the volitional stage describes how we do it and how long we persist (Gao et al., 2012). The distinction between motivational and volitional stages lies in observable behavioral changes. The motivational stage primarily forms intentions; individuals in this stage want to act but have not yet acted. Individuals in the volitional stage have already executed the intended behavior (Schwarzer, 2008a). In medication adherence contexts, the drug acquisition awareness stage represents the motivational stage of medication-taking, focusing primarily on forming medication-taking intentions. The drug-taking treatment stage represents the volitional stage, describing the process after consumers form medication-taking intentions—transforming intentions into actions and maintaining medication-taking behavior. The transition point between these stages lies in whether consumers have formed medication-taking intentions (Schüz et al., 2009).

The following sections will systematically examine factors influencing consumer medication adherence levels during both stages and corresponding intervention measures, providing scientific evidence for improving consumer medication adherence behavior.

3 Factors Influencing Medication Adherence Under the Two-Stage Model

Based on two-stage model theory, this section examines factors influencing consumer medication adherence behavior across both stages. The two-stage theoretical model of consumer medication adherence divides the treatment process into the drug acquisition awareness stage and the drug-taking treatment stage.

3.1.1 Consumer Inherent Beliefs

(1) Inherent Beliefs About Medications

Consumers often rely on inherent beliefs—general knowledge and intuition

about how things work—to judge product efficacy. For example, the belief that "no pain, no gain" may influence efficacy perceptions. In pharmaceuticals, emphasizing that products negatively affect consumers and have side effects may lead consumers to infer greater effectiveness. Kramer et al. (2012) found that drugs with frequent side effects may be perceived as more effective than those with few or no side effects, because consumers believe that more potent drugs produce more frequent or severe side effects. Similarly, the belief that "good medicine tastes bitter" is deeply ingrained—medications that taste unpleasant may be inferred as relatively more effective, while pleasant-tasting medications are likely considered ineffective, reflecting the "no pain, no gain" heuristic.

(2) Inherent Beliefs About Treatment Methods
Consumers hold specific beliefs about different alternative therapies (e.g., Western vs. Chinese medicine). For instance, consumers generally believe Western medicine focuses on symptom relief (treating symptoms but not root causes) and targets specific body parts, while Chinese medicine focuses on treating diseases (addressing root causes) and considers the whole body. Wang et al. (2010) demonstrated that these inherent beliefs ultimately drive consumer preferences and consumption decisions. When consumers can easily identify disease roots (i.e., high diagnostic certainty), they tend to choose therapies that directly target specific causes (e.g., medications targeting specific body parts). When consumers face difficulty inferring causes from symptoms (high diagnostic uncertainty), they prefer therapies focusing on the whole body. These choices can be explained by inherent beliefs that Western medicine works quickly while Chinese medicine works slowly.

3.1.2 Prior Knowledge About Medications

Consumer experience and existing knowledge affect medication adherence levels through medication attributes (e.g., size, color) and external packaging factors.

(1) Inherent Medication Attributes
Medication attributes such as hue and saturation significantly influence perceived efficacy and consumer medication-taking intentions. Regarding hue, research indicates that colored medications appear more effective than colorless ones (Brieger et al., 2007). Roullet and Droulers (2005) found that products in dark packaging (red, blue, brown) were perceived as more therapeutic, faster-acting, more expensive, and having more side effects. Red, brown, and gray (but not yellow and green) packaging was perceived as designed for serious diseases. Regarding color saturation, research demonstrates that high-saturation colors correlate more with health, while bright packaging easily associates with unhealthy products (Mead & Richerson, 2018).

(2) External Medication Packaging
Medication packaging significantly influences consumer medication adherence behavior during the acquisition awareness stage. In healthcare marketing, con-

sumers encounter two common scenarios: physicians prescribing medications in a single package containing several drugs, or different medications presented in separate bottles. Researchers term the former single-serve packaging and the latter multi-packaging. Studies show that single-serve packaging promotes consumption closure psychologically, making consumers feel each dose might be the last and that the dosage is sufficient, thereby enhancing perceived efficacy (Ilyuk & Block, 2016).

Product packaging also interacts with brand to influence medication-taking intentions. Research indicates that when generic drug packaging resembles brand-name drug packaging, consumers may infer that generic brands perform equivalently to brand-name drugs (Kardes & Cronley, 2004). Other studies find that when brand information is salient, product attractiveness positively correlates with perceived efficacy. However, when consumers cannot access external product information (e.g., brand reputation), they may doubt the efficacy of visually highly attractive products (Batra et al., 2009).

3.1.3 Information Processing Biases

(1) Availability Bias

Availability bias refers to people's tendency to judge event probability based on cognitive accessibility. By simulating or imagining an event, consumers judge it as more likely to occur in reality (Tversky & Kahneman, 1974). In health information processing, information accessibility, frequency, and processing fluency all influence processing biases and medication adherence. For example, when encouraged to imagine certain symptoms while receiving product information, consumers become more sensitive to these symptoms, increasing information accessibility and thus medication use likelihood (Wang et al., 2021). Scholars have also found that simply repeating product claims can improve efficacy ratings (Hassan & Barber, 2021). Therefore, increasing information frequency about product effectiveness may lead consumers to eventually believe it. Health information processing fluency also affects availability bias. Song and Schwarz (2009) found that difficult-to-pronounce drug categories or brands (e.g., polyene phosphatidylcholine capsules) feel more unfamiliar and thus riskier compared to easily pronounced brands. Conversely, easily processed information feels familiar, highly available, and reduces risk perception.

(2) Perceived Risk and Benefit

Perceived risk and benefit constitute important factors influencing initial medication adherence levels. When risk stimuli feel aversive, people tend to rely on intuition, judging high risk and low benefit. Conversely, if consumers have positive overall feelings about a medication, they may underestimate risks while overestimating benefits (Siegrist & Árvai, 2020). Yan and Sengupta (2013) explored what causes people to overestimate or underestimate health risks. Experimental results showed that when base disease prevalence was high (e.g., common flu) and case risk low (e.g., only one symptom), participants underestimated their own infection likelihood compared to others' likelihood. When

base prevalence was low (e.g., H1N1 flu) and case risk high (e.g., four symptoms), participants overestimated their own disease likelihood compared to others'. Regarding COVID-19, as vaccines developed, global medical authorities called for vaccination to achieve herd immunity. However, WHO data through 2021 showed low vaccination willingness across countries. Scholars found that potential vaccine side effects influenced risk perception, constraining vaccination rates and consumer medication adherence behavior (Kaplan & Milstein, 2021).

(3) Information Presentation Format

Different information presentation formats also cause processing biases. Cox et al. (2006) demonstrated that gain-framed information increased consumer tolerance and preference for temporary product risks (e.g., temporary rash from hepatitis medication) compared to loss-framed information. However, for more permanent, severe risks (e.g., hepatitis B infection), gain framing made consumers more cautious (e.g., more likely to vaccinate). Many studies confirm that relative versus absolute terms elicit different consumer responses to health information. Griffith et al. (2009) found that for two equally effective drugs, 56.8% of participants chose the drug when benefits were expressed in relative terms, but only 14.7% chose it when benefits used absolute terms. Additionally, Chandran and Menon (2004) noted that presenting health-related information in a daily (versus yearly) format increases consumer self-risk perception and enhances risk communication effectiveness.

(4) Emotional Resources

When rational product information coexists with strong emotional responses, product information influence weakens or disappears (Gershoff & Koehler, 2011). For example, if medication side effects include potential hearing loss and this information evokes highly negative emotional reactions, consumers will reject the medication regardless of whether the probability is 1% or 10%. Research on emotional resource theory shows that for inward-focused positive emotions, self-referenced health information proves more effective than family-focused information, while for outward-focused emotions, family-focused information works better than self-focused information (Agrawal et al., 2007). Lee et al. (2008) found that negative emotions and health self-efficacy jointly affect health information use. For consumers with high health self-efficacy, negative emotions positively correlate with information seeking; for those with low self-efficacy, negative emotions negatively correlate with information seeking. Gerend and Maner (2011) discovered that fearful participants who received loss-framed information ate more fruits and vegetables than those receiving gain-framed information, whereas angry participants who received gain-framed information ate more than those receiving loss-framed information.

3.2 Drug-Taking Treatment Stage

While the drug acquisition awareness stage focuses on factors influencing medication-taking intentions, the drug-taking treatment stage concentrates on

consumer behavior change. After forming medication-taking intentions, maintaining medication-taking behavior to promote and preserve health represents an important yet challenging topic. We further organize factors influencing the drug-taking treatment stage, examining them through medication onset rate, marketing communication, and after-sales service.

3.2.1 Medication Onset Rate Medication onset rate refers to the time until medication begins working and duration of efficacy (Wang et al., 2010). For prescription and over-the-counter drugs, onset time and efficacy duration significantly impact sustained medication adherence levels. In daily life, drug advertisements constantly emphasize powerful benefits and provide examples of people using and experiencing drug effects. Frequent exposure to such advertising may lead consumers to underestimate onset time and misjudge efficacy duration. If consumers judge onset time as too early (or too late), this misjudgment may cause non-adherence (Ilyuk et al., 2014). Ilyuk et al. (2014) recommend clearly stating and emphasizing drug onset time and efficacy duration through advertising and packaging. During medication use, drug information can serve as a reference to help consumers make relatively objective efficacy judgments; otherwise, subsequent treatment stages may lead consumers to judge drug efficacy as poor, causing them to disregard pharmaceutical company or physician recommendations and resulting in improper usage.

Not only does perceived onset time affect subsequent adherence levels, but consumers' estimates of effective duration after use also constitute key factors determining proper and improper drug use. Ilyuk, Block, and Faro (2014) found that judgments of how long medications remain effective depend on the nature of tasks performed during consumption. Specifically, when tasks are perceived as difficult (versus easy), consumers estimate shorter efficacy duration. For example, if consumers engage in difficult cognitive or physical tasks while taking medication (compared to similar but easier tasks), they perceive the drug's efficacy duration as shorter, affecting medication adherence levels.

3.2.2 Marketing Communication for Medication Use Chinese law imposes strict restrictions on medication marketing communication^{2}. However, with healthcare reform and marketization, pharmaceutical information dissemination has become increasingly popular within legal boundaries, influencing medication adherence behavior. During the medication-taking stage, marketing communication aims to reinforce post-purchase behavior. However, research indicates that marketing communication effects are not always positive—they can be negative or neutral. First, studies show marketing communication can strengthen medication adherence. Advertising can remind consumers to take medication, reinforce adherence among compliant consumers, and make non-compliant consumers feel "guilty," thereby promoting adherence (Bowman et al., 2004). Wang et al. (2023) conducted multiple studies involving COVID-19, breast cancer, and other diseases, finding that disease anthropomorphism promotes adherence by increasing psychological closeness to the disease and

perceived susceptibility. However, marketing communication strategies do not always produce positive reinforcement. Research also shows advertising may negatively impact adherence. Generally, consumers without ad exposure rely more on physicians for information. Consumers exposed to ads may feel autonomous and choose to change dosage schedules without consulting physicians, especially those with mild symptoms who may be less willing to follow medical advice (Bowman et al., 2004).

Bolton et al. (2008) discovered a "boomerang effect," where communicating products as medications (versus supplements) leads consumers to engage less in healthy lifestyles (e.g., taking cholesterol-lowering products). Researchers attribute this effect to two causes: First, medications may reduce consumers' risk perception, decreasing their emphasis on health-protective behaviors. Second, medications may associate with poor health conditions, reducing self-efficacy and leading to decreased health behaviors. Some scholars have also found neutral results, where marketing communication effectiveness depends on moderating factors (e.g., advertiser, personality traits). Wosinska (2005) analyzed four-year panel data, showing that competitor advertising increased category-wide adherence, while own-drug advertising decreased adherence for that specific drug. Briley et al. (2017) proposed personality trait moderation effects, suggesting that for consumers with interdependent self-construal facing health challenges, "actor" marketing communication frames (e.g., "man proposes, God disposes") prove more effective for promoting adherence, while for independent self-construal consumers, "reactor" frames (e.g., "counter soldiers with arms, water with earth weirs") work better.

3.2.3 After-Sales Service for Medication Use Among various factors influencing the drug-taking treatment stage, after-sales service represents an essential element affecting consumer adherence. First, service provider interaction characteristics critically influence consumer adherence. Snell et al. (2013) and Hausman (2004) emphasized the importance of service quality and interpersonal interaction, particularly one-on-one interaction and emotional communication during physician services. Dellande et al. (2004) demonstrated through weight-loss clinic cases how service providers enhance consumer adherence through professional knowledge and attitudinal homophily, thereby achieving satisfaction and goal attainment.

Second, service interaction characteristics interact with consumer self-efficacy factors to influence adherence. For example, Seiders et al. (2015) revealed that professional service provider behaviors, such as advice-giving frequency and focus on negative consequences, significantly impact consumer adherence, with these effects moderated by consumer and provider self-efficacy. Similarly, Wittkowski et al. (2020) explored self-tracking technology (STT) in monitoring and analyzing health data, finding STT effectiveness depends on consumer self-efficacy, with STT use potentially undermining adherence to medical advice among low self-efficacy consumers.

4 Interventions for Medication Adherence Based on Two-Stage Theory

After clarifying medication adherence influencing factors, how should healthcare service providers and health managers intervene in consumer medication adherence levels? The key difference between stages is that the drug awareness stage involves attitude intervention, while the treatment stage involves behavior intervention. Therefore, this section summarizes and elaborates consumer medication adherence interventions corresponding to each stage.

4.1 Attitude Interventions for the Acquisition Awareness Stage

For attitude interventions, enhancing medication-taking intention represents the key factor promoting initial medication adherence. We synthesize intervention strategies from three levels: patient education, corporate nudging, and media regulation.

Patient Education. Patient education includes consumer self-education and external health education. Our review of influencing factors reveals numerous consumer biases in drug acquisition awareness, including inherent belief biases about medication (Kramer et al., 2012; Wang et al., 2010), prior knowledge biases about drugs (Roullet & Droulers, 2005), and risk perception biases (Yan & Sengupta, 2013). Therefore, intervening in consumer medication adherence requires patient education to address thoughts and cognition. Healthcare providers can conduct health science popularization activities to disseminate scientific medical knowledge, helping consumers recognize and understand their health biases to promote objective medication efficacy evaluation. Regarding health risk perception, most consumers lack medical knowledge and tend to overestimate or underestimate health risks (Shen et al., 2023). Helping consumers evaluate risks more objectively represents an important prerequisite for correctly guiding medication adherence. When consumers perceive high disease risk, they form medication-taking intentions. However, overestimated risk assessment may also lead to over-adherence, causing excessive medication use and wasting healthcare resources. For example, Samper and Schwartz (2013) found that consumers perceive low prices of sacred products as making them more accessible to those in need, leading consumers to believe they face higher risk and increasing consumption willingness. Conversely, higher prices reduce risk assessment and consumption willingness. Therefore, healthcare providers can use patient education to improve health awareness and knowledge, helping consumers recognize health biases, evaluate personal health risks objectively, and promote consumer health and well-being.

Corporate Nudging. Drugs are special products subject to strict national and legal constraints in direct-to-consumer processes. However, with increasing healthcare marketization, scholars have identified strategies that can nudge consumer medication adherence. First, regarding product packaging, numerous studies show that packaging color (Brieger et al., 2007) and style (Mead &

Richerson, 2018) affect efficacy perceptions. Accordingly, corporate managers can optimize drug packaging design by integrating industry standards, brand design, and consumer psychological perception. Second, regarding product information dissemination, companies can target information processing fluency to boost medication-taking intentions. Research shows that processing difficulty increases risk perception—for example, difficult-to-pronounce names feel riskier (Song & Schwarz, 2009). Therefore, when consumer medication adherence is low, particularly for chronic diseases like hypertension and hyperglycemia, healthcare providers can use fluency principles to influence risk perception and improve adherence. Consumers with low health literacy or limited health information comprehension abilities (e.g., elderly or language-limited individuals) are particularly vulnerable to marketing communication influences. These consumers are less likely to comply with drug recommendations conveyed through packaging, inserts, or black box warnings; instead, they may rely on heuristic information, emotions, and inherent beliefs (Nielsen-Bohlman et al., 2004). For such groups, improving decision information fluency similarly represents an important strategy for enhancing medication-taking intentions. Finally, nudging can occur during decision-making processes. Steffel et al. (2022) demonstrated through three experiments that improving medical decision communication fluency increases engagement: when information about options is presented in fluent (versus disfluent) formats, consumers are more likely to engage in medical treatment decisions (rather than delegating to professionals). Fluency increases engagement by enhancing subjective comprehension (i.e., making people feel they better understand choices and have more confidence in their decision-making ability). Fluency effects are most pronounced for health literacy-deficient consumers under time pressure and are unaffected by past experience. Therefore, corporate service personnel can enhance consumer engagement and adherence to their own treatment choices by improving option fluency during communication.

Media Regulation. Consumer health product choices are significantly influenced by public information (e.g., news articles, research papers, online customer reviews, online product discussions, and TV programs). Health science popularization education conducted by official public health service units can enhance consumer health awareness and promote medication-taking intentions. However, because health constitutes a fundamental prerequisite for routine social activities, it also carries vulnerability. Slight behavioral deviations can cause serious negative consequences. For example, Shi et al. (2022) identified the "Oz Effect" in healthcare. This effect refers to the dramatic increase in public attention and acceptance of health products or medical protocols after celebrity physicians like Dr. Oz recommend them. However, these recommendations often lack sufficient scientific evidence. Media typically amplifies this effect, further guiding people to trust and use these products even without broad scientific support. This may lead to medication misuse or abuse, increasing consumer health risks. Therefore, while advocating for consumer medication adherence, health managers should strictly regulate mass media information dissemination, particularly concerning celebrity effects.

4.2 Behavioral Interventions for the Drug-Taking Treatment Stage

According to two-stage theory, the focus of drug-taking treatment stage interventions involves extending consumer volition after forming medication-taking intentions to maintain adherence. Improving medication adherence behavior requires joint efforts from consumers, enterprises, and government health service departments. Synthesizing existing literature, we organize intervention strategies for the drug-taking treatment stage through customer empowerment, corporate incentives, and multi-party collaboration.

Customer Empowerment. Empowerment refers to strategies or mechanisms that provide people with sufficient knowledge and autonomy to exert control over decisions (Camacho et al., 2014). Empowerment has gained increasing importance in healthcare. Many studies have explored how healthcare provider (e.g., physician, nurse) empowerment affects adherence. For example, Wang and Yim (2019) proposed that achieving "dominance transition"—shifting the service provider's dominant position before giving advice to the client after giving advice—can improve adherence. This study showed that when healthcare providers dominate before medical advice but transfer dominance to consumers afterward, adherence increases because this enhances perceived common ground, making consumers more willing to follow advice. With WHO advocacy, customer empowerment has become increasingly important in healthcare, particularly in chronic disease management. Researchers analyzing data from 378 type 2 diabetes patients recruited from two primary care clinics in the southeastern United States found that emphasizing empowerment and self-efficacy positively correlated with improved diabetes management outcomes (Hernandez-Tejada et al., 2012). Regarding timing of empowerment, Fallis et al. (2013) identified the critical importance of the consumer discharge period for adherence interventions. They found that 28% of consumers exhibited medication non-adherence within one week post-discharge, and one-fifth of all new prescriptions were unfilled.

Corporate Incentives. Persisting in the same behavior long-term challenges most consumers, leading to medication non-adherence. Accordingly, enterprises can adopt different incentive approaches based on disease type to promote adherence. Financial incentives represent a frequently discussed approach. Giuffrida and Torgerson (1997) conducted a systematic literature review of using financial incentives (cash, vouchers, lotteries, or gifts) to enhance adherence, finding that 10 of 11 studies showed financial incentives improved adherence. Similar conclusions have been empirically supported for improving adherence among consumers with mental disorders (Noordraven et al., 2017). For consumers with chronic hypertension, hyperlipidemia, heart disease, diabetes, and/or asthma/COPD, research has examined financial incentives (e.g., cash, gift cards, vouchers) versus social recognition (e.g., encouraging messages, feedback, personal recognition, team competition) effects on adherence (Hastings et al., 2021). Results showed most consumers considered incentives for these diseases appropriate and preferred financial incentives over social recognition-

based incentives. However, certain patient groups—those with lower annual income, no college degree, and higher adherence levels—considered medication adherence incentives less appropriate. Therefore, corporate staff should consider individual and disease characteristics when designing incentive interventions. Some scholars categorize chronic diseases along two dimensions: incentives for following optimal treatment regimens and required behavior change magnitude (Christensen et al., 2009). Incentives for following optimal treatment refer to adherence consequences. For example, myopia and allergies show visible cure effects shortly after following medical advice, representing high adherence incentive intensity, whereas hypertension and hyperlipidemia show less visible short-term effects, representing low adherence incentive intensity. Regarding required behavior change, chronic diseases like myopia, allergies, hypertension, and hyperlipidemia require minimal consumer behavior change, primarily depending on medical treatment and technology. However, obesity and addictive disorders require greater consumer behavior change and stronger volition. Therefore, interventions can improve adherence by increasing technology dependence, reducing behavior dependence, and enhancing adherence incentive intensity. For example, when designing treatment regimens for low self-efficacy consumers, options with faster perceived effects or more timely feedback can be considered to achieve strong incentive effects (Christensen et al., 2009).

Multi-Party Collaboration. Improving consumer medication adherence requires collaborative efforts from multiple health service personnel including enterprises, communities, and healthcare centers at various levels. Hackerson et al. (2018) designed and implemented a collaborative prescription management program requiring cooperation between community pharmacies and primary care centers. Specifically, primary care centers first diagnose consumers and issue prescriptions, providing targeted interventions before dispensing. Community pharmacies then fill new prescriptions for center consumers. Within two days, pharmacists call consumers to inform them prescriptions are ready and emphasize the importance of initial adherence. If consumers fail to fill prescriptions after 48 hours, pharmacists contact prescribers or family members to address potential barriers. Healthcare center staff conduct further follow-up during later medication use. This increased communication between primary care centers and community pharmacies, combined with consumer education at each stage, significantly reduced initial non-adherence. As healthcare marketization progresses, many drugs are directly available to consumers in the market. For some chronic disease patients who can purchase medications from original pharmacies without hospital follow-up visits, chronic disease consumer management requires joint hospital-enterprise intervention. For example, forgetfulness represents a major cause of chronic disease medication non-adherence, and many studies confirm that medication reminder devices can address this. Hospitals and enterprises can collaborate to implement reminder strategies before and after the treatment stage to promote adherence. Notably, Fischer et al. (2014) evaluated two interventions to increase initial adherence to cardiovascular medications: automated pharmacy reminders and manual telephone reminders. Through a field

experiment with 900,000 consumers and 1.2 million prescriptions, they found automated pharmacy reminders did not significantly increase initial adherence, while experimental groups receiving manual telephone reminders showed nearly 5% lower abandonment rates for new prescriptions. Vervloet et al. (2012) reviewed multiple studies finding that electronic reminders were more effective than text messages or pager reminders for short-term adherence. Similar results have been validated among coronary heart disease consumers (Santo et al., 2019). Therefore, during multi-party collaboration, interveners must pay special attention to selecting specific intervention strategies based on disease type.

5 Summary and Future Directions

As shown in Figure 1 [Figure 1: see original paper], this paper deeply examines factors influencing consumer adherence behavior based on two-stage model theory. Exploring consumer medication adherence levels from a consumer behavior perspective can enrich relevant theories in medication adherence research theoretically, and provide management and marketing insights for healthcare providers and pharmaceutical enterprise managers practically. Viewing medication adherence from a consumer behavior perspective fundamentally differs from previous logic that treated sub-healthy or unhealthy individuals as patients, instead treating these individuals as consumers purchasing medical products and experiencing medical services. Although scholars have explored this area, many issues remain for investigation from a two-stage theoretical perspective.

Figure 1. Influencing factors and intervention strategies of consumer medication adherence behavior from a two-stage theoretical perspective

5.1 Exploring Bridges for the "Intention-Behavior" Gap

According to the two-stage theoretical model, the second stage begins when consumers have formed medication-taking intentions. However, a gap exists between deciding to take medication and persisting with it. Generally, behavior not aligning with intentions is common. In the volitional stage, despite forming health behavior intentions, consumers may compromise or abandon them due to unexpected interference. In medication adherence research, meta-analyses show that behavioral intentions explain only 28% of behavior variance on average (Sheeran, 2002), known as the intention-behavior gap (Rich et al., 2015). While previous research has identified factors predicting stronger intention-behavior relationships—such as older age (Reuter et al., 2010), higher socioeconomic status (Conner et al., 2013), and stronger perceived behavioral control (Sheeran & Abraham, 2003)—few studies have deeply examined moderators of this gap. Future research should continue investigating potential moderators affecting the intention-medication behavior relationship. First, multi-level model analyses can examine how sociocultural, psychological, and marketing factors jointly influence adherence intentions and actual behaviors. Second,

experimental designs can directly test different intervention strategies' (e.g., information prompts, social support, material rewards) effectiveness in reducing the intention-behavior gap. Finally, research should explore individual differences in medication adherence, such as through longitudinal studies to identify factors causing health intention instability and affecting medication behavior. Future research should also more deeply explore explanatory mechanisms for the intention-behavior gap. Previous continuous models such as the Theory of Reasoned Action and Planned Behavior (Ajzen, 1991) and Protection Motivation Theory (Rogers, 1983) view intention as the most direct and important behavioral predictor, but these theories do not explicitly explain how intention drives behavior. Deeply discussing the mechanisms through which intention drives behavior holds significant importance for improving intervention effectiveness. For example, de Bruin et al. (2012) identified self-regulatory processes as mediators of the intention-behavior relationship, processes triggered after intention formation that explain how intentions translate into actual behavior. Their findings suggest that interventions strengthening both medication intentions and individuals' self-regulatory abilities are more likely to effectively improve adherence. Specifically, this may involve teaching consumers how to plan and monitor their medication goal progress or using electronic devices providing immediate behavioral feedback. Future research can also extend to different disease contexts to explore effective ways to bridge the intention-behavior gap, which holds significant implications for medical practice. For example, Scholz et al. (2012) found that in organ transplantation contexts, social support from female partners positively correlated with medication adherence intentions, while support from male partners slightly negatively correlated with their female spouses' adherence intentions. For future research, this finding suggests that in different disease contexts (e.g., chronic or mental illnesses), researchers can more deeply explore how social support and relationship quality affect the intention-behavior relationship and propose specific interventions accordingly. Such exploration not only helps better understand the role of social environmental factors in medication adherence but may also have practical application value for improving medical adherence rates, particularly across different disease contexts.

5.2 Adopting an Integrated Approach to Explore the Complete Medication Adherence Process

In this study, we synthesized influencing factors and intervention approaches for individual medication adherence behavior from a consumer behavior perspective based on the two-stage theoretical model from health behavior change research, addressing limitations of continuous models. However, through literature review, we also found that current research mostly explores stages separately, with few studies examining the entire medication adherence journey. Therefore, future research should adopt an integrated approach to study medication adherence across both the drug acquisition awareness stage and drug-taking treatment stage. For example, using new technologies and large-scale individual-level data analysis combined with laboratory experiments and real-

world consumption scenarios can provide systematic and macro-level summaries of consumer medication adherence behavior patterns. Technological advances provide technical support for whole-process research. According to Tabi et al. (2019), over 1,000 mobile apps already exist for consumer medication adherence, such as diabetes consumers easily tracking blood glucose levels through measurement devices synchronized to mobile apps, thereby improving adherence. Data show global health app installations have reached an estimated 3.35 billion. Particularly mobile health devices and apps with tracking functions can collect extensive consumer data, including diet, activity levels, and physiological indicators like heart rate and weight, or capture changing cognitive components to better understand the entire medication adherence process. According to two-stage theory, different cognitive components play important roles at different health behavior change stages, and the same cognitive component may change across stages—for example, self-efficacy. In the motivational stage, one internal reason for promoting intention formation is consumers' action self-efficacy, while in the volitional stage, action self-efficacy transforms into maintenance or recovery self-efficacy (Schwarzer, 2008a). Future research can better understand the complete medication adherence process by capturing these changing cognitive components, simultaneously providing new supporting evidence for two-stage theory.

5.3 Exploring Antecedent Factors of Medication Adherence from Multiple Perspectives

Medication adherence issues are closely related to people's health. Unlike other products, health products are subject to national macro-level strategic regulation and guidance while facing strict legal constraints in marketing channels. Concurrently, as healthcare reforms and marketization progress and health management gains importance, pharmaceutical companies increasingly recognize the pharmaceutical market's importance (Agarwal et al., 2020). Therefore, medication adherence research faces rare opportunities and challenges in the coming years. Future research must both pay attention to policy changes and explore antecedent factors from diverse perspectives in increasingly marketized contexts.

National and government public policies change constantly, with many drug-related policies directly affecting consumer medication adherence levels. Exploring consumer medication adherence issues under new public policy backgrounds represents a promising future research direction. For example, in March 2019, China's major medical reform initiative—the "4+7" volume-based drug procurement policy—used national power to exchange volume for price, transforming drug markets across 11 pilot cities and effectively improving drug accessibility while reducing prices. Whether this improved drug accessibility and reduced pricing affects consumer medication-taking intentions and adherence behavior warrants further investigation. As healthcare reforms and marketization advance, today's consumers can more conveniently purchase drugs online and easily find consulting physicians via the internet. Mobile health apps and smart

devices give consumers greater autonomy in health management. Accordingly, future research can examine antecedent factors influencing consumer medication adherence from marketing perspectives such as purchase channels (online versus offline), service providers (AI or human customer service), and empowerment methods (self-empowerment or professional empowerment).

5.4 Deeply Exploring Internal Mechanisms and Influencing Factors of Medication (Non-)Adherence

Previous research shows scholars have relatively thoroughly explored the drug acquisition awareness stage, but research on the drug-taking treatment stage remains insufficient. Therefore, future research should focus more on the drug-taking treatment stage. Long-term adherence to medical advice represents a challenging task for most consumers, especially for chronic diseases requiring lifelong medication after diagnosis. Medication adherence research must, on one hand, deeply examine consumer psychological characteristics during the medication-taking stage to identify psychological mechanisms and influencing factors of non-adherence. For example, in public health, a mature theoretical concept—stigma—exists. "Stigma" refers to people's shame about disease (Hatzenbuehler et al., 2013), which may affect medication intentions and methods. Consumers may refuse medication simply because they are unwilling to acknowledge illness or be labeled as "sickly." This psychological process differs from medication-taking intention and efficacy inference—it represents consumers' self-perception during medication-taking. Future researchers can deeply explore this psychological process to summarize stigma's influencing factors in medication adherence contexts. Additionally, evolutionary psychology offers new explanatory perspectives on why patients are unwilling to take medication. For example, according to behavioral immune system theory, disliking medication may represent self-protection. Human ancestors evolved the gustatory experience that "bitter equals poisonous," with bitter taste preventing consumption of harmful substances and effectively avoiding danger. Therefore, future researchers can discuss why consumers are unwilling to take medication from an evolutionary psychology perspective, contributing theoretical and practical value.

On the other hand, we must also prevent consumer over-medication. In recent years, consumer over-medication has become an important issue that cannot be ignored. Consumers may overestimate risks due to healthcare environmental factors (Shen et al., 2023), risk portfolios (Mourali & Yang, 2023), and information inference biases (Yan & Sengupta, 2013), leading to excessive healthcare resource expenditure. Long-term over-expenditure negatively impacts consumer health. Tian et al. (2023) studied how consumers follow product label instructions in over-the-counter (OTC) drug consumption contexts. Their analysis based on a unique online consumption diary where consumers could choose between two acetaminophen products (single-ingredient or combination) to treat pain or non-pain symptoms showed that when consumers experienced multiple

symptoms, they were more likely to exceed recommended doses (e.g., >4g daily). This research indicates that medication adherence may lead to over-medication when consumers experience multiple symptoms. Therefore, future scholars can further explore influencing factors and internal mechanisms affecting consumer risk perception and medication adherence to identify health behavior patterns.

References

Gao, W., Yang, L. Z., & Li, X. X. (2012). Development and prospects of the Health Action Process Approach model. *Advances in Psychological Science*, 20(10), 1651–1662.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211.

Agrawal, N., Menon, G., & Aaker, J. L. (2007). Getting emotional about health. *Journal of Marketing Research*, 44(1), 100–113.

Agarwal, R., Dugas, M., Gao, G. G., & Kannan, P. K. (2020). Emerging technologies and analytics for a new era of value-centered marketing in healthcare. *Journal of the Academy of Marketing Science*, 48(1), 1–15.

Batra, R. K., Brunel, F., & Chandran, S. (2009). When good looks kill: An examination of consumer response to visually attractive product design. *Advances in Consumer Research*, 36, 698–698.

Bolton, L. E., Reed, A., Volpp, K. G., & Armstrong, K. (2008). How does drug and supplement marketing affect a healthy lifestyle?. *Journal of Consumer Research*, 34(5), 713–726.

Bowman, D., Heilman, C. M., & Seetharaman, P. B. (2004). Determinants of product-use compliance behavior. *Journal of Marketing Research*, 41(3), 324–338.

Brieger, W. R., Salami, K. K., & Oshiname, F. O. (2007). Perceptions of drug color among drug sellers and consumers in rural southwestern nigeria. *Research in Social and Administrative Pharmacy*, 3(3), 303–319.

Briley, D. A., Melanie, R., & Jennifer, A. (2017). Cultivating optimism: how to frame your future during a health challenge. *Journal of Consumer Research*, 44(4), 895–915.

Brug, J., Conner, M., Harre, N., Kremers, S., McKellar, S., & Whitelaw, S. (2005). The Transtheoretical Model and stages of change: A critique: observations by five commentators on the paper by Adams, J. and White, M.(2004) why don't stage-based activity promotion interventions work?. *Health Education Research*, 20(2), 244–258.

Camacho, N., De Jong, M., & Stremersch, S. (2014). The effect of customer empowerment on adherence to expert advice. *International Journal of Research*

in Marketing, 31(3), 293–308.

Chandran, S., & Menon, G. (2004). When a day means more than a year: Effects of temporal framing on judgments of health risk. *Journal of Consumer Research*, 31(2), 375–389.

Christensen CM. Grossman J, Hwang J. 2009. *The Innovator's Prescription* (p. 161). New York: McGraw-Hill.

Conner, M., McEachan, R., Jackson, C., McMillan, B., Woolridge, M., & Lawton, R. (2013). Moderating effect of socioeconomic status on the relationship between health cognitions and behaviors. *Annals of Behavioral Medicine*, 46(1), 19–30.

Costello, J. P., Garvey, A. M., Germann, F., & Wilkie, J. E. (2023). The uptrend effect: Encouraging healthy behaviors through greater inferred normativity. *Journal of Marketing Research*, 00222437231167832.

Cox, A. D., Cox, D., & Zimet, G. (2006). Understanding consumer responses to product risk information. *Journal of Marketing*, 70(1), 79–91.

Cutler, R. L., Fernandez-Llimos, F., Frommer, M., Benrimoj, C., & Garcia-Cardenas, V. (2018). Economic impact of medication non-adherence by disease groups: A systematic review. *British Medical Journal Open*, 8(1), e016982.

de Bruin, M., Sheeran, P., Kok, G., Hiemstra, A., Prins, J. M., Hospers, H. J., & van Breukelen, G. J. (2012). Self-regulatory processes mediate the intention-behavior relation for adherence and exercise behaviors. *Health Psychology*, 31(6), 695–703.

Dellande, S., Gilly, M. C., & Graham, J. L. (2004). Gaining compliance and losing weight: The role of the service provider in health care services. *Journal of Marketing*, 68(3), 78–91.

Desai, N. R., Ross, J. S., Kwon, J. Y., Herrin, J., Dharmarajan, K., & Bernheim, S. M., et al. (2016). Association between hospital penalty status under the hospital readmission reduction program and readmission rates for target and nontarget conditions. *Jama*, 316(24), 2647–2656.

Fallis, B. A., Dhalla, I. A., Klemensberg, J., & Bell, C. M. (2013). Primary medication non-adherence after discharge from a general internal medicine service. *PloS one*, 8(5), e61735.

Fischer, M. A., Choudhry, N. K., Bykov, K., Brill, G., Bopp, G., Wurst, A. M., & Shrank, W. H. (2014). Pharmacy-based interventions reduce primary medication nonadherence cardiovascular medications. *Medical Care*, 52(12), 1050–1054.

Gerend, M. A., & Maner, J. K. (2011). Fear, anger, fruits, and veggies: Interactive effects of emotion and message framing on health behavior. *Health Psychology*, 30(4), 420–423.

Gershoff, A. D., & Koehler, J. J. (2011). Safety first? The role of emotion in safety product betrayal aversion. *Journal of Consumer Research*, 38(1), 140–150.

Giuffrida, A., & Torgerson, D. J. (1997). Should we pay the patient? Review of financial incentives to enhance patient compliance. *BMJ*, 315(7110), 703–707.

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice* (pp. 23–40). Jossey-Bass.

Griffith, J. M., Lewis, C. L., Pignone, M. P., Sheridan, S. L., & Hawley, S. (2009). Randomized trial of presenting absolute v. relative risk reduction in the elicitation of patient values for heart disease prevention with conjoint analysis. *Medical Decision Making*, 29(2), 167–174.

Hackerson, M. L., Luder, H. R., Beck, A. F., Wedig, J. M., Heaton, P. C., & Frede, S. M. (2018). Addressing primary nonadherence: A collaboration between a community pharmacy and a large pediatric clinic. *Journal of the American Pharmacists Association*, 58(4), S101–S108.

Hatzenbuehler, M. L., Phelan, J. C., & Link, B. G. (2013). Stigma as a fundamental cause of population health inequalities. *American Journal of Public Health*, 103(5), 813–821.

Hassan, A., & Barber, S. J. (2021). The effects of repetition frequency on the illusory truth effect. *Cognitive Research: Principles and Implications*, 6(1), 1–12.

Hastings, T. J., Hohmann, N. S., Jeminiwa, R., Hansen, R. A., Qian, J., & Garza, K. B. (2021). Perceived appropriateness of medication adherence incentives. *Journal of Managed Care & Specialty Pharmacy*, 27(6), 754–762.

Hausman, A. (2004). Modeling the patient-physician service encounter: Improving patient outcomes. *Journal of the Academy of Marketing Science*, 32(4), 403–417.

Hernandez-Tejada, M. A., Campbell, J. A., Walker, R. J., Smalls, B. L., Davis, K. S., & Egede, L. E. (2012). Diabetes empowerment, medication adherence and self-care behaviors in adults with type 2 diabetes. *Diabetes Technology & Therapeutics*, 14(7), 630–634.

Ilyuk, V., Block, L., & Faro, D. (2014). Is it still working? Task difficulty promotes a rapid wear-off bias in judgments of pharmacological products. *Journal of Consumer Research*, 41(3), 775–793.

Ilyuk, V., & Block, L.(2016). The effects of single-serve packaging on consumption closure and judgments of product efficacy. *Journal of Consumer Research*, 42(6), 858–878.

Ilyuk, V., Irmak, C., Kramer, T., & Block, L. (2014). Efficacy expectations and adherence: Evidence of consumer biases and heuristics in pharmaceutical

marketing. In D. Min, J. Eliashberg, & S. Stremersch, (Eds.), *Innovation & Marketing in the Pharmaceutical Industry* (pp. 315–344). Springer.

Kaplan, R. M., & Milstein, A. (2021). Influence of a covid-19 vaccine's effectiveness and safety profile on vaccination acceptance. *Proceedings of the National Academy of Sciences*, 118(10), e2021726118.

Kardes, F. R., & Cronley, P. M. L. (2004). Consumer inference: a review of processes, bases, and judgment contexts. *Journal of Consumer Psychology*, 14(3), 230–256.

Kramer, T., Irmak, C., Block, L. G., & Ilyuk, V. (2012). The effect of a no-pain, no-gain lay theory on product efficacy perceptions. *Marketing Letters*, 23(3), 517–529.

Lee, S. Y., Hwang, H., Hawkins, R., & Pingree, S. (2008). Interplay of negative emotion and health self-efficacy on the use of health information and its outcomes. *Communication Research*, 35(3), 358–381.

Luszczynska, A., & Schwarzer, R. (2005). Social cognitive theory: Predicting health behaviours and the role of self-efficacy. *Psychology, Health & Medicine*, 10(1), 85–97.

Mead, J., A., Richerson, R. (2018). Package color saturation and food healthfulness perceptions. *Journal of Business Research*, 82, 10–18.

Mourali, M., & Yang, Z. (2023). Misperception of multiple risks in medical decision-making. *Journal of Consumer Research*, 50(1), 25–47.

Nielsen-Bohlman, L., Panzer, A. M., & Kindig, D. A. (2004). The extent and associations of limited health literacy. In *Health literacy: a prescription to end confusion* (Chapter 3, pp. 59-70). National Academies Press (US).

Noordraven, E. L., Wierdsma, A. I., Blanken, P., Bloemendaal, A. F., Staring, A. B., & Mulder, C. L. (2017). Financial incentives for improving adherence to maintenance treatment in patients with psychotic disorders (Money for Medication): A multicentre, open-label, randomised controlled trial. *The Lancet Psychiatry*, 4(3), 199–207.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51(3), 390–395.

Reuter, T., Ziegelmann, J. P., Wiedemann, A. U., Lippke, S., Schüz, B., & Aiken, L. S. (2010). Planning bridges the intention–behaviour gap: Age makes a difference and strategy use explains why. *Psychology and Health*, 25(7), 873–887.

Rich, A., Brandes, K., Mullan, B., & Hagger, M. S. (2015). Theory of planned behavior and adherence in chronic illness: a meta-analysis. *Journal of Behavioral Medicine*, 38, 673–688.

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In B. L. Cacioppo & L. L. Petty (Eds.), *Social psychophysiology: A sourcebook* (pp. 153–176). London, England: Guildford.

Roullet, B., & Droulers, O. (2005). Pharmaceutical packaging color and drug expectancy. Paper presented at the meeting of the Association for Consumer Research, San Antonio, Texas.

Samper, A., & Schwartz, J. A. (2013). Price inferences for sacred versus secular goods: Changing the price of medicine influences perceived health risk. *Journal of Consumer Research*, 39(6), 1343–1358.

Santo, K., Singleton, A., Rogers, K., Thiagalingam, A., Chalmers, J., Chow, C. K., & Redfern, J. (2019). Medication reminder applications to improve adherence in coronary heart disease: A randomised clinical trial. *Heart*, 105(4), 323–329.

Scholz, U., Klaghofer, R., Dux, R., Roellin, M., Boehler, A., Muellhaupt, B., … & Goetzmann, L. (2012). Predicting intentions and adherence behavior in the context of organ transplantation: Gender differences of provided social support. *Journal of Psychosomatic Research*, 72(3), 214–219.

Schwarzer, R. (2008a). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, 57(1), 1–29.

Schwarzer, R., & Luszczynska, A. (2008). How to overcome health-compromising behaviors: The health action process approach. *European Psychologist*, 13(2), 141–151.

Schwarzer, R. (2008b). Some burning issues in research on health behavior change. *Applied Psychology: An International Review*, 57(1), 84–93.

Schüz, B., Sniehotta, F. F., & Schwarzer, R. (2007). Stage-specific effects of an action control intervention on dental flossing. *Health Education Research*, 22(3), 332–341.

Schüz, B., Sniehotta, F. F., Mallach, N., Wiedemann, A. U., & Schwarzer, R. (2009). Predicting transitions from preintentional, intentional and actional stages of change. *Health Education Research*, 24(1), 64–75.

Seiders, K., Flynn, A. G., Berry, L. L., & Haws, K. L. (2015). Motivating customers to adhere to expert advice in professional services: a medical service context. *Journal of Service Research*, 18(1), 39–58.

Shi, Z., Liu, X., & Srinivasan, K. (2022). Hype news diffusion and risk of misinformation: The Oz effect in health care. *Journal of Marketing Research*, 59(2), 327–352.

Sheeran, P. (2002). Intention—behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, 12(1), 1–36.

Sheeran, P., & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin*, 29(2), 205–215.

Shen, M., Gao, S., & Wang, H. (2023). The effect of social crowding on self-perceived health risks in healthcare services. *Psychology & Marketing*, 40(4), 845–862.

Siegrist, M., & Árvai, J. (2020). Risk perception: Reflections on 40 years of research. *Risk Analysis: An International Journal*, 40(1), 2191–2206.

Snell, L., White, L., & Dagger, T. (2014). A socio-cognitive approach to customer adherence in health care. *European Journal of Marketing*, 48(3/4), 496–521.

Song, H., & Schwarz, N. (2009). If it's difficult to pronounce, it must be risky: Fluency, familiarity, and risk perception. *Psychological Science*, 20(2), 135–138.

Steffel, M., Williams, E. F., & Carney, S. (2022). Empowering consumers to engage with health decisions: Making medical choices feel easy increases patient participation. *Journal of the Association for Consumer Research*, 7(2), 154–163.

Tabi, K., Randhawa, A. S., Choi, F., Mithani, Z., Albers, F., Schnieder, M., … Krausz, M. (2019). Mobile apps for medication management: Review and analysis. *JMIR MHealth and UHealth*, 7(9), e13608.

Tian, M., Kaufman, D. W., Shiffman, S., & Arora, N. (2023). EXPRESS: Over-the-counter drug consumption: How consumers deviate from label instructions. *Journal of Marketing Research*, 00222437231199434.

Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *Science*, 185(4157), 1124–1131.

Vervloet, M., Linn, A. J., van Weert, J. C., De Bakker, D. H., Bouvy, M. L., & Van Dijk, L. (2012). The effectiveness of interventions using electronic reminders to improve adherence to chronic medication: a systematic review of the literature. *Journal of the American Medical Informatics Association*, 19(5), 696–704.

Wang, H. S., & Yim, C. K. (2019). Effects of dominance transitions on advice adherence in professional service conversations. *Journal of the Academy of Marketing Science*, 47(5), 919–938.

Wang, L., Touré-Tillery, M., & McGill, A. L. (2023). The effect of disease anthropomorphism on compliance with health recommendations. *Journal of the Academy of Marketing Science*, 51(2), 266–285.

Wang, W., Keh, H. T., & Bolton, L. E. (2010). Lay theories of medicine and a healthy lifestyle. *Journal of Consumer Research*, 37(1), 80–97.

Wang, P., Sun, L., Zhang, L., & Niraj, R. (2021). Reference points in consumer choice models: A review and future research agenda. *International Journal of Consumer Studies*, 45(5), 985–1006.

Weinstein, N. D. (1993). Testing four competing theories of health-protective behavior. *Health Psychology*, 12(4), 324–333.

Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: conceptual and methodological issues. *Health Psychology*, 17(3), 290–299.

Wiener, E. S., Mullins, C. D., & Pincus, K. J. (2015). A framework for pharmacist-assisted medication adherence in hard-to-reach patients. *Research in Social and Administrative Pharmacy*, 11(5), 595–601.

Wittkowski, K., Klein, J. F., Falk, T., Schepers, J. J., Aspara, J., & Bergner, K. N. (2020). What gets measured gets done: can self-tracking technologies enhance advice compliance?. *Journal of Service Research*, 23(3), 382–401.

Wosinska, M. (2005). Direct-to-consumer advertising and drug therapy compliance. *Journal of Marketing Research*, 42(3), 323–332.

Yan, D., Sengupta, J. (2013). The influence of base rate and case information on health-risk perceptions: A Unified model of self-positivity and self-negativity. *Journal of Consumer Research*, 39(5), 931–946.

---

^{2} According to Article 15 of the *Advertising Law of the People's Republic of China*, special drugs including narcotics, psychotropic drugs, toxic drugs for medical use, and radioactive drugs, as well as drug-type precursor chemicals and drugs, medical devices, and treatment methods for drug rehabilitation, cannot be advertised. Articles 16-19 stipulate content prohibited in medical, drug, medical device, and health food advertisements. Drug advertisement content must be consistent with instructions approved by the State Council's drug regulatory department and must prominently indicate contraindications and adverse reactions. Prescription drug advertisements must prominently state "This advertisement is for medical and pharmaceutical professionals only," while OTC drug advertisements must state "Please purchase and use according to drug instructions or under pharmacist guidance." Therefore, drug information dissemination activities must strictly comply with national laws and regulations.

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