The Impact of Conflicting Health Information on Users' Health Information Seeking: An Uncertainty Perspective Postprint

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Abstract

[Purpose/Significance] In recent years, due to the exponential increase in the volume of information on various health topics on the Internet and the variable quality of such information, encountering conflicting health information has become a common experience for users during health information seeking. However, research on the impacts of conflicting health information on users remains scarce. This study proceeds from classical information seeking theories, examines the relationship between information seeking and uncertainty, and proposes research questions specifically targeting conflicting health information. [Method/Process] An experimental approach was employed to construct experimental and control groups, and one-way ANOVA was used to test the effects of conflicting health information on users' knowledge conceptual states, confusion, and health beliefs. [Results/Conclusion] The experimental results demonstrate that encountering conflicting health information during the health information seeking process leads to ambiguity in users' knowledge conceptual states regarding a specific health topic, increases confusion, and decreases health beliefs, consequently elevating the uncertainty they face. Based on these findings, the theoretical and practical implications are discussed in detail.

Full Text

The Impact of Conflicting Health Information on Users' Health Information Seeking: An Investigation from the Perspective of Uncertainty

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Abstract

[**Purpose/Significance**] In recent years, the proliferation of health information on the Internet, coupled with heterogeneous information quality, has made encountering conflicting health information a common experience for users during health information seeking. However, research on the impact of conflicting health information remains scarce. This study departs from classical information seeking theories to examine the relationship between information seeking and uncertainty reduction, proposing research questions specifically addressing conflicting health information contexts.

[**Method/Process**] Using an experimental approach, we constructed experimental and control groups, employing one-way ANOVA to test the effects of conflicting health information on users' knowledge concept states, confusion, and health beliefs.

[**Result/Conclusion**] Experimental results demonstrate that encountering conflicting health information during health information seeking significantly blurs users' knowledge concept states regarding specific health topics, increases confusion, and decreases health beliefs, thereby elevating the uncertainty they face. Based on these findings, we discuss relevant theoretical and practical implications.

Keywords: conflicting health information; health information seeking; health information behavior; uncertainty; experimental method

1. Introduction

Online health information seeking has become a ubiquitous activity in daily life [1-2], as individuals frequently conduct extensive searches on specific health topics to address personal needs or assist others [3]. In traditional information environments, people primarily obtained health information through mass media, healthcare institutions, and interpersonal networks [4]. However, the Internet has dramatically expanded both the coverage and accessibility of health information. Beyond professional health websites, various health social networks, online knowledge communities, and medical Q&A platforms now offer diverse health information services [5], granting individuals greater autonomy in their health information seeking endeavors.

This convenience, however, introduces significant challenges. On one hand, the sheer volume of online information sources makes identifying valuable information increasingly difficult. On the other hand, Internet information quality varies considerably [6], particularly in user-generated content environments where health information dissemination lacks adequate oversight [7]. This results in the coexistence of high-quality health information alongside substantial

amounts of distorted information and health rumors [8-9], causing users to frequently encounter conflicting health information during their searches.

Classical information seeking theories posit that information seeking typically accompanies knowledge gain and uncertainty reduction. N.J. Belkin described information seeking motivation as a response to an Anomalous State of Knowledge (ASK), emphasizing that information seeking represents a reaction to uncertainty [10]. Yet whether conflicting health information effectively reduces user uncertainty remains unknown [11]. Current research on conflicting health information remains insufficient. D.M. Carpenter and colleagues have called for enhanced scholarly attention to conflicting information in health contexts to improve understanding of its impacts [11], arguing that revealing its mechanisms and consequences will help people process health information and make scientifically sound health decisions in complex information environments [12].

2. Literature Review

Conflicting health information refers to "inconsistent information on the same medical health topic" [13], which can be categorized into two types: (1) inconsistent behavioral directions on the same topic (e.g., "red wine benefits cardiovascular health" versus "red wine increases cancer risk"), and (2) inconsistent pathways leading to the same behavioral outcome (e.g., "women should begin breast cancer screening at age 40" versus "women should begin at age 50") [13-14]. As the first type is more common, this study focuses on conflicting health information with inconsistent behavioral directions on the same health topic. Notably, different groups perceive conflicting health information differently. Trained researchers, recognizing scientific complexity, can often find dialectical unity among different phenomena and may not view divergent evidence as truly conflicting [14]. In contrast, ordinary health consumers typically lack strong health information literacy skills, making them more susceptible to experiencing conflicting health information as problematic [15].

In a survey of 7,092 pregnant or lactating women across 19 countries, D.M. Carpenter et al. found that approximately 80% reported receiving conflicting health information about medication [16]. Among these, 83.7% obtained health information from more than two sources, and 22.4% reported encountering conflicting information when seeking health information across different sources. The data indicated that the likelihood of encountering conflicting health information correlates positively with the number of health information sources used—the more sources, the greater the probability of encountering conflicts [17]. G. Eysenbach [18] noted that encountering conflicting evidence is common during online health information seeking. The proliferation of low-quality health websites and the coexistence of distorted and credible health information further exacerbate this problem.

Conflicting health information intensifies the impact of information asymmetry on decision-making, often placing individuals in dilemmas. Research shows that

conflicting health information produces numerous negative effects [19], including increased anxiety [20], heightened risk perception [21], and complicated information evaluation processes [22]. While conflicting health information exists beyond health domains, its negative consequences are particularly pronounced in health contexts, potentially leading to suboptimal health decisions, missed optimal treatment windows, and even threats to personal safety. Given these serious implications, particularly amid increasingly severe health security situations, investigating the impact of conflicting health information on the public is essential.

3. Theoretical Foundation

3.1 Information Seeking and Uncertainty Since Shannon's information theory, the library and information science community has shown keen interest in the relationship between information and uncertainty. T.D. Wilson metaphorically described uncertainty in information seeking as a "ghost at the feast" to characterize its persistent nature [23], while noting that this uncertainty represents a general principle from a user-centered perspective. K. Yoon argued that information seeking behavior involves a complex reconciliation of certainty and uncertainty at the cognitive level, with both coexisting to form a complete perception of the information seeking process [26].

Regarding the origin of uncertainty, Wilson explained that it stems from problems—certain events in an individual's "lifeworld" can cause typification discrepancies in Schutz's phenomenological sense. "Typification" refers to the fundamental way people categorize and perceive the world [27], and typification discrepancies place individuals in dilemmas, making problem-solving and discrepancy elimination behavioral goals. Wilson constructed problem-solving as a four-stage process: problem identification, problem definition, problem resolution, and problem solution, with information accumulation accompanying uncertainty reduction until elimination [Figure 1: see original paper].

C.C. Kuhlthau similarly addressed uncertainty in her information search process model, arguing that uncertainty exists at all stages of information seeking, particularly during the initial stage when individuals perceive an information need and the exploratory stage when they browse to establish their problem. She described uncertainty as "a cognitive state that can cause emotional anxiety or lack of confidence," originating from gaps in human knowledge and meaning systems, with filling these gaps constituting the primary motivation for information seeking [28].

3.2 Conflicting Information and Uncertainty More than two decades have passed since Wilson proposed his classical information seeking theory, during which the global information environment has transformed dramatically. With the rise of the Internet, online information channels and sources have proliferated. While this enriches the volume and forms of health information, it also increases the difficulty of information seeking. For ordinary users, evaluat-

ing various Internet sources is already among the most challenging information seeking tasks [33]. The surge in information channels and sources increases the likelihood of encountering conflicting information—whether through active searching or passive information encountering [34]—where different sources provide inconsistent or contradictory descriptions, recommendations, or conclusions on the same topic [35].

The prevalence of conflicting information relates to fundamental uncertainty in human knowledge. Scientific research typically progresses gradually, and on unsettled issues, inconsistent evidence and conflicting academic viewpoints are common. While these may reveal different facets of phenomena and reflect the essence of scientific exploration, untrained members of the public may interpret such inconsistencies as conflicting information [15].

Processing conflicting information involves complex cognitive processes that significantly impact meaning-making and subsequent decision-making. Compared with consistent information, conflicting information demands greater cognitive resources, often leading to heuristic processing due to cognitive economy principles. Heuristic processing is a convenience-driven information processing tendency where recipients rely on proximity or availability to select information for processing, typically engaging fewer cognitive resources and relying on past experience for rapid evaluation [36-37]. This heuristic approach can trigger cognitive biases, notably confirmation bias (the tendency to seek, interpret, and recall information supporting one's beliefs) [38] and selective exposure (psychologically choosing which information enters consciousness, typically favoring supportive information while avoiding contradictory information) [39].

For health information specifically, conflicting health information produces various potential cognitive, psychological, and behavioral impacts. Studies on medication information seeking during pregnancy found that using more than four types of information sources significantly increased anxiety, and experiences with conflicting information positively correlated with decisions to discontinue medication, often due to fear of potential effects on the fetus [41-42]. D.M. Carpenter et al. demonstrated that the frequency of encountering conflicting health information significantly correlated with medication adherence, with less conflict corresponding to higher adherence [16]. Compared to users exposed to consistent health information, those encountering conflicting information showed changed health beliefs, more hesitant decision-making, and reduced decision certainty [43]. During public health emergencies (e.g., COVID-19), conflicting health information may cause information overload, leading people to avoid health information and adopt passive protective measures [44-45].

4. Research Design

This study employed an experimental method to investigate the impact of conflicting health information on individuals. We selected vitamin C as our research topic for three reasons: (1) vitamin C is a common nutritional supplement with

low learning costs for participants; (2) it serves both as a nutritional supplement and medical drug, making it representative in health contexts; and (3) conflicting health information about vitamin C is readily available online, ensuring ecological validity.

Researchers first used search engines (Baidu and Google) to identify vitamin C-related information, from which two conflicting sub-topics emerged: Subtopic A ("whether vitamin C supplementation can prevent or treat colds") and Sub-topic B ("positive or negative effects of vitamin C supplementation on the human body"). To balance topic effects, both sub-topics were included, each containing pro and con arguments. Researchers controlled reading difficulty to ensure comparable length and technical vocabulary across materials.

Based on Carpenter's definition of conflicting health information, we constructed two experimental groups and one control group. Experimental Group 1 read two conflicting materials: A+ supporting vitamin C's therapeutic effects on colds, and A- refuting this claim. Experimental Group 2 read B+ arguing for positive effects and B- declaring negative effects. The control group read two non-conflicting materials (A+ and B+), as shown in .

Table 1. Crossover Experimental Design

Group	Material 1	Material 2
Conflict Group 1	A+ (supports vitamin C for colds)	A- (refutes vitamin C for colds)
Conflict Group 2	B+ (positive effects)	B- (negative effects)
Control Group	A+ (supports vitamin C for colds)	B+ (positive effects)

Measurements included basic demographics (gender, age, education) and variables such as topic relevance, health beliefs, knowledge concept state, and confusion. Topic relevance served as a control variable, while health beliefs, knowledge concept state, and confusion acted as proxy variables for uncertainty at the meaning-making level, all measured on 5-point Likert scales. Demographics and control variables were measured pre-test, while dependent variables were measured both pre- and post-test, as detailed in . Cronbach's Alpha values exceeded 0.65 and composite reliability exceeded 0.8 for all variables, indicating acceptable reliability [47-48].

Table 2. Experimental Measurement Items and Reliability

Variable	Items	Cronbach's Alpha
Knowledge Concept State	1. I understand vitamin C's role in the human body2. I know when it's appropriate to take vitamin C3. I know whether I should take vitamin C	0.854
Confusion	1. I feel confused about recommendations regarding vitamin C use2. I find it difficult to understand articles or research about vitamin C	0.862
Health Beliefs	1. Vitamin C will harm my body*2. Vitamin C will help improve my health condition3. Vitamin C will positively impact my quality of life	0.820

Variable	Items	Cronbach's Alpha
Topic Relevance	1. Vitamin C is closely related to my life2. Vitamin C is important to me	0.905

*Reverse-scored item

Participants were recruited online, provided electronic informed consent, completed demographic questionnaires, and were randomly assigned to experimental or control groups (with experimental participants further randomly assigned to one of two sub-groups). They read assigned materials and answered questions about their subjective experiences. A manipulation check asked participants to summarize each material's main idea. Initial responses totaled 86, with 72 valid responses after manipulation checks.

5. Data Analysis

5.1 Random Grouping Check To balance topic effects, we designed two sub-groups within the experimental condition. First, we conducted one-way ANOVA on the two sub-topics, finding no significant systematic differences between experimental sub-groups on any covariates (see), allowing us to merge them for main effect analysis.

Table 3. One-Way ANOVA of Two Sub-Topics

Covariate	F-value	p-value
Gender	0.412	0.506
Age	4.412	0.506
Education level	3.765	0.198
Topic relevance	0.380	0.858

We then tested randomization effectiveness by examining potential systematic differences between experimental and control groups. ANOVA analysis of gender, age, education level, and topic relevance revealed no significant differences, confirming successful randomization (see).

Table 4. One-Way ANOVA Between Experimental and Control Groups

Covariate	F-value	p-value
Gender	0.472	0.482
Age	4.611	0.946
Education level	3.736	0.123
Topic relevance	0.389	0.162

5.2 Main Effects Analysis With no significant covariate differences between groups, we proceeded to analyze the main effects of conflicting health information on dependent variables.

5.2.1 Knowledge Concept State

Pre-test analysis showed no significant between-group differences in knowledge concept state ($F(1,70) = 0.01$, $p = 0.906$). The control group showed a non-significant slight improvement after reading non-conflicting materials ($t(35) = 1.43$, $p = 0.160$). In contrast, the experimental group exhibited a significant decline in knowledge concept state after encountering conflicting information ($t(35) = -2.24$, $p = 0.032$). Post-test analysis revealed significant between-group differences ($F(1,70) = 7.23$, $p = 0.009$), as shown in [Figure 2: see original paper]. These results indicate that conflicting health information blurs individuals' knowledge concept states.

5.2.2 Confusion

Prior research indicates that people often feel confused during online health information seeking [49]. We therefore included confusion as an uncertainty indicator. Pre-test analysis showed no significant between-group differences in confusion levels ($F(1,70) = 0.16$, $p = 0.689$). The control group's confusion decreased non-significantly after reading consistent materials ($t(35) = -1.10$, $p = 0.279$), while the experimental group's confusion increased marginally significantly ($t(35) = 1.93$, $p = 0.062$). Post-test analysis revealed significant between-group differences ($F(1,70) = 5.93$, $p = 0.017$), as shown in [Figure 3: see original paper]. Thus, conflicting health information significantly increases user confusion about health topics.

5.2.3 Health Beliefs

Health beliefs significantly influence health decision-making, with higher beliefs facilitating decisive action and lower beliefs leading to hesitation [50]. We measured health beliefs as a third dependent variable. Pre-test analysis showed non-significantly higher health beliefs in the control group ($F(1,70) = 2.24$, $p = 0.139$). Post-test analysis revealed that control group beliefs increased marginally ($t(35) = 1.80$, $p = 0.081$), while experimental group beliefs decreased significantly ($t(35) = -2.28$, $p = 0.029$). Significant between-group differences emerged post-test ($F(1,70) = 13.75$, $p = 0.001$), as shown in [Figure 4: see original paper].

6. Discussion and Implications

6.1 Main Findings Our findings demonstrate that conflicting health information significantly impacts knowledge concept states, confusion, and health beliefs. Specifically, conflicting health information blurs knowledge concept states, increases confusion, and decreases health beliefs. Overall, encountering conflicting health information during health information seeking increases uncertainty and complicates health decision-making. These results align with D. Clark et al.'s experimental research on nutritional topics, which found that conflicting nutritional information negatively affects attitudes, beliefs, and behavioral intentions, creating confusion and skepticism about nutritional science [14].

6.2 Theoretical Significance Broad information behavior models have long relied on rational decision-making assumptions, lacking alignment with dynamic, complex, uncertain, time-constrained naturalistic decision-making contexts [51]. As N.J. Belkin described information seeking as a response to uncertainty [10] and Wilson's model depicted uncertainty decreasing linearly through information seeking stages [23,30], our study reveals that in naturalistic contexts, information seeking is not a linear process but rather a recursive spiral where uncertainty may increase rather than decrease [52]. By empirically demonstrating that conflicting health information blurs knowledge states, increases confusion, and reduces health beliefs, we extend traditional information behavior theory by relaxing the strong assumption of information consistency and incorporating the dimension of conflicting information's impact.

Furthermore, this study contributes to health information behavior literature by focusing on information characteristics rather than just source differences, user characteristics, or source-user interactions [53-54]. As Carpenter noted, clarifying conflicting health information's impacts is an urgent research need [11]. Our findings respond to this call by revealing how information's internal logic and behavioral implications affect user-information interaction, enhancing understanding of the dynamic relationships among people, information, technology, and sociocultural contexts [55].

6.3 Practical Implications Our research reveals conflicting health information's negative impacts on public emotions, cognition, and attitudes, warranting serious attention from institutional managers. Conflicting health information can trigger cognitive dissonance and negative emotional experiences. Our results show it significantly increases confusion, while R.H. Nagler et al. found it may cause anxiety, frustration, anger, and grief [56]. During public health emergencies, conflicting information can induce information overload requiring timely intervention [44].

Institutions should prioritize ensuring information consistency when releasing public health information, guide the public toward reliable sources, and improve health information literacy to enhance quality discernment [57-58]. To address

knowledge state confusion, institutions should strengthen regulation of health information sources, govern false and distorted information promptly [6,8], and expand dissemination channels through social media to increase supply of high-quality health information [59]. Monitoring systems should track conflicting health information, with scientific explanations promptly published to clarify public understanding [60]. Health literacy cultivation activities using representative cases can help the public recognize and properly respond to conflicting health information [6], potentially delivered through popular formats like social media posts, short videos, and livestreams.

7. Limitations and Future Directions

This study has several limitations. First, although experimental methods measured immediate effects of conflicting health information, they could not capture specific cognitive mechanisms or long-term impacts. Future research should employ neuroscientific tools (e.g., eye-tracking, EEG) to probe cognitive activities during conflict processing and use mobile experience sampling methods to capture persistent real-world effects [61]. Second, our participants were relatively young; given that older adults' information behaviors may differ from younger populations [62-63], future studies should examine age-related differences in responses to conflicting health information. Finally, this study focused on conflicting health information with inconsistent behavioral directions; future research should also investigate the type where inconsistent pathways lead to the same behavioral outcome, exploring conceptual differences and distinct modeling approaches.

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Author Contributions

Song Shijie: Conceptualized the study, collected data, analyzed results, wrote the manuscript.
Qi Yunfei: Developed research framework, guided data analysis, reviewed and validated the manuscript.
Zhao Yuxiang: Assisted with literature collection, reviewed and validated the manuscript.
Zhu Qinghua: Supervised research design, reviewed and validated the manuscript and approved final version.

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