

# A Multidiscipline Conceptual Framework for Consumer Health Informatics

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## Abstract

*This paper presents an idealized conceptual framework for consumer health informatics research drawing from complementary disciplines: information science and health campaign research. This synthesis is designed to provide researchers with a flexible model to evaluate current research and inform future studies. Following a description of the major components, we describe a recent evaluation of consumer perceptions of a health information system, Genetics Health Reference. This study illustrates how the framework may be applied to provide some direction and insights into ongoing consumer health informatics research. While this model represents a work in progress, we present it in support of efforts to understand the multidimensional impacts of the public's access to health information. We also discuss challenges that remain to develop a better conceptual understanding of how consumers converge on health informatics services.*

## Keywords:

Health Behavior; Internet; Informatics; Communication; Information Science; Consumer Satisfaction; Evaluation Studies

## Introduction

Napoli [1] suggests that consumer health informatics research underemphasizes the importance of comprehensive theoretical underpinnings in evaluating how consumers interact with health information services. Napoli [1] encourages informatics researchers to:

- Account for an array of institutional, social, professional, individual challenges that impede interactive consumer-based health informatics.
- Propose comprehensive models that underlie and instruct how research might be conceptually conceived and ultimately conducted.
- Borrow theoretical frameworks from health campaign research in conjunction with more traditional informatics research, such as information sciences.

Napoli [1] and Dutta Bergman [2] agree that a challenge in health campaign and consumer health informatics research is to provide a more holistic conceptual foundation, which

would help scholars conceive and critique both existing and future research efforts. Health campaigns are non-commercial, research-based efforts that seek to change a target audience's awareness or basic knowledge about a disease, condition, or public health issue [2].

Baker and Pettigrew [3] explain a conceptual framework also serves as a roadmap, which helps a researcher conceive projects in a multidimensional fashion. Reinforcing the idea that there is nothing more practical than good theory, a broad conceptual framework identifies the areas that should be considered in planning an evaluation and clarifies the conceptual omissions that need to be explained.

In this paper, we present an idealized conceptual framework that integrates components from information science and health campaign research. A recent evaluation of a consumer health information Website is used to illustrate how the application of the framework provides some direction and adds insights in ongoing consumer health informatics research.

Our objective is to "sketch" the conceptual landscape representing and integrating existing theories about consumer interaction with health information media. While this model represents a work in progress, we present it in support of efforts to understand the multidimensional impacts of the public's access to health information and account for the related infrastructural, biopsychosocial, and interactional dimensions that have been identified – especially in health campaign research.

## Background

In this section, we summarize foundational concepts from two disciplines that have explored information seeking from two different perspectives: (1) information science and (2) health campaign research.

### Information Science

The well-established information science literature conceptualizes the information-seeking process (ISP) as a dynamic, iterative series of cognitive processes and physical actions required for satisfying information needs (e.g., [4-7]). Several

“core” non-linear, dynamic, and iterative information-seeking states are common to these ISP models:

- Need: identifying/expressing information needs;
- Access: finding relevant information; and
- Evaluation: assessing information that is found.

Briefly, information needs represent gaps in knowledge. The process of seeking “missing” knowledge helps to resolve these needs. However, consumers may have trouble identifying missing knowledge (i.e., knowing what is not known). Challenges include ineffective query formulation resulting from a lack of knowledge about medical concepts and terminologies [8] as well as finding credible information resources, constructing well-formed mental representations, and navigating online systems. The retrieved information is evaluated within the context of the original problem, another potential barrier for consumers in the medical domain.

Thus, from a traditional information science perspective, ISP consists of making sense of information within a dynamic environment. While these models typically emphasize decision-making and other cognitive processes, very few conceptual frameworks accommodate well-identified variables within the health campaign literature, including affective dimensions of consumer behavior [6] and the socio-cultural and economic environment that surrounds media use [7,2].

### Health Campaign Research

Although health campaign researchers have embraced an individual-centered model, in recent years they have been prone to discuss the phenomena of how persons interact with health media (e.g., health news and information sources on the Internet), as a process of convergence rather than information seeking [9]. The term *convergence* is used because it is perceived to bridge both consumer information seeking and an array of more affective-oriented rationales for why people use mass media, often collectively referred to as *gratifications* [10].

Overall, health campaign research theory recognizes an array of interactions that conceptually frame the dynamics that occur in consumer health informatics. These dynamic interactions encompass intrapersonal, interpersonal, demographic, and cultural factors, as well as media source credibility, preparation of messages, and channel characteristics [2].

McGuire [9] and Cappella [11] note that the conceptual development of health campaign research has occurred in three phases. The first phase is similar to the ISP model described previously and emphasizes optimizing an individual’s exposure to resources with their information needs [9].

The second phase emphasizes the potential communication barriers inherent in the characteristics of how a health media or interpersonal source is perceived. It encompasses potential communication barriers presented by messages, media channel, receiver (individual) and destination characteristics [10]. In other words, health messages may not be optimally understood by consumers if the message is poorly written, if a written rather than a visual media is used to reach some audiences,

if a person has little access to mass media, or if messages are poorly timed with an individual’s or target audience’s needs. The emphasis in the second phase is on both individual perception and media characteristics [9].

The third phase encompasses: a) immediate social influences, such as the influences of peer pressure and commercial advertising on health behaviors, b) cognitive behavioral factors, such as a person’s problem and decision making skills, and c) the degree that a commitment to a specific health behavior requires broader skills and individualized training to foster a healthier lifestyle. This phase includes theoretical models as well as approaches to research health message effects [11]. These include behavior change theories, individual information processing modes, message effects research and immediate systemic factors. It also emphasizes a person’s individual cognitions and skills as well as his or her behavioral adaptability and milieu, or immediate social surroundings [11].

Dutta Bergman [2] adds that health campaign research has entered a fourth phase where the emphasis is to introduce macro forces, such as a nation’s or region’s health resources, its global or national context (e.g. developing versus industrialized, cultural and religious heritage) its economic prosperity and geo-political factors. Macro influences are seen as relevant to a conceptual understanding why health campaigns are accepted or rejected by intended audiences.

Dutta Bergman [2] notes a challenge of the fourth phase is to integrate all four dimensions described above. The model proposed below is one approach for integrating the interaction of the phases of health campaign research with the ISP model.

## A Multidimensional Framework

Drawing from a new generation of relevant health campaign research and other ISP models and theories, we propose a conceptual framework (Figure 1) for visualizing high-level health information dimensions that span and bridge two disciplines. Each major dimension is described briefly and encompasses the literature cited above. The model also includes an important added dimension that we term ‘outcome.’

### Consumer/Individual

This dimension covers how a person responds to health communication messages and notes psychological, motivational, immediate social, family factors, and related applied context. This is discussed in the description of phases one, two, and three in health communication research above as well as ISP research. Psychosocial factors may influence the basic information-seeking process (described previously). For instance, an individual’s cognitive abilities, affective state, life skills and existing knowledge of the information problem, domain, or information source is likely to interact with the perception of information need, motivation, or effort spent evaluating retrieved information.

Other variables include individual demographic attributes, social influences, personal goals, and how a person perceives a health message. For example, a message that seems incon-

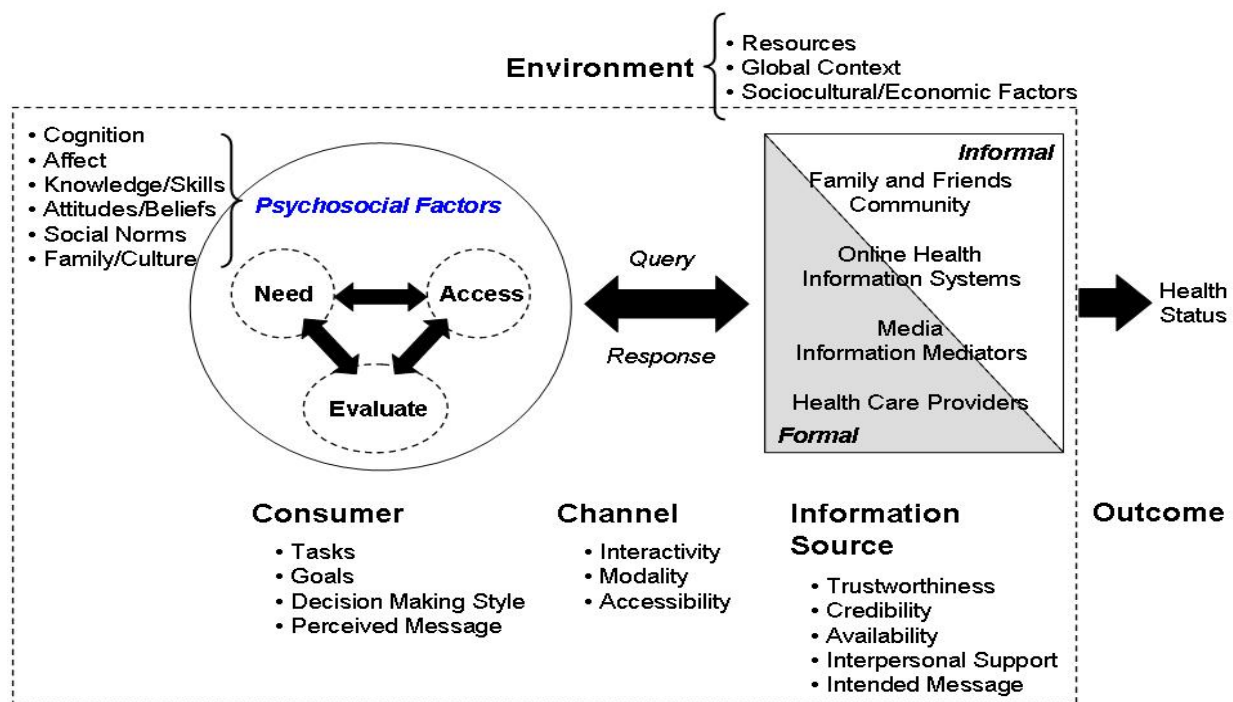


Figure 1: Conceptual framework for consumer health informatics with five interactive dimensions – Consume (or Individual), Channel, Information Sources, (Macro) Environment, and Outcome

sistent with an individual’s personal beliefs (i.e., cognitive dissonance) may contribute to ending an information-seeking session before an information need has been met.

### Channel

This dimension describes the influence of the media channel by which health messages are conveyed. This is discussed in the description of phase two of health campaign research above. Channel includes attributes such as the level of interactivity (e.g., unidirectional versus bidirectional), modality (visual, audio, or multimodal), and accessibility (e.g., due to noise or insufficient bandwidth). For instance, some consumers prefer multimedia compared to text (only).

### Information Sources

This dimension encompasses the perception of the credibility of personal, professional, and media sources and how it influences an individual’s reception of health messages. This is discussed in the description of phase two and three of health campaign research above. Many formal and informal sources of health information are available to consumers. Since information sources are typically characterized by perceptions of trustworthiness, credibility, availability, intrapersonal support, and the intended message, health communication from multiple formal (health care providers) versus informal sources (media, health informatics Websites, family and friends) can be a source of confusion for individuals.

### Macro Environment

This dimension includes the socio-economic, and cultural environment or heritage in which health communication occurs. This is discussed in phase four of health campaign research above. The context, such as available resources due to market and economic forces and socio-cultural trends and traditions, influences all of the other dimensions. For example, the “digital divide” and the impact of religious beliefs impact how individuals perceive health messages.

### Outcome

Although health information convergence results in many outcomes (e.g., satisfying an information need), a critical, elusive component is finding therapeutic associations between consumer information access and resulting health behaviors:

Despite abundant speculation regarding the consequences of consumer participation in interactive health communication, little research has investigated these issues... Ultimately interest and research on effects should focus on quality of health and health care. [12:686-7]

This dimension was added to the above description of ISP and health campaign research.

Overall, each component and its attributes potentially affect health information seeking and convergence on individual behaviors. People do not seek health information in a vac-

uum—it is integrated into their lives. How and when the need to seek information (perceived or real) overcomes other competing needs, interests, and activities may be based on predictable factors, such as risk-benefit analysis, or simple serendipity. Nevertheless, the design of effective consumer health information systems will likely improve significantly only after researchers better understand the practical role and nature of health information convergence on individual behaviors.

## Sample Application

While we recognize the complexity of the model and the research challenges posed by multiple interacting components and dimensions, we believe that the framework is useful for presenting a high-level map of areas to be explored. As Greenberg and colleagues state, “the more we know about [online consumer health information seeking] variables, the better we can design educational and technical strategies that help consumers get to the information they seek” [13:1].

Recently, the proposed framework was applied in evaluating the National Library of Medicine (NLM) site, Genetics Home Reference (GHR) [14]. GHR helps consumers understand information about genetic conditions and their related gene or chromosome variations.

A survey was conducted to evaluate perceptions of GHR from consumers’ perspectives. Between February and April 2004, 374 members of the Genetic Alliance, an international advocacy group for people with genetic conditions, completed online surveys designed to probe multiple dimensions of consumer perception: content, design, and interface. The survey and data collection were approved by the U.S. Office of Management and Budget.

After consideration, two dimensions (macro environment, channel) were bypassed for investigation because of an anticipated high acceptability of health information seeking on the Internet among the study’s participants. Two dimensions (individual and information sources) were pursued. Within the latter dimensions, researchers focused on investigating the perceived uses and gratifications of the Website by exploring participants’ thoughts (cognitive) and feelings (affective) about GHR. Researchers also wished to assess participants’ assessment of GHR’s credibility. The focus on uses and gratifications resulted in questions about the Website’s aesthetic appeal and emotions associated with using GHR [15]. Perceived affective dimensions, source credibility, and cognitive uses were derived from semantic differential scales, which are often used in studies of audience media perceptions [9].

By including a range of variables within the individual and information source dimensions, researchers were able to assess whether content quality and aesthetic characteristics in addition to traditional measures such as demographics, online experience, interest and ease of site navigation, predicted user satisfaction.

The study found that content quality and affective dimensions each predicted overall consumer satisfaction [15]. However, age, gender, prior online experience, interest, and education

did not predict consumer satisfaction, which is contrary to some previous findings [16].

Further, in a factor analysis that combined all the 13 outcome variables that assessed cognitive, affective feelings and source credibility, the researchers found there were three distinctive perceptual orientations towards GHR [15]:

- Visual design and appeal
- Perceived source credibility/information quality
- Perceived complexity/simplicity and potential bias

In short, participant motivations to use GHR were more holistic than an expected interest to retrieve high quality information about genetics.

The point is that, by using the conceptual framework and integrating variables based on its dimensions, findings about the relative importance of how persons project attitudes onto GHR were better identified. The conceptual framework broadened the research variables that were pursued. In turn, these yielded results that expanded the existing literature about consumer motivations to use a consumer health Website. By initially focusing on a broader conceptual framework, the investigators defined narrow regions to explore and areas to bypass, as well as identified new types of research orientations that yielded surprising results.

## Challenges

The health campaign research literature notes an array of methodological challenges, such as understanding audience segmentation and accounting for macroscopic socio-political and economic influences on the behavior of both consumers and media organizations [2]. Similarly in information science, there are challenges to capturing the “personal value” consumers place on health information, understanding relevance to particular health needs in the context of situational variables, and tracking the episodic and often serendipitous nature of health information seeking among formal and informal sources. Finally, a dearth of common terms across disciplines and validated instruments for measuring variables hinders consumer health informatics research [17].

Initial methodological challenges we encountered in applying a comprehensive framework include:

- Difficulty in obtaining representative samples online, including underserved populations
- Challenges in identifying and creating operational definitions, and isolating key variables such as “information exposure”
- Lack of standard assessment methods, variables, and operational definitions across research studies

Nevertheless, idealized, comprehensive conceptual frameworks are important in assisting investigators critique the dimensions they have encompassed or eclipsed in modeling consumer informatics research. While the model presented here reinforces this suggestion, it also underscores that even a

consumer-centered, psychosocial approach represents only one of the major components of a more expansive, interactive system. It is important to evaluate both motivations for consumer behaviors and operant factors—information source, channel, consumer and environmental. The latter may be useful to explain why intended audiences are drawn or repelled to health Websites and embrace or reject health management and information-seeking concepts in the first place.

## Conclusion

Although we may never fully account for the multidimensional spectrum that an idealized model represents, a comprehensive framework adds accountability to social research that fosters consideration of a range of issues and encourages investigator disclosure of the dimensions that are less explored.

An idealized conceptual framework outlines the considerations for which researchers should strive, debate, and defend. A model needs to be comprehensive in order to be ultimately useful and it needs to set a conceptual tradition that is well-grounded in sister disciplines. We hope such a model of consumer information seeking and convergence has been introduced in this conceptually driven manuscript.

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