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The role of information in health behavior:

A scoping study and discussion of major public health models

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Abstract

Information interventions aimed at influencing health behavior are both a major element of the public health toolkit, and an area of potential interest and investigation for LIS researchers. In order to explore the conceptualization and use of information as a concept within dominant public health behavior models, and the manner in which information practices are acknowledged and handled therein, we undertook a scoping study. We scoped the explicit mention of “information” within core English-language health behavior textbooks, and examined dominant models of health behavior for information practices. Index terms within these texts indicated a lack of common language around information-related concepts. Nine models/theories were discussed in a majority of the texts. These we grouped as Stages of Change Models, Value-Expectancy Models, and Other, and examined for information-related concepts and constructs. Information was typically framed as a “thing” or resource, and information practices were commonly included and/or implied within health behavior models. However, a lack of specificity regarding the definition of information, how it differs from knowledge, and how context affects information practices, make the exact role of information within health behavior models unclear. Although public health information interventions may be grounded in behavioral theory, a limited understanding of the ways information works within the contexts of people’s real lives hinders our ability to effectively use information to intervene in the health behavior of individuals and populations. LIS can help improve understanding of the role of information in health behavior; likewise information scientists can learn from public health’s interventionist approach.

Keywords: Information use, information practices, health behavior, models, theories

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Information interventions aimed at influencing health behavior are a major element of the public health toolkit. This is due in part to the power ascribed to knowledge within health behavior models, as well as to the relative ease of implementing information campaigns. Information interventions, such as communication and surveillance efforts, are also perceived to be non-invasive and therefore generally ethically permissible (Nuffield Council on Bioethics, 2007). However, our understanding of the effectiveness of such interventions, let alone how they work (or fail) to impact health behavior, is quite limited. Further unpacking the role of information, and information practices (Savolainen, 2008), within theories of health behavior may help us better understand how to use information to encourage and support health behavior change.

Health researchers have long aimed to identify aspects of public health communication interventions that contribute to greater effectiveness (Noar, 2006; U.S. Department of Health and Human Services, 2000). With the advent of the Internet, mobile technologies, and near-ubiquitous information streams, public health research is increasingly being conducted on health information practices such as online dissemination of and searching for health information (Khechine, Pascot, & Premont, 2008) as well as patient social media use for seeking, sharing, and sense-making (Hamm et al., 2013). However, little-to-none of this research clearly defines “information” or unpacks the multitude of ways individuals and populations of interest interact with information.

Within the field of library and information science (LIS) there is a rich tradition of discussion and debate regarding the nature of information, as well as a major stream of research

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and theory focused on information practices. Table 1 presents examples of several information practices that may be relevant to health behavior change processes. Some of these (e.g., accessing and encountering) could be clustered within common public health information-related concepts, such as health communication, while others (e.g., avoiding and recalling) are rarely acknowledged in health behavior. LIS researchers have developed many models to describe, explain, and predict the ways humans interact with information (c.f., Case, 2006; Chelton & Cool, 2004; K. E. Fisher, Erdelez, & McKechnie, 2005). Yet, health behavior research rarely draws upon LIS theory¹ when planning or assessing information-based interventions.

Table 1

Selected information practices relevant to health behavior change

Practice	Health Behavior Examples
Accessing	Downloading an article on a health topic of interest
Assessing	Deciding whether a webpage promoting a particular diet has “truthful” health information
Avoiding	Declining to read, and throwing out informational brochures provided by one’s health care provider
Blunting	Procrastinating routine health screenings and/or not seeking detailed results
Encountering	Reading a public health ad on public transit, or finding interesting online information while searching on a different topic
Knowledge Formation	Incorporating information on medical and surgical options, personal beliefs, and other factors in order to select an appropriate treatment plan.
Monitoring	Reading health news with an eye to risk and preventative factors for a cancer than runs in one’s family
Recalling	Remembering fitness advice given by a trainer or physiotherapist
Receiving	Listening to instructions for post-surgical wound care.
Processing	Using multiple sources of new and old information on dental health and to

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	create/modify a daily hygiene routine.
Seeking	Asking one's doctor a question about a particular symptom of concern, or looking up possible side-effects of a prescribed medication.
Sense-making	A recently-diagnosed patient cognitively and socially exploring and evaluating treatment options within the context of her/his own life
Sharing	Telling a pregnant friend one's own childbirth story and tips for coping with labor.
Use in context	Calling a nurse help line for decision support when caring for a sick child

The minimal use of LIS theory within public health raises several questions. How is information defined and understood within health behavior models? Is the conceptualization of information within theories of health behavior rich and nuanced enough that there is no need for public health to borrow theory from information science? Or, on the contrary, could behavioral public health research and intervention planning benefit from applying LIS theory, in order to better understand the way information practices function to influence health behavior? Finally, are there lessons LIS researchers and practitioners might draw from health behavior models, which could improve our understanding of health information practices and help us better understand the information-related needs of our user communities?

Method

In order to assess the extent to which information is explicitly and implicitly integrated into contemporary public health behavior models, we undertook a scoping exercise (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010) of major current texts dealing with health behavior theory in public health. Health behavior is a multi-disciplinary field that has advanced to the point that reviewing the entirety of information-related research in one article would be impractical. Over time a canon has developed, and major publishers have released textbooks on

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the topic; therefore teaching texts may now be examined as a broad representation of dominant thought and teaching regarding health behavior models and theory.

Objective

This scoping study aimed to explore the conceptualization and use of “information” as a concept within dominant public health behavior models, and the manner in which information practices are acknowledged and handled therein. In order to fulfill this objective, we scoped the explicit use of “information” within current health behavior texts, and examined dominant models of health behavior within these texts for conceptual applications of information practices.

Selection of Sources

Our sources were English-language textbooks on health behavior. The core list was assembled via searches of Worldcat, the world’s largest union catalogue of library holdings. Within Worldcat, we searched for English-language, non-fiction books published 2000-2012, using “health behavio(u)r” as a keyword. We ranked the results by number of libraries reporting the item in their collections, discarding those in fewer than 75 libraries. Duplicate versions of the same text (e.g., electronic and print) were combined as one item; for texts with multiple editions, we included only the most recent.

We scanned the titles of the resulting records for relevance, selecting all substantively about health behavior. We excluded those focused on specific populations or health topics (e.g., elders, obesity), specific clinical disciplines (e.g., nursing), or a single theory (e.g., the Health Belief Model). We then compared this list of core texts in health behavior with the top results from the online bookseller Amazon, and sought feedback from academic experts in health behavior, in order to identify any key texts we may have missed.

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Assessment and Mapping

In order to assess the explicit discussion of information within the texts, we scanned the indexes for “information” and related terms (e.g., information seeking, information technology), reading the relevant sections of the books to understand the context and meaning. We tracked and tallied which and how many sources used each information-related indexing term.

In order to identify which health behavior models were included in each book, we scanned the indexes, tables of contents, and relevant chapters of each text. We considered any presented in at least half of the included textbooks to be “core” health behavior models. We then created a matrix of the ways information practices were apparent in and/or related to each of these models.

Results

Worldcat searching resulted in a list of eight core health behavior textbooks (Table 2). Amazon searching and expert consultation did not identify any additional key texts; rather these methods served to validate our existing list.

Table 2

List of core health behavior textbooks

Year	Lead Author	Title	Publisher
2000	Abraham	Understanding and changing health behavior: from health beliefs to self-regulation	Psychology Press
2012	DiClemente	Health behavior theory for public health: Principles, foundations, and applications	Jones & Bartlett
2007	Edberg	Essentials of health behavior: Social and behavioral theory in public health	Jones & Bartlett
2008	Glanz	Health behavior and health education: Theory,	Jossey-Bass

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		research, and practice	
2009	Hayden	Introduction to health behavior theory	Jones & Bartlett
2010	Martin	Health behavior change and treatment adherence: Evidence-based guidelines for improving healthcare	Oxford University Press
2009	Shumaker	The handbook of health behavior change	Springer
2012	Simons-Morton	Behavior theory in health promotion practice and research	Jones & Bartlett

“Information” within Health Behavior Texts

Back-of-book indexing is intended to be a distillation of the key concepts within a text, in order to provide easy access to important ideas. In these eight textbooks, there were 19 information-related top level entries (50 including sub-entries). The majority of these were unique to the book index in which they appeared, indicating a lack of common language around information-related concepts. Two books had zero information-related index terms. Table 3 lists the indexing terms that were found in multiple texts, along with the number of texts in which they were found. Most of the information-related index entries found at the back of multiple health behavior textbooks referred to book sections discussing socially-constructed information practices or processes, and the general conceptualization of information appeared to be as “thing” to be sought, exchanged, or processed (Buckland, 1991). Examples of this include casting information as a resource that accumulates within an individual’s possession, to be used when the individual is ready to make a change, or as a catalyst, the receipt of which spurs or speeds a change reaction.

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Table 3

Information-related index terms found in multiple texts

Indexing term	# of texts	Information process or practice?
Information-motivation-behavioral skills (or Information-motivation-strategy) model	4	Yes
Informational support	4	Yes
Information processing	3	Yes
Information	2	No
Information exchange	2	Yes
Information seeking	2	Yes
Information technologies	2	No

Information within Health Behavior Models and Theories

Nine models or theories were discussed in at least half of the textbooks. Two of these (the theory of reasoned action and theory of planned behavior) were typically presented together; thus they are combined in this analysis. All other models and theories were included in three or fewer of our selected books, and excluded.

Table 4 presents the core models/theories, along with the number of textbooks in which each was discussed, the type of model, and the level at which each model functioned. Models were classified by type as either: stages of change models, which describe stages through which an individual passes on their way to making behavioral change; value-expectancy models, which identify predictive determinants of individual-level behavioral change; or “other” models—those that were neither stages of change nor value-expectancy, and may focus on the individual and/or more collective levels of functioning.

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Table 4

Health behavior models/theories, by number of texts in which they were discussed, type of model, and level of functioning.

Model/Theory name	# of Texts	Model Type	Level of Functioning
Theory of reasoned action & Theory of planned behavior	10 (each)	Value-expectancy	Individual
Transtheoretical model/stages of change	10	Stages of change	Individual
Health belief model	8	Value-expectancy	Individual
Social cognitive theory/Social learning theory	8	Social/environmental	Intermediate
Ecological model(s)	6	Ecological	Multi-level
Diffusion of innovations	6	Social process/ Communication	Group
Precaution-adoption process model	5	Stages of change	Individual
Information-motivation-behavioral skills/strategy model	4	Value-expectancy	Individual

While only one of these models has “information” in its title, many of them contain information-related constructs, processes, factors, and stages. In what ways are information practices (things people do with information) explicitly or implicitly included in these leading health behavior theories? The following section reviews the core models, discussing the ways information practices are explicitly or implicitly present in each one.

Stages of change models

Stages of change models of health behavior typically contain strong information practice components in the early stages, identifying information as a key instigating factor for behavior change. The Transtheoretical model (TTM) was pioneered by Prochaska (Prochaska,

DiClemente, & Norcross, 1992; Prochaska & Velicer, 1997; 1979) for application with addictions recovery processes. The TTM proposes that people proceed through five phases or “stages” in order to make intentional behavior change: pre-contemplation, contemplation, preparation, action, and maintenance. In addition to articulating temporal stages, the TTM identifies ten “processes of change” that help people move through the stages. It is clear that certain of the TTM’s processes, stages, and constructs imply various information practices.

In the precontemplation phase, outside forces provide information to raise the individual’s consciousness or awareness of the need for behavior change. The individual may seek or merely encounter this information, or it may be provided despite the individual’s desire to avoid or minimize it. In the contemplation phase the individual, who is now considering change, weighs the pros and cons, assessing the information and making sense out of it in combination with other knowledge or beliefs. Embedded within this model is a multiplicity of dimensions of information processing and use, including affective response (“dramatic relief”) and actual behavior change.

The precaution-adoption process model (PAPM) (Weinstein & Sandman, 1992; Weinstein, 1988) takes the stages of change principle of the TTM and adapts it to address specific types of behaviors: protecting oneself against risk of harm. The PAPM also posits that an individual moves through stages over time, however this model has seven stages, one of which is an exit from the model midway. In the PAPM, the unaware stage is followed by an unengaged phase and then a decision stage. The individual may at this point decide not to act, or, alternatively decide to act, which will then be followed by action and maintenance stages.

The emphasis placed on the distinction between unaware and unengaged—stages that are not differentiated within the TTM—suggests that information provision, receipt, and processing

are highly relevant to the PAPM, and the PAPM suggests different information-communication or tailoring strategies to people at these two stages. The consideration of a deliberate choice *not* to change behavior is also a departure from the TTM, and implies a role for the individual's personal assessment of information, as well as stages in which one might engage in protective practices such as monitoring information on a topic without necessarily taking action, as well as avoidant ones such as blunting.

Value-expectancy models.

In contrast with the stages of change models, value-expectancy models are less cohesive regarding the role of information in health behavior change. Some of these models merely invoke knowledge or awareness (e.g., of social norms), the acquisition of which depend upon information practices. Others include more explicit and immediate information involvement, for example as a cue to prompt action toward behavior change. Most invoke the idea of beliefs and values, which are constructed in large part out of information, but typically over a long period of time rather than based on a discrete piece of information.

Ajzen and Fishbein's (1980) theory of reasoned action (TRA) proposes that both one's own attitudes toward a behavior and the subjective norms of those around oneself influence intention to engage in, or change, a given behavior. The TRA further asserts that intention to engage in a given behavior greatly increases the likelihood that one will do so. The theory of planned behavior (TPB) (Ajzen, 1991) expands on the TRA to include the construct "perceived behavioral control," which relates to the individual's beliefs about how much control s/he has over the behavior in question. The TRA and TPB value-expectancy theories contain very little in the way of constructs of explicit information practice. Rather, the role information plays is

indirect, through communication and of social norms and by way of intrinsic information in the form of beliefs (and, particularly in TPB, previous experience).

The health belief model (HBM) (Hochbaum, 1958), one of the oldest health behavior models, was originally developed by psychologists to explain and predict participation (and lack thereof) in screening programs, and has since been applied to health issues ranging from dietary compliance (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977) to sexual risk behaviors for HIV (Lin, Simoni, & Zemon, 2005). Although the HBM has evolved over the years, the basic idea remains that one's personal beliefs and perceptions about both a health risk and the behavior that will minimize the risk affect how likely one is to adopt protective behavior. In the HBM, perceptions about the severity of the health threat and about one's own susceptibility to the threat are weighed against the perceived benefits and perceived barriers to acting. Unlike TRA and TPB, the HBM includes "cues to action," which may roughly translate into received information, whether intentionally sought or merely encountered, and are thought to activate readiness and increase the odds of taking action. While such cues to action may originate within a person as signs of ill health (e.g., developing a suspicious mole, becoming easily winded by climbing stairs), health communication interventions using the HBM aim to be such cues to action by providing information on the severity of threat, one's susceptibility, overcoming barriers to making change, and/or the benefit of making change (e.g., cigarette package warning labels, billboards advising new parents to obtain recommended vaccinations).

The information-motivation-behavioral skills (IMB) model, sometimes referred to as the information-motivation-strategy model, is a newer value-expectancy model, created to understand and reduce HIV risk behaviors (J. D. Fisher & Fisher, 1992). The general idea of the IMB model is that many behaviors are skill-dependent, and skills are influenced by a person's

levels of relevant knowledge and motivation. It would appear that the IMB model generally uses “information” and “knowledge” interchangeably, although these are arguably very different constructs; one may receive a large amount of information without necessarily increasing one’s knowledge. In order for information to translate to knowledge, there are co-requisites such as literacies, information processing, memory and recall, and ability to appropriately use information in context.

Other core models.

The remaining models can only be grouped together by virtue of not fitting within either the stages of change or value-expectancy paradigms. These models have all originated in other fields and been adopted by public health, and range from highly information-focused to too high-level to specify the role of specific practices.

Diffusion of innovation (DOI) theory, first proposed in the 1950s to explain the pattern of farmers’ uptake of hybrid seed (Rogers, 1995), has been applied over the years to many health “innovations” or changes. DOI suggests that communication of information about an innovation helps disseminate the idea, after which people will uptake it over time depending on the innovation’s characteristics.

Information dissemination is key within DOI, as one is unlikely to adopt a new behavior about which one is unaware. While mass media is very efficient at disseminating information to large groups, interpersonal communication between people with commonalities (e.g., friends) appears to have greater impact on the adoption of innovations. Rogers classified people according to how quickly they were to adopt new things (e.g., early adopters, laggards) as dispersed along a normal curve, based on how quickly an individual progressed through a stages of change-like process that included: knowledge, persuasion, decision, implementation, and

confirmation. Information is central to DOI theory, as communication about an innovation is the basis for it spreading, personal communication is highly valued, and knowledge about the innovation is prerequisite for implementation.

Social cognitive theory (SCT), known in early incarnations as social learning theory, was established by Bandura to understand determinants of learning and behavior (Bandura, 1986). SCT has since been applied in many disciplines, including health behavior (Bandura, 2004). According to SCT, individual characteristics (including Bandura's most famous concept, self-efficacy), environmental factors, and the process of "reciprocal determinism"—calibrating one's behavior and the environment—all contribute to behavior change. Similar to several other models and theories, in SCT "knowledge" (i.e., receipt, processing, and positive assessment of information regarding health risks and/or benefits of behavior change) is a precondition for behavior change, although other determinants, including belief in one's own power to change (self-efficacy, a concept incorporated into Ajzen's aforementioned TBP) are also required. This "knowledge" interacts with various forms of internal and external information such as personal beliefs and communication of social approval or disapproval.

"Ecological models" is an umbrella for various models utilizing a similar approach. These were sometimes referred to as "emerging" theories in the textbooks, and did not have clearly defined constructs the way most did, but were included in the majority of the sources and were therefore deemed sufficiently central for inclusion in this analysis. Of these models, which generally relate back to Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1979), the most prominent in public health today is the PRECEDE-PROCEED model (Green & Kreuter, 1999) for planning multi-level health interventions.

Ecological models offer an alternative to individual-focused theories, as they center on the individual in conjunction with multiple levels of environment in which the individual is situated. Relationships between and among these systems levels are assumed to be ongoing and interactive, and a public health intervention is thought to have best odds of success if it addresses multiple levels in complementary ways. Due to the lack of specificity when we lump ecological models together, information practices can only be assumed to be universally evident in the interactions between and among the systems levels, and as part of public health interventions targeted at them. That said, some applications and adaptations of ecological models in public health (e.g., Sallis et al., 2006) include the “information environment,” a concept that has also found resonance within LIS research drawing on ecological models (e.g., Steinerová, 2010; Zhang & Kudva, 2012). While the information environment does not include individual-level or interpersonal information practices, it does acknowledge many public health information interventions, along with contextual factors such as media policies and activities, and health care professional advice.

Table 5

Health behavior models, role of information therein, and some implied information practices

Model	Role of Information	Information Practices
Stages of Change		
Transtheoretical model	Receipt of information raises awareness of need for change. Various types of information weighed when contemplating change. Use of information in implementing change behaviours.	Communicating Seeking and encountering Assessing and sensemaking Blunting Monitoring Tailoring

Precaution-adoption process model	See Transtheoretical model; also information memory/storage in precontemplation phase, recall and processing in contemplation phase, and increased emphasis on assessing information when choosing whether or not to make change.	Accessing Communicating and receiving Tailoring Processing Assessing
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Value-Expectancy

Theory of reasoned action & Theory of planned behavior	Beliefs and attitudes develop over time as a result of receiving, assessing and integrating information.	Communicating and receiving information, including subjective/community norms Using internal/intrinsic information
Health belief model	See Theory of reasoned action; also new information received and assessed as valuable can act as a “cue to action,” inspiring behavior change.	Using internal/intrinsic information Communicating Receiving Assessing
Information-motivation-behavioral skills/strategy model	Receiving, processing, remembering, and being able to apply information can provide basis for knowledge/skills, as well as necessary motivation, for health behaviors.	Receiving Processing Remembering and recalling Appropriately using information in context

Other

Diffusion of innovations	Receiving information, processing it and assessing it as valuable, applying it to make change. Communicating to others helps spread the idea throughout the community.	Communicating (mass and interpersonal) Receiving Processing Assessing
Social cognitive theory/ Social learning theory	Acquisition of information helps build knowledge, which is precondition for change, as well as beliefs including self-efficacy.	Acquiring Using internal/intrinsic information Communicating social norms
Ecological model(s)	Various	Unspecified communicating among systems levels, including the information environment

Stress and Coping Theories

In addition to the dominant models of public health behavior reviewed in this scoping exercise, health information science researchers have incorporated theory from medical sociology and psychology that overlaps substantially with health behavior change models. As with the major models of health behavior, LIS research has begun to clarify information concepts within theories of social support and coping.

Social support as a determinant of or contributor to health outcomes has been a topic of interest within sociology and psychology for decades. Social support has come to include informational support by those in one's social circle as well as other types of caregiving (Cohen & Leonard, 1985; Schaefer, Coyne, & Lazarus, 1981). Health information science literature has, in recent years, taken up specific research questions related to the assistance, potential hindrance, and functioning of social support networks both online (Godbold, 2012; Yan Zhang, He, & Sang, 2013) and off (Veinot, Kim, & Meadowbrooke, 2011). Much of this work has focused on chronic illness communities.

Within health psychology and the psychiatric literature, coping with the stress of change and illness has long been a topic of interest, with information seeking, suppression and blunting, and sharing identified as adaptive coping techniques (Hamburg & Adams, 1967; Skinner, Edge, Altman, & Sherwood, 2003). The most influential model of human coping response to health-related stress is the Transactional Model of Stress and Coping (Glanz, Rimer, & Viswanath, 2008, pp. 213–219; Lazarus & Cohen, 1977), a model that has been extended at times to include information seeking. Health information science literature has begun to build on such coping theory to investigate and theorize information activities and practices—such as seeking and

avoiding information, and information network development—among people in positions of medical uncertainty (Rubenstein, 2008) or facing chronic illness (St Jean, 2012; Veinot, 2010).

Discussion

Information practices are commonly included and/or implied in core health behavior models. Such models typically frame information as a resource, with which people “do things” such as seek, receive, or share. Within the field of health behavior, there appears to be a lack of common language around information-related concepts and practices. Information is a near-ubiquitous “thing” acknowledged to influence health behavior, but it is often unclear what exactly we are talking about, when we talk about information.

The portrayal of the role of information within health behavior models raises some concerns. One is the common conflation of the words “information” and “knowledge.” There has been much discussion within information science regarding not only the definition of “information” but the distinction between this and “knowledge.” While some (c.f. Buckland, 1991) have discussed the use of the term information to represent knowledge, it is commonly accepted that while information may attempt to *represent* knowledge (e.g., in writing) (McCreadie & Rice, 1999), there are multiple information practices and processes at work in *creating* knowledge—and even more so in developing an identity as knowledgeable. The dominant interdisciplinary model of this is the variously-attributed data-information-knowledge-wisdom hierarchy (Ackhoff, 1989). The core health behavior models, however, appear to frequently treat these terms as if they were interchangeable concepts; as if receiving or possessing information renders an individual knowledgeable.

A second issue is the frequent decontextualization of information; the idea that information just exists, and acts the same within individuals or social groups no matter how the information

is acquired. The lack of examination of communication processes within some health behavior models is potentially problematic, as there are multiple ways of communicating, all of which carry connotations and evoke responses beyond merely delivering information, and do not influence people the same way. Within both information science and health behavior, increasing attention has been paid to the importance of social context as a critical influence on behavior, and this should be extended to examining the role of context in health-related information practices.

Unpacking the Relationships Between Health Behavior and Information Practices

Collaborative, interdisciplinary research groups spanning health and information science have begun to investigate the relationships between information practices and health behaviors, using and expanding models that contain clearly-articulated information constructs.

Hirvonen and colleagues (2012), for example, augmented the TTM with health information behavior measures, finding correlations between particular “stages of change” and various self-reported information behaviors such as avoidance, recognition of needs, scanning and actively seeking information. Meadowbrooke et al (2014) generated an expanded TPB model for predicting health behavior intentions, which incorporated self-reported knowledge and three health information behaviors, substantially increasing the model’s predictive accuracy compared with the non-adapted TPB.

A chapter in the reference text *Theories of Information Behavior* (K. E. Fisher et al., 2005) asserts that the information practice elements to the TTM are so strong that the model may be viewed as essentially a theory of health information interventions (Wathen & Harris, 2005). The authors highlight some theory-based information practices that may complement the TTM, including sense-making (Dervin, 1992), blunting, monitoring, and information tailoring. While

the concepts of monitoring and blunting styles of information seeking/avoidance (Ek & Heinström, 2011; Miller, 1987), as well as health communication tailoring have seen uptake within both information science (Cortese & Lustria, 2012) and health science (Kreuter, Oswald, Bull, & Clark, 2000), some other information practice concepts have not yet been well integrated into the theory and practice of health behavior.

Ecological and “ecosystem” models have their own history within LIS research, stretching far beyond health topics (Greyson, 2012). Along with the shift toward user-centred studies of information behavior and practices, context has been an increasingly important element of LIS research, and ecological models have been one way scholars have approached the integration of context as an element beyond a simple “container” (Courtright, 2007) or backdrop for information activities. Some of this work builds on Bronfenbrenner’s Ecological Systems Theory (Williamson & McGregor, 2006; Williamson, 1998), applying ecological behavioral models to information research, while some—including Ecological Interface Design within Cognitive Work Analysis—also draws inspiration from earlier “ecological psychology” (Fidel, 2006, 2012; Given, 2007; Sadler & Given, 2007). Yet other information research uses “ecology” to create analogies to biological environmental settings and ecosystems (Nardi & O’Day, 1999). Although multi-level process models are beginning to emerge, which may incorporate attributes of stages of change, value-expectancy, and ecological modelling (Veinot, 2010), we have yet to see LIS take full advantage of ecological models to inform successful interventions for behavioral change, the way public health does. There is great potential for further experimentation along these lines.

Why focus on information practice elements of health behavior?

So what? Why is it important to explore and further theorize the role of information practices in health behavior? And, to flip the question, why might it be useful to information scientists to draw on health behavior models when working with and beyond health information issues? Closing the gap between our understanding of information practices in context and knowledge of health behavior processes has the potential to benefit both disciplines.

Lessons for Public Health from Information Science

Communication of health information is commonly used, in public health as well as clinical settings, as a tool to inspire and support health behavior change. The success of such interventions is commonly assessed by correlating information campaigns with the desired health behavior change. Surveillance programs in public health are typically assumed to be relatively invisible to the public, assessed primarily on their utility to disease monitoring and research. However, a richer understanding of the ways information does and does not influence health behavior can lead us to improved effectiveness of health information interventions.

For example, a jurisdiction may have a public health program that provides nurse home visits to postpartum mothers. The program is intended to provide personalized information support and referral to “high risk” parents, as well as to screen for problems such as post-partum depression, baby failure to thrive, and domestic abuse. While the program may increase referrals to support services, and many recipients of home visits may report feeling reassured by such visits, some mothers may conversely report feeling “spied upon” and “lectured” by a “bossy stranger.” Understanding what factors—both maternal and on the part of the health information interventions themselves—influence the perceived credibility, usefulness, and trustworthiness of the home visitors can help refine the program.

Another region may run an advertising campaign against alcohol consumption in pregnancy. Advertisements on television and public transit are accompanied by brochures in clinics, and restaurant outreach including education of wait staff and stickers in ladies' restrooms warning about the dangers of drinking in pregnancy. Although this information campaign is multi-level and widely disseminated, it may fail to be associated with any change in pregnant women's self-reported drinking choices or with any changes in rates of fetal alcohol syndrome. In order to understand, we must investigate the target audience's experiences with this encountered information, including the way population members assess the information's usefulness and credibility, sense-make within the context of existing beliefs and knowledge, and apply this information in their individual contexts. While both of these examples may have been designed with strong theoretical grounding in health behavior models, inquiry into the nature and role of information practices within health behavior change could improve the success of future public health information interventions.

It must also be noted that information practices—even “positive” practices such as seeking, use and sharing (as opposed to avoidant or deceptive practices)—may at times lead to individuals and groups choosing *not* to follow the medical advice of practitioners or public health agents. Engaged, self-efficacious, “activated” patients are associated with better health outcomes and care experiences (Hibbard & Greene, 2013), and information practices—such as access, seeing, and use—are often part of the description or definition of engagement/activation in health care (Hibbard, Stockard, Mahoney, & Tusler, 2004). The models of health behavior change most prominent in the public health canon today reflect this general attitude that information is helpful in motivating and supporting positive health behavior; however this is not always the case.

A clinical example of this might be patients' own modification of their medication dosing or schedules, in order to minimize adverse effects, accommodate atypical life schedules, or otherwise acting as an autonomous individual resisting blanket medical advice (Wolf & Veinot, 2014). In public health, parental compliance with routine childhood immunizations is one area in which a better understanding of the role of information practices in health behavior could be key. Research has correlated online information seeking with lower perceptions of vaccine safety and effectiveness and increased opting-out of one or more routine vaccinations (Jones et al., 2012). Although it is believed that online information sharing may be important in shaping parental decisions about childhood immunizations, efforts to evaluate the effectiveness of various pro-vaccination internet-based public health messages have found it challenging to identify any information interventions that increase parental intent to vaccinate (Nyhan, Reifler, Richey, & Freed, 2014). This may therefore be an example of counter-intuitive public health behavioral outcomes related to information practices, and requires further study.

Lessons for LIS from Public Health Behavior Models and Approaches

It is clear that LIS has much to offer scientific understanding of health behavior, in ways that might improve public health practice and the health of individuals and populations. However, health behavior change models could also help advance thinking about major concepts in information science. With regard to information need, for example, health behavior models raise the question of when a deficit is a need. Is a deficit a need only when an individual is troubled by it (as commonly used in LIS literature)? Is it a need when an expert recognizes that filling that need could improve the individual's life? Or is lack of information under either of those circumstances only a need if the individual is ready to receive and use such information? The precontemplation phase within Stages of Change models is heavily related to the state of

“incognizance” as described by St. Jean (2012), in which a person has not yet gained awareness of an existing information need, and therefore of limited ability to engage in information practices to meet that need. However, St. Jean observed incognizance across multiple stages, indicating that experiencing and overcoming incognizance may be a more complex and iterative process than a simple accumulation of information as a resource or catalyst to support change.

In terms of information use—a concept not yet well plumbed in LIS—looking at information’s role within process and predictive behavioral models may help clarify certain ways people use information in the context of their lives. Regarding context itself, while public health may not have the concept completely figured out, several health behavior models, including predictive models and ecological models, are more advanced than most LIS models in terms of identifying (and sometimes quantifying) specific aspects of environment, setting, and socio-cultural factors that impact outcomes. Information science can learn from this as we continue to clarify the importance of various contextual elements in information needs, seeking, sharing, and use.

Furthermore, public health’s use of behavioral models to inform an interventionist approach with information may inform and challenge information science. Behavioral research in information science tends to concentrate on the user side, particularly self-identified needs and seeking. Health behavior, on the other hand, tends to focus on communications to individuals and populations, whose needs are often perceived by others more than themselves. Related to this interventionist perspective, public health as a discipline is highly concerned with policy-making, whereas information behavior and practices research has rarely sought to extend findings to explicitly influence public policy. By exploring health behavior models from an information perspective, and applying interdisciplinary behavioral models such as ecological

systems theory, information scientists might also adopt a multi-level approach to issues ranging from student plagiarism to accurate assessment of online health information, working with individuals and small groups to change information practices, with communities to collectively address information issues, and higher-level institutions such as governments to facilitate desired public information behaviors and de-incentivize negative ones.

Future Work in this Area

There is much potential for further development of the knowledge base related to the interplay of information practices and health behavior. Firstly, in order to gain a more in-depth understanding of current understandings and use of “information” within empirical research and practice within health and healthcare, researchers might undertake full systematic reviews of specific questions focused on high-priority health topics (e.g., cardiac care, childhood immunizations), given information practices (such as patient information seeking or mass media public health communications), or limited by health discipline (e.g., public health nursing). Such studies could add to, and expand upon the findings of, the current scoping review, possibly indicating more detailed suggestions for information science research and transdisciplinary researcher collaboration.

Second, while we have discussed select outstanding examples of health information scientists working to test, refine, and improve models of public health behavior, there remains much work to be done in this arena. A particularly salient area within this stream of research is the question of when and how information practices may actually act to diminish health. Both quantitative research (e.g., for predictive modelling and understanding stage-of-change correlation) and qualitative research (e.g., generating phenomenological and ethnographic knowledge regarding sub-populations and deviations to expected health behavior change

pathways) are necessary in this endeavor, and it seems likely that the richest work will emerge out of collaborations between information scientists and health researchers.

Conclusion

Information is framed as an instigating or foundational element in many core models of health behavior change. Information interventions, often guided by such models, are a mainstay of public health practice. However, our understanding of the information practices involved—in other words *how* information works (or does not work) within the contexts of people's real lives to impact health behavior—is quite limited. This limited understanding hinders our ability to effectively use information to intervene in the health behavior of individuals and populations.

A lack of critical examination of the multitude of information practices within health behavior models may lead to lack of full comprehension of the potential of a given information intervention. Peeking into the black box of “information” within health behavior models, and asking how people truly engage with health information, may lead to an improved understanding of causal mechanisms for health behavior. Borrowing from information practice research and theory, and pursuing further research by interdisciplinary teams spanning information science and public health, can lead us to a better science of health promotion. Unpacking and more deeply investigating information-related constructs and activities within health behavior change processes can aid us in improving effectiveness of public health information interventions, ultimately strengthening our ability to use information to improve health.

Information science also stands to benefit from such interdisciplinary work. Health behavior models help advance thinking about major concepts, such as needs, use, and context, in information science. Additionally, behavioural researchers in information science could learn

from public health's interventionist approach, leading to greater impact of information research within and beyond health.

Footnote:

¹ While there is an active debate within both public health and information science regarding what is a model versus a theory, for the purposes of this paper the terms are used interchangeably in order to focus on content of the models/theories of interest.

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