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The undersigned, approved by the Doctoral Dissertation Committee, have examined the dissertation entitled

**PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN:  
THE PHYSICIANS' ROLE IN FACILITATING CONSUMERS' DIGITAL HEALTH  
INFORMATION SEEKING**

presented by Andrew J. Dahl

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PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN:  
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INFORMATION SEEKING

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By

ANDREW J. DAHL

Dr. Jimmy Peltier, Dissertation Chair

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PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN:  
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ABSTRACT

Health marketers and policymakers have routinely called for more consumer accountability in health care decisions and patient-health provider shared decision-making (SDM). Despite this plea, marketing efforts designed to engage consumers and physicians in health co-creation via patient-provider SDM are ineffective. Digital media's increased availability offers new opportunities for jointly creating and disseminating valuable health information, which in turn can improve health decision-making, motivate health behavior changes, and enhance health outcomes. However, there is a lack of research empirically investigating the health value co-created through patients' digital health information seeking. Additionally, research is needed which examines the health provider's value-facilitating role and other prerequisite conditions for facilitating consumers' digital health information use.

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This dissertation fills this gap by examining the role of consumers' digital health information seeking in developing co-created health value as part of a jointly created patient-provider SDM-environment. Specifically, this study explores (a) the different prerequisite conditions to consumers' health provider-related versus external digital health information seeking, (b) the direct and indirect effects leading to consumers' external digital health information seeking, and (c) the co-created health consequences in the context of motivating personal health behavior changes and health outcomes. Multivariate regression and structural equation models (SEM) provide analyses of door-to-door survey results from over 300 health consumers demonstrating the ancillary value to the health provider-patient relationship created via encouraging consumers' digital health information seeking as part of patient-provider SDM.

Combined, the results provide implications for the marketing, consumer behavior, and health literature regarding consumers' and physicians' health value co-creation roles. The empirical results outline the precursors to motivating digital health information seeking and prerequisite conditions to generating improved health outcomes. First, health providers must have an SDM-orientation, while consumers must also feel shared responsibility for their health decisions and outcomes. Additionally, both parties must equally value digital health information inputs as part of the behavior change process. The results suggest health providers who encourage patients to utilize digital health information strengthen the impact of a collaborative decision-making environment through value facilitation. In particular, marketing efforts directing patients from provider-related to external digital information sources are likely to facilitate greater patient activation in behavior changes leading to better overall health. Finally, this study provides marketing and policy implications for improving health decision-making, health behaviors, and health outcomes via digital-based marketing efforts.



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Policymakers and health researchers have long touted the value of shared decision-making (SDM) between physicians and their patients. SDM reflects a collaborative decision-making process involving two-way communication between the physician and patient to jointly determine the best course of action given evidence-based interventions (Stiggelbout, Pieterse, & De Haes, 2015). SDM requires both patients and physicians to express preferences and share relevant concerns, information, and questions (Politi, Dizon, Frosch, Kuzemchak, & Stiggelbout, 2013). Delivering patient-centered care is a core element of SDM and includes determining what matters most to the patient, presenting relevant options and information for improving the patients' health, and empowering the patient in the decision-making process (Makoul & Clayman, 2006). Research shows SDM involving patients and their health providers improves treatment decisions, enhances quality of care, and lowers health care costs (Grande, Faber, Durand, Thompson, & Elwyn, 2014). Research also indicates patient-provider SDM increases patients' self-efficacy for navigating the health care system (O'Hair et al., 2003), improves health outcomes and well-being (Street, Makoul, Arora, & Epstein, 2009), and increases satisfaction with the quality of care (Katz & Hawley, 2013). As a result, researchers, policymakers, and health practitioners continue to search for ways to effectively engage consumers and physicians in SDM and increase patients' responsibility toward their health decisions, behaviors, and outcomes (Stiggelbout et al., 2015).

Physicians who support patients taking an active role in their health via SDM help patients enhance their health knowledge (Stacey et al., 2014), make better health decisions (Durand et al., 2014), and increase patient adherence to physicians' recommendations (Briss et al., 2004). Despite the need for increased consumer accountability and patient-provider SDM,



efforts to engage patients and physicians in SDM exhibit mixed effectiveness or are lacking altogether (Légaré & Witteman, 2013; Oshima Lee & Emanuel, 2013). In response, a growing literature stream suggests physicians' support for SDM may impact consumer engagement in numerous ways (Pollard, Bansback, & Bryan, 2015). First, physicians perform a central role facilitating consumers' health by encouraging patient participation in the decision-making process (Fraenkel & McGraw, 2007). Two important mechanisms physicians use to support patient engagement include identifying patients' treatment preferences (Levinson, Lesser, & Epstein, 2010), and inviting patients' informational input during the health care encounter (Epstein & Gramling, 2013). Conversely, physicians may discourage greater patient involvement in SDM due to misconceptions about patient interest and ability (Légaré, Ratté, Gravel, & Graham, 2008; Légaré & Thompson-Leduc, 2014; Légaré & Witteman, 2013), dismissing information patients share (Wald, Dube, & Anthony, 2007), or creating a sense that opinionated patients are difficult (Frosch, May, Rendle, Tietbohl, & Elwyn, 2012). Unfortunately, patients' health care experiences often fail to meet their preferences for collaborative decision-making (Chewning et al., 2012).

Research on value co-creation implies the patient-physician relationship must be conducive to maximize SDM's value for consumers' health outcomes (Grönroos & Ravald, 2011; Grönroos & Voima, 2013). Although important to the patient-provider relationship, research suggests many physicians have insufficient interest in actively engaging patients in care decisions (Gremigni, Casu, & Sommaruga, 2016), thereby minimizing the health provider's value facilitation role and limiting actual SDM between the patient and physician. Joseph-Williams, Elwyn, and Edwards (2014, p. 291) suggest health providers must acknowledge "it takes at least two to tango" in order to achieve more effective patient-provider SDM. Likewise,

patients must be willing to take an active role in their health decisions to maximize health value co-created with their physicians (Hibbard & Greene, 2013). Research is thus needed that examines the antecedents to co-created health behaviors and outcomes while considering both (a) the physicians' value-facilitating role via SDM-orientation and (b) the patients' desired involvement in health decisions (Hibbard & Greene, 2013; Joseph-Williams et al., 2014; Pollard et al., 2015).

Health reform efforts advocating for consumers' increased engagement as part of the patient-provider SDM process align with the service-dominant logic's (SDL) views on value co-creation (Vargo & Lusch, 2004, 2008). Under this theoretical lens, consumers have joint responsibility with their health providers for value creation across all stages of the health care service delivery process. Yi and Gong (2013) suggest customers exhibit value co-creation behaviors in a service context via information seeking, information sharing, responsible behavior, and the quality of the personal interaction with the service provider. Specific to a health care context, consumers may create added value by actively seeking relevant health information and social support, sharing relevant information to enhance diagnosis, taking responsibility by accepting and following directions during and after the service encounter, and building strong relationships with their health provider (Ba & Wang, 2013; Bell, Hu, Orrange, & Kravitz, 2011; Frosch & Elwyn, 2014). Patients who engage in these value creation behaviors through SDM may experience stronger health accountability, greater intentions toward health behavior changes, and enhanced service encounter perceptions (Glass et al., 2012). Consumers' engagement in knowledge acquisition, dissemination, and integration represents a critical function in the interactive value co-creation process (Lusch & Vargo, 2011). Therefore, a key component to health value co-creation beyond a patient-physician SDM-environment involves

the integration of relevant informational inputs from both the patient and physician (Grönroos & Ravald, 2011; Grönroos & Voima, 2013). In today's digital world, health consumers may turn to two digital sources for health information—*provider-related* (those produced or facilitated by the health provider's digital marketing efforts) and *external* sources (those produced or facilitated by sources other than the health provider). As a result, researchers, policymakers, and health practitioners continue to examine how to leverage new digital marketing resources for health communication purposes including knowledge acquisition and dissemination (Brouwer et al., 2011; Srivastava & Shainesh, 2015).

Unfortunately, health professionals have traditionally expressed skeptical views regarding digital health information's value, fearing consumers will make ill-advised health decisions due to unreliable or false information (Moorhead et al., 2013). However, recent data show consumers are increasing digital health information use (eMarketer, 2013b), including using digital health technologies to share information with health providers (Salesforce, 2016). Furthermore, consumers are increasingly integrating digital health technologies into their daily routine via mobile health applications and fitness trackers (eMarketer, 2015), leading to more informed and engaged health consumers. Beyond consumers' growing use of interactive digital health technologies, encouraging patients' digital health information seeking offers a number of health advantages. First, these emerging digital health platforms offer great potential for enhancing consumers' health literacy and health decision-making via timely communication of health information using limited resources (Adams, 2010; Thackeray, Neiger, & Keller, 2012). Second, increasing consumers' health information access via digital health resources may improve an individual's health literacy or capacity to acquire and comprehend health information (Parker & Ratzan, 2010). Subsequently, this leads to more informed decision-making, better

chronic condition management, improved health outcomes, and lower health care costs (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Sørensen et al., 2012). Recent research also highlights digital media's transformative role in the information-based power shift occurring across consumer contexts. The resulting digital power shift gives consumers more control and influence by reducing information asymmetry in the marketer-consumer dyad, thereby enhancing consumers' empowerment in decision-making (Labrecque, von dem Esche, Mathwick, Novak, & Hofacker, 2013). Consumers may thus feel more accountable for their health decisions, and follow through with behavior change when they actively integrate digital health information which is complementary to information shared during patient-provider interactions.

Despite digital media's growing use and promise, relatively little is known about what influence digital information sources have on consumers' decision-making processes and behaviors (Hautz, Füller, Hutter, & Thürndl, 2014; King, Racherla, & Bush, 2014). In particular, researchers know little about how integrating provider-related (i.e. the health provider's website and personal e-health records) and external (i.e. social media, digital videos, health blogs, forums, and mobile applications) digital health information sources impacts consumers' health decision-making. Moreover, researchers understand even less about what motivates consumers' usage of the different digital health information types and the resulting impact on health value creation. Laranjo et al.'s (2015) meta-analysis offers promising evidence of social media's potential impact on health behavior change, but also demonstrates digital media's effectiveness for motivating behavior change varies substantially and research explaining this inconsistent impact is necessary. Digital marketing's growing footprint encompasses a range of digital health resources, thereby requiring further exploration given patient safety and information credibility concerns across provider-related and external digital

health information sources (Moorhead et al., 2013; Pandey, Hasan, Dubey, & Sarangi, 2013). Furthermore, the evolving marketer-consumer dyad necessitates research examining the health provider's role in consumers' digital health information input evaluation processes. Specifically, health marketers and policymakers will benefit from research that increases understanding of the health provider's value facilitation role in forming consumers' perceptions and supporting consumers' utilization of digital health information. Research is also needed that explores how this joint digital health resource integration can enhance consumers' involvement in the decision-making process and ultimately change health behaviors. Therefore, the current study is designed to investigate the value-facilitating prerequisites to consumers' digital health information seeking and the resulting impact on consumers' decision-making and health outcomes via the value co-creation process.

The current study addresses the research gaps by examining the value added to consumers' health when consumers integrate provider-related and external digital health information sources in the patient-physician SDM-environment. Specifically, this study explores the value co-created via physicians' SDM-orientation and its interactive relationship with consumers' personal health accountability, and consumers' digital health information input value perceptions through the context of increased provider-related and external digital health information seeking. As such, this study strives to answer four research questions related to the value added to the patient-provider interaction given today's expanding digital health information environment. Five models were tested to answer the following research questions (RQ):

- RQ 1. What differential effects do the SDM elements of (1) physicians' SDM-orientation, (2) patients' health accountability, (3) physicians' digital influence, (4) digital information

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credibility, (5) digital information perceived usefulness, and (6) patients' health self-awareness have on consumers' provider-related and external digital information seeking? (Model 1)

RQ 2. What are the antecedents of facilitating and integrating consumers' external digital health information seeking in the health decision-making process? (Model 2)

RQ 3. What are the consequences of facilitating and integrating provider-related and external digital health information on consumers' health behavior changes? (Model 3)

RQ 4. What impact does provider-related and external digital information have on consumers' overall health? (Models 4 and 5)

The proposed health value co-creation framework draws on the foundational views of value co-creation originating from the SDL literature. The research tests five empirical models which encompass the SDM value-facilitating antecedents affecting consumers' digital health information seeking (provider-related and external sources) and the resulting consequences on consumers' health behaviors and overall health. The data show both the physician and patient need to agree that it is important to establish a collaborative relationship as part of the health decision-making environment. Therefore, the first prerequisite to facilitating health value co-creation is establishing a patient-physician relational culture conducive to SDM in which the health provider empowers patients and the patient assumes responsibility for health decision-making.

Second, assuming there is joint agreement on collaborative decision-making, the next precursor to health value co-creation requires mutual agreement on the value of integrating digital health information inputs. If both parties do not equally value the digital informational inputs in the decision-making process, collaborative decision-making will be less effective in co-

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creating health behavior changes and related positive health outcomes. Third, the co-creation framework suggests the extent to which consumers seek out and integrate different digital health information resources is dependent on jointly establishing the SDM-environment in conjunction with provider-patient agreement on the value assessment of digital health information inputs.

As part of this interrelationship, this study postulates that a co-created collaborative decision-making environment will enhance consumers' value perceptions of digital health information inputs (via credibility and perceived usefulness), thereby leading to greater digital health information integration. However, consistent with the value co-creation literature, the empirical models indicate the co-created SDM-environment produces differential effects on consumers' integration of (a) provider-related digital sources (i.e. the health provider's website and personal e-health records) in comparison to (b) external digital information sources (i.e. social media, digital videos, health blogs, and forums). Moreover, the evolving marketer-customer dyad suggests the ensuing information flow and consumers' health information seeking from provider-related to external digital health sources will have an additive effect on co-created health behavior changes. Consequently, the research implies health providers play a vital facilitating role in fully activating patients' SDM involvement and enhancing the health value created by encouraging and supporting patients' integration of external digital health information in their health decision-making. Subsequently, the enhanced patient activation is more likely to trigger healthier lifestyle choices and improvements in consumers' overall health. In combination, the process reflects the digital health value co-creation chain stemming from a shared view of collaboration and valuation of digital information inputs resulting in improved health decision-making.

### **Scope and Importance of the Study**

This study divides the proposed overarching health value co-creation framework into five empirical models for parsimony during data analysis. Data collected via a door-to-door health consumer survey covers consumer perceptual measures along with self-reported digital health information use and health behavior changes. Model 1 uses multivariate regression analysis to identify the differing effects of SDM factors on two types of consumers' digital health information seeking: (1) provider-related versus (2) external digital information sources. Model 2 uses AMOS to conduct structural equation model (SEM) path analysis examining the direct and indirect information flows that lead consumers to seek and integrate external digital health information. Specifically, Model 2 demonstrates the influential value-facilitating role health providers have on consumers' value perceptions of digital health information, which increases both provider-related and external digital health information seeking. Model 3 builds on Model 2 to analyze the subsequent impact integration of digital health resources has on health decision-making via the consumers' diet and exercise lifestyle changes. Of significance, Model 3 demonstrates the importance of facilitating consumers' external digital information seeking to achieve greater patient activation. Model 4 uses SEM path analysis to examine the ensuing value co-created on consumers' health outcomes through the combined effects of integrating provider-related and external digital health information sources to health behavior changes and consumers' overall health perceptions. Finally, Model 5 extends Model 4 to examine the joint impact of a collaborative orientation with consumers' digital health information seeking on health behavior changes and overall health perceptions.



### **Summary of Contributions to Theory & Practice**

In combination, this study contributes to the marketing, consumer behavior, and health literature and practice in multiple ways. First, this study addresses the marketing literature's request for additional transformative consumer research (Scammon et al., 2011; Sweeney, Danaher, & McColl-Kennedy, 2015) by enhancing understanding of the antecedents and consequences of consumers' digital health information integration in terms of consumers' health behavior changes and related health outcomes. Second, the results provide empirical support for value co-creation during the service delivery process when consumers use both provider-related and external digital health and wellness resources as part of a physician-facilitated SDM process. Consumers' increased participation in information creation and sharing via digital media has triggered a major shift in the balance of power for marketers and presents new challenges across diverse marketing contexts (Hennig-Thurau, Hofacker, & Bloching, 2013). Marketers must therefore adapt communication and other marketing strategies to address this power shift and support consumers' integration of marketer-produced and external resources in the value creation process (Grönroos & Ravald, 2011). Hence, the health value co-creation chain's theoretical implications may extend beyond health care to other marketing settings where consumers' increased access to digital information inputs enhances decision-making, motivates behavior changes, and ultimately influences value perceptions.

In terms of practical implications, this study provides insights on how marketers can improve the service delivery process to enhance consumers' decision-making and activate behavior changes via facilitating integration of digital information sources. Specific to health value creation, the results provide empirical support for health and social change marketers seeking to motivate positive behavior changes via digital health resources. In combination, this

study provides valuable insight to marketers, policymakers, and health providers on the growing importance of digital health communications for improving public health through motivating healthier lifestyle choices. Finally, the findings outline potential changes to improve health service delivery and enhance the patient-provider SDM process by facilitating consumers' utilization of both provider-related and external digital health information sources.

### **Organization of Dissertation**

The remainder of this dissertation uses the following structure. The Literature Review and Hypothesis Development chapter summarizes the relevant marketing literature with specific focus on the health provider's value-facilitating role for enabling consumers' digital health information integration in the health value co-creation chain via reconciliation of the SDL and SDM literature streams. This chapter also outlines the overarching research framework and hypothesized relationships for the four empirical research models. The Methods chapter describes the research methods including sample, measures, and data collection. Chapter four provides data analysis and findings from the five models. Finally, chapter five provides a summary discussion of the implications for theory and practice, limitations, and future research directions.

## **Literature Review and Hypothesis Development**

### **Chapter Introduction**

The SDL literature provides the foundational basis for value co-creation. Under this theoretical lens, consumers play a central role in co-creating value along with the service provider prior to, during, and after the service exchange (Vargo & Lusch, 2004, 2008). In other words, without the consumers' interactive participation in the service delivery process, marketers (hereafter referred to as service providers) merely propose value propositions through their

service offerings. Moreover, customers only experience complete value creation when they continue the value creation process through value-in-use (Grönroos, 2011). Importantly, as consumers engage in information search both prior to and following a service interaction, they become more informed and active participants in the value co-creation process (Grönroos & Voima, 2013).

### **Literature Review**

**Value co-creation and the principles of SDL.** Although the extant marketing literature recognizes that service providers and customers both experience value creation, the emerging perspective of value co-creation indicates value creation is best defined from the customer's viewpoint (Grönroos, 2011; Grönroos & Ravald, 2011; Grönroos & Voima, 2013). Following SDL, researchers commonly embrace customer value creation (hereafter referred to simply as value creation) to reflect a customer's evaluation of a process that makes the individual better off (Grönroos, 2008) or increases that person's well-being (Vargo, Maglio, & Akaka, 2008). The SDL literature represents an evolving perspective of services as the dominant aspect in all economic exchange including the consideration of physical goods as a transmittal of service (Vargo & Lusch, 2004). Fundamentally, SDL represents a paradigm shift within the marketing discipline where service—the application of knowledge, skills, and operant resources—mediates all value exchange between a customer and firm (Grönroos, 2011). Vargo and Lusch (2004) initially proposed eight foundational premises (FP's) of SDL and later revised the wording of the original premises while adding a ninth (Vargo & Lusch, 2006) and tenth proposition (Vargo & Lusch, 2008). Although not all ten FP's relate to value co-creation, Table 1 delineates the eight FP's as outlined by Vargo and Lusch that have implications for value co-creation in a preventative health and wellness context. FP2, "Indirect exchange masks the fundamental basis

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of exchange,” and FP5, “All economies are service economies,” do not have health value co-creation implications and are excluded from Table 1. Additionally, Table 1 identifies the constructs incorporated into the proposed health value co-creation framework and related models.

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Table 1

*Service Dominant-Logic's (SDL) Foundational Premises (FP's) and Proposed Value Co-Creation Implications for Patients' Health*

	<b>FP's Stated by Vargo &amp; Lusch<sup>a</sup></b>	<b>Value Co-Creation Implications</b>	<b>Health Value Co-Creation Implications</b>	<b>Related Constructs</b>
FP1	Service is the fundamental basis of exchange	Customers and service providers co-create value through the application and exchange of operant resources derived from both parties.	Patients experience health value co-creation when they integrate their health knowledge, external health information inputs, and the specialized skills or knowledge of their health providers.	Physicians' SDM-Orientation; Health Accountability; Health Self-Awareness; Provider-Related/ External Digital
FP3	Goods are a distribution mechanism for service provision	Physical goods contribute to value co-creation when consumers apply and gain knowledge during the consumption process.	Using health information technologies (i.e. smartphones, fitness trackers) as part of the exchange and application of health-related knowledge increases value co-creation.	Provider-Related/External Digital
FP4	Operant resources are the fundamental source of competitive advantage	Service providers gain competitive advantages by collaborating with customers to apply and share operant resources from both parties during value co-creation.	Patient-provider engagement in SDM and information exchange increases health value co-creation. Health providers who integrate more knowledge resources also may gain a competitive advantage via increased patient satisfaction or loyalty and lower costs via healthier patients.	Physicians' SDM-Orientation; Health Accountability; Health Self-Awareness; Physicians' Digital Influence; Provider-Related/External Digital
FP6	The customer is always a co-creator of value	The customer is at the center of value creation and value only occurs once the service is used.	The patient plays a central role in health value creation through their active involvement in the SDM process and healthy lifestyle choices or other health outcomes.	Physicians' SDM-Orientation; Health Accountability; Health Behavior Changes

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FP7	The enterprise cannot deliver value, but only offer value propositions	Without customer interaction and value-in-use, there is not complete value creation. Service providers facilitate value co-creation via the service's value propositions.	The health care service delivery process must involve collaborative efforts via the physicians' SDM-orientation and the patients' sense of responsibility, which leads them to take an active role in their health and facilitates resource integration.	Physicians' SDM-Orientation; Health Accountability; Physicians' Digital Influence; Digital Credibility; Digital Usefulness; Provider-Related/External Digital
FP8	A service-centered view is inherently customer oriented and relational	The customer is at the center of value creation and requires the service provider to adopt a customer-centric relationship orientation.	The health care service delivery process and provider-patient relationship will maximize value when it is patient-centered.	Physicians' SDM-Orientation; Health Accountability
FP9	All social and economic actors are resource integrators	Both service providers and consumers act as resource integrators. Providers facilitate and enable customers' value co-creation by identifying and incorporating appropriate resource inputs.	Health care providers help patients create health value by recommending and valuing informational inputs from a variety of provider-related and external digital sources.	Physicians' Digital Influence; Digital Credibility; Digital Usefulness; Provider-Related/External Digital
FP10	Value is always uniquely and phenomenologically determined by the beneficiary	The measurement of value (creation) must consider the customer's perspective and their context of use (value-in-use).	Patients ultimately define what value they receive to their health and only when they integrate and use various resource inputs available to them to improve their health and well-being.	Integration of Provider-Related/External Digital; Health Behavior Changes; Overall Health

<sup>a</sup> Updated wording of FP's taken from Vargo and Lusch (2008).

In combination, the underlying SDL premises have a number of important implications for value co-creation. First, Vargo and Lusch (2004) define service to involve the application or exchange of operant resources such as specialized skills and knowledge to create value (FP1). Accordingly, customers and service providers co-create value through the integration of information inputs available to either party (Grönroos & Ravald, 2011). Thus, one mechanism for enhancing health value co-creation occurs when patients integrate external information inputs in combination with health providers' applied skills and knowledge during the SDM process (McColl-Kennedy, Vargo, Dagger, Sweeney, & Kasteren, 2012).

Similarly, SDL suggests physical goods create value through consumers' application of knowledge, skill, or other inputs during the consumption process (FP3). Health information technology devices contribute to value co-creation efforts when the devices offer opportunities for information gathering and exchange between the consumer and service provider or other external sources (Nambisan, 2009). In particular, emerging digital-enabled technologies such as smartphones, mobile health applications, and fitness trackers may enhance the application of health information during the health value co-creation process (Gallant, Irizarry, Boone, & Kreps, 2011; Pandey et al., 2013).

FP4 concentrates on the firm's perspective of value creation. In line with FP1, the fourth premise suggests operant resources (i.e. knowledge and skills) are central mechanisms for value co-creation including establishing competitive advantages for firms applying more operant resources during the service process. Consequently, service providers who integrate more input resources during the service delivery process not only increase value created for consumers, but also stand to benefit from competitive differentiation (Vargo & Lusch, 2008). Health providers encouraging greater knowledge integration may increase patients' value co-creation and in turn

benefit the health care firm via enhanced patient satisfaction, increased patient loyalty, and lower health care costs (Cossio-Silva, Revilla-Camacho, Vega-Vazquez, & Palacios-Florencio, 2016).

In combination, FP1, FP3, and FP4 establish that integrating knowledge, skill, and other resources is central to co-creating value. However, these initial premises do not address consumers' or service providers' specific responsibilities in value co-creation.

More specific to value co-creation roles, FP6 states "the customer is always a co-creator of value" (Vargo & Lusch, 2004). SDL considers customers as collaborators with service providers and essential contributors to value creation, a drastic shift from the "goods-dominant" perspective of customers merely as targets for value distribution (Lusch, Vargo, & O'Brien, 2007). Grönroos and Ravald (2011) further suggested that customers are not just collaborators or value co-creators, but the primary value creators. This perspective aligns with FP7 which postulates value creation only occurs through a customer's value-in-use rather than any value proposition the service provider offers via service design (Frow et al., 2014; Grönroos, 2011). Similarly, FP8 indicates service providers must focus on impacting value co-creation via customer-service provider relationship interactions since SDL places the customer at the center of value creation (Vargo & Lusch, 2008). Under this evolving value creation perspective, the marketing discipline's central aim is to support customers' value creation processes. Consistent with FP9, customer-centric service providers help customers construct value when the provider facilitates customers' efforts to incorporate available (external) resources in combination with service provider-produced input resources (Grönroos & Ravald, 2011). Consequently, a customer is most likely to experience value maximization when (a) the individual possesses increased access to a variety of input resources and (b) the service provider supports the customer's efforts to apply those resources during personal interactions and throughout the



customer-provider relationship. Finally, FP10 indicates customers experience value creation through their unique perceptions of their well-being (Vargo et al., 2008), requiring service providers to measure value in terms of each customer's perspective. Accordingly, maximizing health value co-creation involves health providers' efforts to increase patient involvement via the patient-provider SDM process and requires the provider facilitate consumers' evaluation and integration of provider-related and external digital health resources (McColl-Kennedy et al., 2012; Sweeney et al., 2015).

Extending value co-creation theory, Grönroos and Ravald (2011) divided the customer value creation continuum into "open" and "closed" dimensions which reflect the importance of customer-provider interactions to achieve co-creation. Specifically, they proclaimed service providers can only directly and jointly impact value creation during the service provider-customer interactions (referred to as the open dimension or value co-creation). Meanwhile, the closed dimension of value creation occurs when the service provider is not present and thus only the customer creates value in that phase.

However, service providers can support customer value creation via value facilitation, which refers to the act of providing resources for customers to integrate throughout the value creation process (Grönroos & Ravald, 2011; Grönroos & Voima, 2013). Following these assertions, service providers' value-facilitating role may occur prior to the encounter via the service design process, during the co-creation interactions of SDM, and post-encounter via digital-enabled communications. While service providers contribute some prerequisite inputs for customer value creation, customers also contribute inputs by seeking external information and other resources to integrate throughout the value creation process (Grönroos & Voima, 2013; Sweeney et al., 2015). Together, the service provider and customer co-produce the resource

inputs that support customer value creation efforts. Overall, this vision of value creation and co-creation in customer-service provider relationships aligns with the FP's of the SDL, particularly FP's 6-10. In combination, these latter SDL principles establish the customer as the central value creator and the service provider as a value facilitator. Although there is growing interest, much of the extant SDL and value co-creation literature is theoretical in nature and research is necessary which empirically examines how digital resource integration impacts value co-creation and service providers' value-facilitating role (Bharti, Agrawal, & Sharma, 2015; Ranjan & Read, 2016).

**Value co-creation in health care.** Recent health care reform efforts emphasize the importance of increasing patient accountability and engagement in the health care service delivery process (Hibbard, Greene, Sacks, & Overton, 2015). Despite its relationship to consumer engagement, value co-creation has received little attention in the extant literature on patient engagement (Hardyman, Daunt, & Kitchener, 2015). The principles of patient accountability advocate for consumers to take greater ownership of the patient-provider relationship, care process, and their health and wellness behaviors (Hibbard & Greene, 2013). Accordingly, consumers contribute to the value co-creation process following the patient-provider interaction via dietary improvements, increased physical activity, treatment adherence, elimination of negative health behaviors, and maintenance of positive behavioral changes (Frosch & Elwyn, 2014). Additionally, patients contribute to health value creation prior to (co-production of inputs) and during the service exchange (co-creation) via active participation in seeking and sharing health information inputs with their health providers (Ledford, Cafferty, & Russell, 2015). In combination, this joint integration of input resources from both the health providers' and customers' perspectives is likely to enhance health value creation (Grönroos &

Voima, 2013). Of particular interest in a health care context is how consumers' integration of digital health information technologies as resource inputs might also extend the open phase of the patient-provider relationship to increase the health provider's direct value co-creation influence (Grönroos & Ravald, 2011). However, research shows substantial variation exists in patient-provider relationships and each party's valuation of digital input resources, which are likely to constrain the value co-created in terms of consumers' health behaviors and outcomes initiating from SDM (Gallan, Jarvis, Brown, & Bitner, 2013; Makarem, Smith, Mudambi, & Hunt, 2014).

**Health co-creation via SDM.** SDM's foundational basis is consistent with the value co-creation perspective requiring collaborative decision-making efforts by both the consumer and the health provider (Stiggelbout et al., 2015). Although similarities exist, the SDL and SDM streams offer contradictory insights on the responsibilities of health providers and health consumers in health value co-creation that require closer examination. Fundamentally, both SDL and SDM acknowledge the importance of health provider-patient collaboration in enhancing consumers' health decision-making and creating health value. Despite recognizing the importance of a collaborative patient-provider relationship, the SDM literature argues health providers may perform a more influential role in health value co-creation (Katz & Hawley, 2013). In part, this view reflects the level of information asymmetry that puts patients at a disadvantage in terms of health-related information and decision-making (Kareklas, Muehling, & Weber, 2015) and sustains the traditional paternalistic service delivery model. Conversely, the foundational premises of SDL indicate value creation revolves around the patient (Grönroos, 2011), and a significant portion of the health value creation chain occurs external to the patient-physician interaction (Grönroos & Voima, 2013).

A key element of health value co-creation as part of the patient-provider SDM process involves both parties contributing resource inputs and physicians supporting consumers' external resource integration (Grönroos & Ravald, 2011). Similarly, research shows the SDM process is more effective when both parties exchange preferences, concerns, information, and questions (Politi et al., 2013). Despite mounting evidence of SDM's benefits across populations including disadvantaged, low health literacy patients (Durand et al., 2014), physician implementation and patient engagement in SDM continues to be lacking (Fowler, Gerstein, & Barry, 2013; Gallan et al., 2013). Likewise, research indicates patients routinely fail to modify diets, increase physical activity, or pursue a host of other physician-recommended pro-health lifestyle choices limiting SDM's effectiveness for health value co-creation (Hibbard & Greene, 2013; Makarem et al., 2014).

SDM's low adoption and the contradictory findings on its effectiveness reflect existing barriers at the consumer and health provider levels. First, preferences for decision-making involvement not only differ between consumers, but might also change based on decisional complexity which can vary from preventative health and wellness to emergency health care contexts (Livaudais, Franco, Fei, & Bickell, 2013). Motivated by health marketers' growing interest in health improvements via preventative efforts (Remington & Booske, 2011; Remington, Catlin, & Gennuso, 2015), the current study concentrates on patient-provider SDM in a preventative health and wellness context. Second, patients fear being labeled as difficult if they ask questions, provide informational input, or share preferences in their health decision-making (Frosch et al., 2012). Unfortunately, much of the research to date focuses heavily on patient characteristics such as age, education, and health literacy which do not sufficiently explain an individual's desire for SDM involvement (Benbassat, Pilpel, & Tidhar, 1998;

Chewning et al., 2012) and contribute to common misconceptions among health providers (Légaré & Thompson-Leduc, 2014). To-date, relatively little attention is given to patients' desire to engage in SDM (Frosch et al., 2012), and research exploring patients' SDM perspectives is needed. Moreover, research is lacking that empirically examines how patients' active involvement in SDM with their physician impacts patients' health behaviors and other health outcomes (Clayman, Bylund, Chewning, & Makoul, 2016).

In comparison, research on health providers' SDM perspectives is more mature. Barriers such as increased workloads, limited time during the patient-provider interaction, perceived higher implementation costs, along with misconceptions about consumers' interest or ability hinder SDM's adoption and implementation (Légaré et al., 2008; Légaré & Thompson-Leduc, 2014; Légaré & Witteman, 2013). Research also indicates many health providers possess a perceptions-reality gap in terms of whether they actually practice SDM (Stiggelbout et al., 2012), suggesting future research should consider physicians' SDM-orientation from the consumers' perspective in combination with patients' desired involvement in their health decision-making (Katz & Hawley, 2013). Thus, more research is necessary to determine the interactive value co-creation effects on health behaviors and other health outcomes facilitated by physicians' SDM-orientation and patients' desired role in collaborative health decision-making (Clayman et al., 2016). Table 2 highlights key similarities and differences between SDL and SDM perspectives on value co-creation that informed the model development.

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Table 2

*Summary of Similarities and Differences Between Service-Dominant Logic (SDL) and Shared Decision-Making (SDM)*

Attribute	Similarities	SDL Perspective	SDM Perspective	Implication
Health Value Co-Creation	Patient-provider collaborative decision-making is important to health value and health behavior change.	Health (value) is defined from the customer perspective.	Health (value) is co-created by the health provider and patient.	Both recognize importance of collaborative decision-making, but it is less clear whether patient (via health accountability) or provider (via physicians' SDM-orientation) has the more influential role on health value co-creation.
Resource Integration	Integrating information in the decision-making process is important to health value co-creation.	Resource integration adds more value when it consists of both provider-related digital and external digital sources used by patient.	Provider-related digital information inputs add more value.	Conflicts may exist in terms of physicians' support of integrating different digital health resources.
Valuation of Information Inputs	Health providers facilitate value by supporting patients' integration of digital health resources.	Service providers create more value by supporting both provider-related and external sources. Hence, physicians' digital influence should affect the valuation (credibility and usefulness) and integration of both provider-related and external digital equally.	Health providers consider provider-related health information more credible and valuable. Physicians' digital influence may affect the valuation and integration of provider-related and external digital differently.	How physicians facilitate consumers' valuation of provider-related and external digital resources is important to explore.

**Health co-creation via digital health information seeking.** Resource integration represents a vital element in the customer value creation process during which the service provider helps facilitate and support the use of informational inputs and other resources (Grönroos, 2008; Grönroos & Ravald, 2011). Although both SDL and SDM consider informational inputs imperative to the health value co-creation process, the two appear to differ in the types of valued resources. SDM commonly focuses on integrating evidence-based decision aids and information from provider-approved sources (Friedberg, Van Busum, Wexler, Bowen, & Schneider, 2013), while SDL considers resource integration from a broader perspective and across various informational inputs supplied by the service provider (i.e. health provider-related) and external sources (McColl-Kennedy et al., 2012). Hence, consumers' digital health information seeking across both provider-related and external digital sources represents an important form of resource integration requiring health providers' support to incorporate these informational resources into the patient-provider SDM process (Sweeney et al., 2015). Correspondingly, consumers' digital health information seeking may extend the value co-creation window beyond the patient-provider encounter and give the health provider more direct influence on patients' health value co-creation (Grönroos & Voima, 2013).

The health communication literature defines health information seeking behavior as an individual's active efforts to obtain specific health information from both mediated and interpersonal sources (Niederdeppe et al., 2007, p. 155). Consumers actively engaged in health information seeking increase their access to operant resources, improve their health literacy, and make more informed decisions with their health provider (Ledford et al., 2015). While research shows a narrowing divide in terms of consumers' digital health information seeking (Lustria, Smith, & Hinnant, 2011), the extant health information seeking literature reveals younger, highly

educated, Caucasian, and female consumers are more likely to seek digital health information (Dobransky & Hargittai, 2012; Feng & Xie, 2015; Kim, 2015). Nevertheless, a major shortcoming of the extant studies is the failure to address health information seeking differences across age groups (Tennant et al., 2015), or the presence of chronic conditions (Anker, Reinhart, & Feeley, 2011; Minsun, Kelly, & Hornik, 2006), or to consider non-demographic, psychosocial factors (Y. Chen & Feeley, 2014). Additionally, there is a lack of research attention on consumers' integration of specific digital health resources such as social networking sites, mobile health applications, or fitness trackers with many studies exploring digital health information seeking from a more universal perspective (Pandey et al., 2013; Shahab, Brown, Gardner, & Smith, 2014). Even less is known about consumers' utilization of provider-related versus external digital sources and how SDM elements in the patient-provider health co-creation chain impact health consumers' digital health information use (Sommerhalder, Abraham, Zufferey, Barth, & Abel, 2009). Research is needed to explore other psychosocial factors that might influence digital health information seeking such as physicians' SDM-orientation, personal health accountability, health self-awareness, and perceptions of the value of digital health information inputs.

**Health co-creation and value perceptions of digital health information inputs.** The SDL indicates facilitating customers' knowledge acquisition and integration are central to the value co-creation process (Lusch & Vargo, 2011). Information processing theory indicates consumers' digital health information integration will depend on perceived information diagnosticity, signifying consumers' assessment of the information's usefulness, quality, and helpfulness in making an informed decision (Jiang & Benbasat, 2004; Qiu, Pang, & Lim, 2012). Research demonstrates health providers facilitate consumers' efforts in integrating digital



information resources into the SDM process (Sweeney et al., 2015). SDL suggests consumer-service provider agreement about the value of information inputs is important (Grönroos & Ravald, 2011; Grönroos & Voima, 2013). However, patients and health providers are likely to place different value on provider-related and external digital health resources (Sommerhalder et al., 2009). Additionally, the patients' decision context (Payne, Bettman, & Johnson, 1993), prior knowledge and experience (Bettman & Park, 1980), information presentation format (Hibbard & Peters, 2003; Winterbottom, Bekker, Conner, & Mooney, 2008), and source credibility (Pescher, Reichhart, & Spann, 2014; N. Xiao, Sharman, Rao, & Upadhyaya, 2014) may impact consumers' judgments of digital health information's value. In particular, health providers are likely to facilitate consumers' value perceptions of digital health information by encouraging patients to seek out specific information and involving the patient in the SDM process (Antheunis, Tates, & Nieboer, 2013). Despite this, little is known about how health providers facilitate consumers' digital information value perceptions across provider-related or external information sources or the resulting impact on consumers' integration into the SDM process (McColl-Kennedy et al., 2012; Sweeney et al., 2015). Consequently, research is necessary that further examines the prerequisite conditions for facilitating consumers' efforts in integrating both provider-related and external digital resources and the consequences on health value co-creation.

**Health co-creation and the digital power shift.** Health decision-making's complexity often leaves patients at a knowledge disadvantage when it comes to participating in SDM or when assessing the quality of care after the service encounter (Berry & Bendapudi, 2007). Likewise, the traditional paternalistic health model creates potential patient-provider information asymmetry in the SDM process (Eysenbach & Jadad, 2001; Fowler et al., 2013). Consumers' increased use of digital health information necessitates a transformational shift from the

prevailing view of the health provider as the only medical authority (Wald et al., 2007) to one where the health provider is a digital information hub (Baird & Nowak, 2015). Similar to shifts across many marketing contexts, consumers' increased access and use of digital media for health information has the potential to shape their behavior and transfer the balance of power from marketers and health providers to consumers (Hennig-Thurau et al., 2013). Labrecque et al. (2013) insinuated part of the power transfer occurs when consumers reduce information asymmetry by actively consuming and producing digital information.

Of particular interest to health marketers, consumers progressively place greater trust in information about products and services originating from user-generated sources as part of the digital information-based power shift in non-health contexts (Meuter, McCabe, & Curran, 2013). Additionally, consumers have greater access to information which can inform their decision-making process and value perceptions prior to marketer and service provider interactions (Labrecque et al., 2013). Health marketers must continually seek ways to increase the effectiveness of patient-provider interactions as part of the service design process in light of this digital-enabled power shift toward a more patient-centered information exchange. The pervasiveness of the digital information power shift aligns with the continued need to move away from provider-centered care models toward actively involving and empowering patients via collaborative health decision-making. Likewise, the SDL principles suggest an individual consumer may enhance value creation through greater access to and integration of operant resources (Grönroos & Ravald, 2011), which in the current context includes increased utilization of digital health information and new digital-enabled devices such as health applications or fitness trackers. SDL also implies that patients' integration of external health information sources contributes to consumers' value co-creation efforts beyond value generated merely from

provider-related inputs. Although isolated, research exploring the antecedents and consequences of digital-enabled consumer decision-making is beginning to surface in the marketing literature (Yadav & Pavlou, 2014). Correspondingly, marketers and health providers will benefit from more research in the health decision-making context investigating the information-based power shift including the value added when consumers integrate provider-related and external digital health information sources.

**Health co-creation and health behaviors and outcomes.** SDL's theoretical perspective of value co-creation is especially relevant to the health care context as patients take greater ownership of the healthy lifestyle choices they pursue (Hibbard et al., 2015). Evidence indicates patients' SDM participation can positively impact behavior change and patients' physical and emotional well-being (Gallan et al., 2013). Yet, research shows patients inconsistently follow physician recommendations or engage in positive health behavior change, and thus are likely to experience considerable variation in terms of co-created health behaviors and well-being (Hibbard & Greene, 2013; Makarem et al., 2014). As a result, the success of health care reform initiatives demanding increased patient accountability is likely to be contingent upon transforming the health care delivery process to encourage greater consumer effort in value co-creation (L. Anderson & Ostrom, 2015; Sweeney et al., 2015). Consistent with SDL and value co-creation, consumers are central to defining health value co-creation when they feel the SDM and resulting behavior change process enhances their well-being (Grönroos, 2008; Vargo et al., 2008).

**Summary of literature review.** The preceding discussion outlines the potential for enhancing health value co-creation originating from a patient-provider SDM-environment via increasing consumers' digital health resource integration (Friedberg et al., 2013). Notably,

consumers' health value creation requires continuous decision-making outside the patient-provider interaction as individuals contemplate adherence or pursuit of healthy lifestyle choices (J. O. Prochaska, 2008). Consequently, health providers must increasingly seek ways to facilitate patients' health value co-creation efforts outside of the patients' office visits when considering preventative health and wellness (Sweeney et al., 2015). Consistent with SDL's foundational premises, health providers primarily act as *value facilitators* through efforts supporting patients' resource integration and decision-making (Grönroos & Ravald, 2011). Health providers facilitate value co-creation by engaging patients in their health decisions and supporting integration of relevant informational inputs across both provider-related and external digital resources. Subsequently, patients will realize health value co-creation when digital health resource integration leads them to engage in healthier lifestyle choices and affects their overall health and well-being. As summarized in Table 1, the SDL literature identifies six constructs originating from the SDM service environment that are likely to facilitate consumers' digital resource integration. Accordingly, the developed models consider the independent and joint impact of (1) physicians' SDM-orientation, (2) patients' personal health accountability, (3) health self-awareness, (4) physicians' digital influence, (5) digital credibility, and (6) digital usefulness on consumers' digital resource integration and resulting health consequences in the health value co-creation framework.

### **Model Development and Hypotheses**

This study develops an overarching health value co-creation framework to explore a number of direct and indirect effects stemming from a collaborative decision-making environment and digital health resource integration on health behaviors and outcomes. First, the framework highlights the need for a collaborative environment that jointly incorporates

physicians' SDM-orientation regarding patient-centered care along with consumers' personal health accountability. Second, the framework acknowledges the value co-creation influence of resource integration. Specifically, the framework incorporates the effects of mutually established patient-provider value perceptions of digital information inputs and the subsequent impact on consumers' digital health information seeking. Finally, the framework examines value co-creation consequences on health decision-making (i.e. health behaviors) and related health outcomes (i.e. overall health).

The health value co-creation framework contributes to the marketing literature by providing an exploratory framework for investigating the antecedents to consumers' digital health information seeking and consequences on health behaviors and overall health. The framework reflects the complex interrelationships stemming from the patient-provider SDM-environment that facilitate value perceptions of digital health information inputs. Sequentially, these mutually established value perceptions enhance consumers' digital health information seeking across both provider-related and external digital health resources, thereby creating a supplemental value co-creation effect on health behaviors and overall health. Figure 1 presents the proposed overarching research framework followed by an overview of the hypothesized direct and indirect relationships split across four related empirical models. As noted previously, Table 1 specifies the connections between SDL's foundational premises and the SDM constructs included in the health value co-creation framework.

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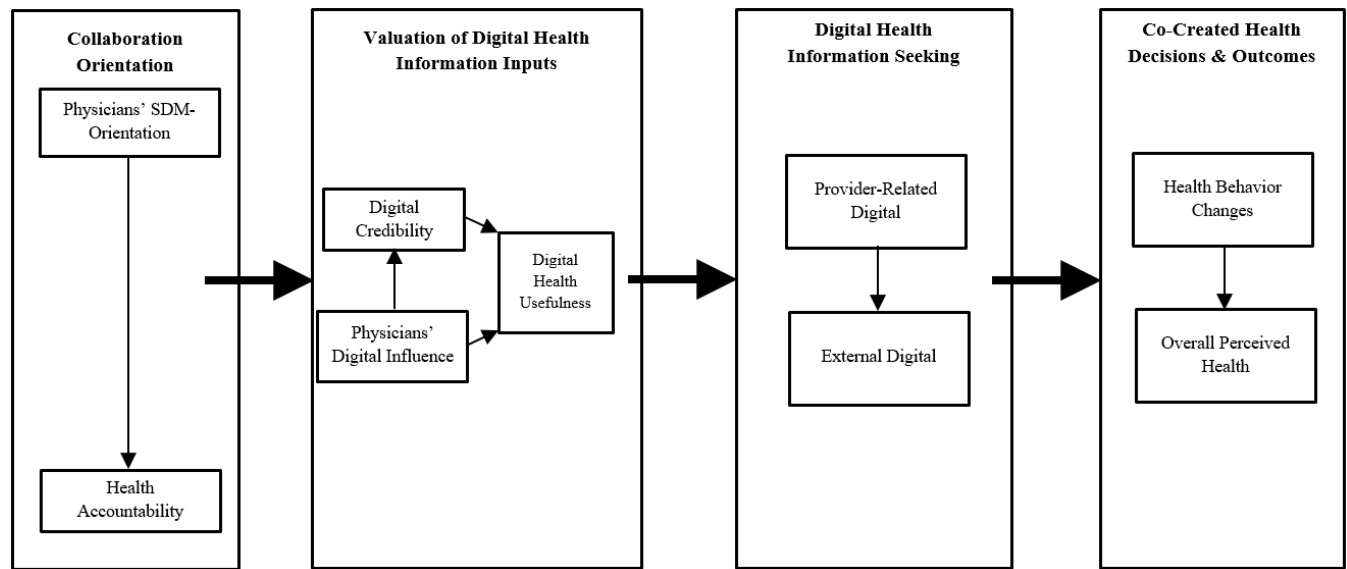


Figure 1. Health value co-creation framework. SDM = shared decision-making.

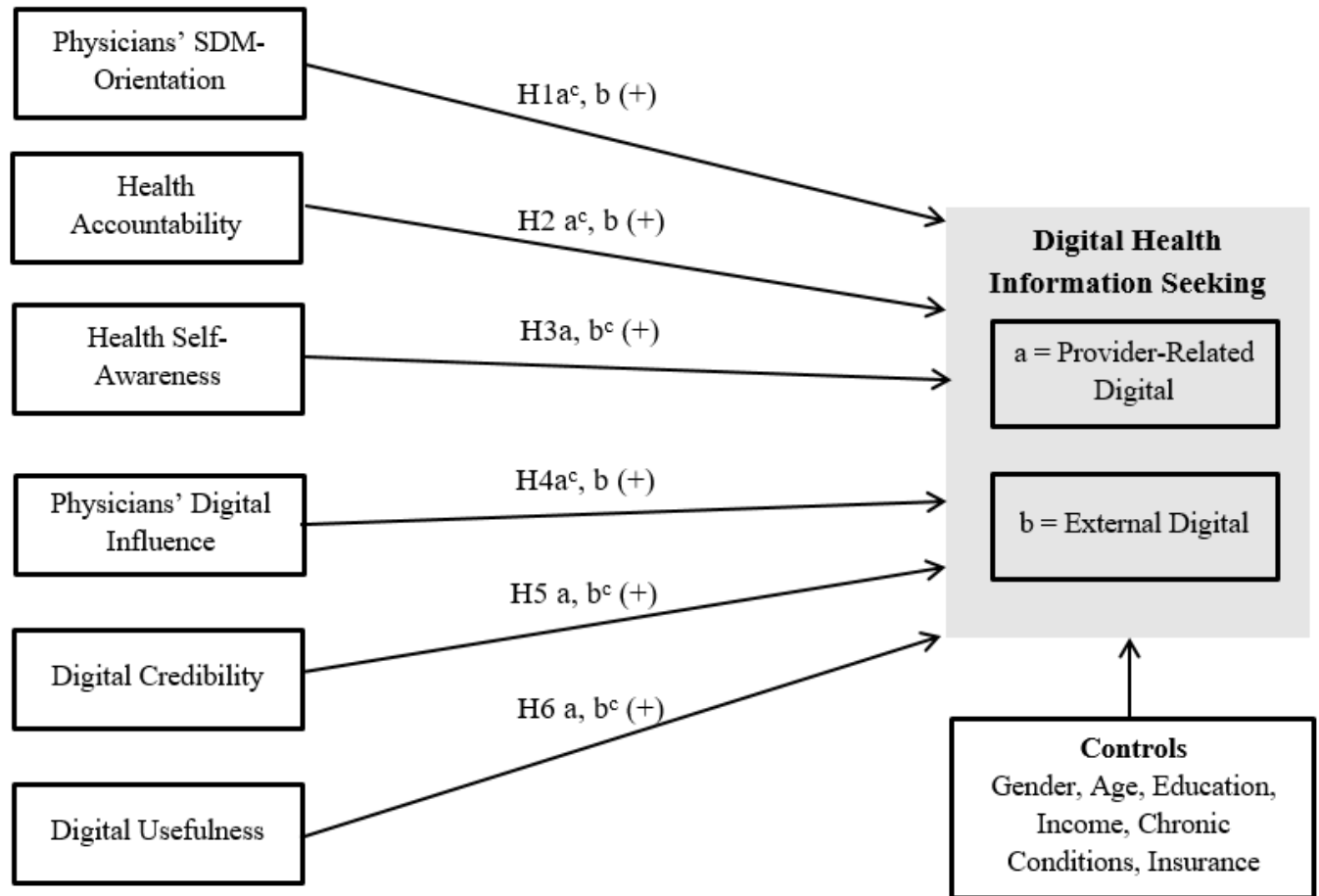
## **Model 1: Examining the differential effects on digital health information seeking.**

As noted in Table 1, integrating information inputs is a critical part of the value co-creation process in the patient-provider SDM-environment (Lusch & Vargo, 2011). The emergence of new digital technologies along with health providers' increasing digital presence presents two key digital sources for digital health resource integration (Adams, 2010; Gallant et al., 2011). Consistent with SDL, health consumers may integrate digital health information facilitated by a health provider's digital presence (referred to as provider-related) or external sources outside of the provider's control. However, most research considers digital health information seeking collectively (Moorhead et al., 2013), and relatively little is known about how SDM elements impact consumers' integration of the two digital health information sources given new health technologies (Pandey et al., 2013). In particular, digital media's influence on the evolving customer-marketer relationship suggests research is needed that examines what motivates consumers' use of both marketer-produced (i.e. provider-related sources such as the health provider's website and personal e-health records) and externally generated (i.e. social media, digital videos, health blogs, forums, and applications) digital health information (Hennig-Thurau et al., 2013; Labrecque et al., 2013).

Recognizing this gap, this study proposes Model 1 to examine the differential effects of SDM factors on consumers' digital health information resource integration. Specifically, Model 1 (see Figure 2) explores the impact of the patient-provider SDM-environment (physicians' SDM-orientation, patients' health accountability, patients' health self-awareness) and the patient-providers' valuation of digital health information inputs (physicians' digital influence, digital information credibility, and digital information's perceived usefulness) on digital information seeking. The evolving digital power shift (Labrecque et al., 2013) and information quality

concerns (Moorhead et al., 2013) are hypothesized to have differential effects on consumers' use of the two digital information sources. As a result, this study demonstrates health providers must consider different engagement and marketing strategies as part of the service design process to increase consumers' integration of the various types of digital health resources as part of maximizing the health value co-creation process. The following section outlines the hypothesized direct effects on consumers' digital health information seeking across the two types of digital health resources related to Model 1, which also carry over to the direct paths leading to digital health information seeking expected in Models 2 and 3. Prior research indicates younger, more affluent, and female consumers are more likely to engage in digital health information seeking (Nölke, Mensing, Krämer, & Hornberg, 2015). Additionally, research shows those with chronic health conditions tend to seek out more health information (Ayers & Kronenfeld, 2007). Thus, Model 1 includes controls for consumers' gender, age, presence of chronic conditions, insurance coverage, education, and income in recognition of the potential health information seeking digital divide (Kim, 2015; Lustria et al., 2011).





*Figure 2.* Model 1: Examining differential effects on digital health information seeking. SDM = shared decision-making. The location of <sup>c</sup> reflects whether the hypothesis expects the variable to have a stronger association with (a) provider- related or (b) external digital health information seeking. a<sup>c</sup>, b indicates a stronger association with provider-related while a, b<sup>c</sup> indicates a stronger association with external digital.

***Digital health information seeking.*** Consumers' health information seeking involves active efforts to obtain specific health information (Niederdeppe et al., 2007). Consumers' integration of digital health resources represents an emerging health value co-creation activity (McColl-Kennedy et al., 2012; Sweeney et al., 2015). In the context of evolving health information technologies (Srivastava & Shainesh, 2015), this study defines digital health information seeking as an individual's frequency of using digital information resources for health and wellness information.

The current study posits two distinct digital health information sources exist, with differing factors motivating consumers' integration of each source into the health decision-making process. First, provider-related digital health information sources include health information sources internal to a health care organization where the health care provider (through the marketing department) has greater control over the message and shared health information. Specifically, a health provider's website and patients' electronic health records accessed via the provider's online health portal represent two digital-based health information sources where the provider has the most control over the information flow. Second, external digital health information sources reflect consumers' use of digital health resources where the health providers (and connected health care organizations) have less control over the messaging and information shared and thus is external to the health provider and health care organization. In the context of this study, these fragmented external digital health information sources include other health and wellness websites, blogs, forums, digital videos, health applications, and social media where information is user-generated or produced and shared by outside organizations (Adams, 2010; Baird & Nowak, 2015). The SDL perspective predicts that both provider-related and external digital resource inputs are important to enhancing customer value creation (Grönroos & Ravald,

2011); how factors motivating consumers' digital information seeking differ across the two digital sources is less clear.

***Physicians' SDM-orientation and digital health information seeking.*** Consistent with SDL, value co-creation in health care service delivery occurs via collaborative decision-making involving both the provider and informed health consumers (Lusch & Vargo, 2006; Vargo & Lusch, 2004, 2008). SDL indicates the health provider enriches the value creation process when the provider supports and enables patients' informational inputs (Grönroos & Ravald, 2011). Likewise, research shows inviting patients to seek out and share information is a key element to maximizing the benefits of patient-provider SDM in terms of better health outcomes (Epstein & Gramling, 2013). Thus, a critical function of the patient-provider relationship involves transforming the traditional view of providers as the sole medical authority (Wald et al., 2007) to a more patient-centered process focused on actively encouraging patients to seek additional health information. Research suggests health providers should increasingly seek to facilitate consumers' integration of new digital resources to the service system to increase value co-creation (Nambisan, 2009; Nambisan & Nambisan, 2009). Health providers who promote digital health information seeking behaviors as part of a collaborative, patient-centric decision-making process enhance consumers' understanding of health and wellness advice shared during the patient-provider interaction (Sommerhalder et al., 2009). Sweeney et al. (2015) also demonstrated an integrated patient-provider care process is a precursor to enhancing customers' efforts to integrate informational resources. Moreover, health providers with an SDM-orientation can reduce the risks of false information, empower consumers with greater control over their health, and improve health outcomes by directing consumers to credible and personally relevant digital health information sources (Baird & Nowak, 2015). This study posits

consumers will be more likely to seek out digital health information across both provider-related and external sources when health consumers feel their physicians' SDM-orientation enables and supports patient engagement in the health decision-making environment.

H1a: Physicians' SDM-orientation will be positively associated with provider-related digital health information seeking.

H1b: Physicians' SDM-orientation will be positively associated with external digital health information seeking.

Although this study expects physicians' SDM-orientation will positively influence integration of both types of digital health information seeking, physicians' SDM-orientation is likely to have different effects when motivating provider-related versus external digital health information sources. Health providers that consider themselves the ultimate authority for patient health information are likely to hold skeptical views of external health information's reliability, even when supportive of patient-provider SDM (Wald et al., 2007). Additionally, health providers may have concerns regarding information provenance and quality of external sources (Moorhead et al., 2013). In particular, research shows health providers are more likely to have negative views of emerging digital resources outside their control (Adams, 2010), and demonstrate an unwillingness to utilize external information the patient brings to appointments (Baird & Nowak, 2015). In combination, physicians' SDM-orientation may lead to increased consumer utilization of provider-related digital health information where the health provider feels greater control over the information and message compared to external digital health information.

H1c: Physicians' SDM-orientation will be more strongly associated with provider-related digital health information seeking than external digital health information seeking.

***Personal health accountability and digital health information seeking.*** In line with value co-creation, consumers' personal health accountability refers to the willingness and ability to take control of managing their health through active participation (Hibbard & Greene, 2013). Consistent with the SDL FP's shown in Table 1, research shows consumer accountability and effort are important precursors to health resource integration (Sweeney et al., 2015). Research also shows health consumers' personal motivation to actively manage their health outcomes is associated with use of both provider-related digital information sources such as digital health portals (Otte-Trojel, de Bont, Rundall, & van de Klundert, 2014) and external sources like social media (Crook, Stephens, Pastorek, Mackert, & Donovan, 2016). Individuals who feel accountable for their health decisions and subsequent health outcomes reflect consumers in high involvement decision-making contexts (Petty & Cacioppo, 1986) and thus are more likely to conduct extensive information searches (McColl-Kennedy et al., 2012). For example, research shows patients exhibiting a heightened responsibility for their health care are more likely to value and seek comparative health information (Hibbard, Mahoney, Stock, & Tusler, 2007). Recent research also indicates patient activation in terms of health accountability tends to be a strong predictor for seeking and utilizing digital health information from multiple sources (Ledford et al., 2015; Nijman, Hendriks, Brabers, de Jong, & Rademakers, 2014).

H2a: Health accountability will be positively associated with provider-related digital health information seeking.

H2b: Health accountability will be positively associated with external digital health information seeking.

The differential effects of individuals' personal health accountability on the two digital health information sources are less clear than physicians' SDM-orientation and other SDM

elements. Consistent with SDL, highly involved patients may seek out additional informational inputs beyond those provided by the marketer (Grönroos & Voima, 2013) and thus integrate more external digital health resources in their health information seeking. Conversely, research shows highly activated patients tend to have higher health literacy levels and, similar to physicians, are more likely to hold skeptical views of external digital health information (Nijman et al., 2014), which may thus translate to greater use of provider-related digital health resources. Research also demonstrates consumers are at an information disadvantage when it comes to health information (Kareklas et al., 2015) and, therefore, even when highly motivated may rely more on credible sources such as provider-related digital health information due to the complexity of the health decision. Therefore, patients who feel a greater sense of responsibility for their health outcomes may place more emphasis on integrating health-provider approved digital information.

H2c: Health accountability will be more strongly associated with provider-related digital health information seeking than external digital health information seeking.

***Health self-awareness and digital health information seeking.*** Health self-awareness signifies consumers' mental orientation or conscious thoughts, reflections, and concerns regarding their health status (Gould, 1988, 1990; Hong, 2009, 2011). Prior research indicates consumers' health self-awareness also reflects individuals' internal motivation to seek out health information to help maintain a healthy lifestyle (Dutta-Bergman, 2003, 2005; Moorman & Matulich, 1993). This study postulates that consumers who indicate higher levels of self-awareness will increase their usage of both types of digital health information sources. However, research shows self-aware individuals are more likely to be in tune with their health information needs and thus better at deciphering and using external health information (Nijman et al., 2014).

Consequently, as individuals exhibit higher levels of health self-awareness they may be more likely to integrate digital informational inputs outside of provider-related information and messaging, suggesting this factor may have a stronger effect on external digital information seeking.

H3a: Health self-awareness will be positively associated with provider-related digital health information seeking.

H3b: Health self-awareness will be positively associated with external digital health information seeking.

H3c: Health self-awareness will be more strongly associated with external digital health information seeking than provider-related digital health information seeking.

### ***Valuation of digital health information inputs and digital health information seeking.***

Consumers may seek or share digital health information for a variety of reasons. As outlined previously, the current study hypothesizes patients may engage in digital health information seeking either when extrinsically motivated by their physicians' SDM-orientation or intrinsically motivated by their personal sense of health accountability and health self-awareness. Beyond SDM-environmental or personal factors, information processing theory implies psychosocial factors related to the perceived value of digital health information will also impact consumers' digital health information seeking (Jiang & Benbasat, 2004; Qiu et al., 2012). Consistent with the value co-creation perspective, consumers will consider integrating digital information as being more valuable when the information is useful, easy to use, and viewed as important by others (Venkatesh, Thong, & Xu, 2012). Within a health context, consumers are likely to consider digital health information useful if it provides relevant health information, offers emotional or social support on health issues, motivates them to take action, or gives them greater

control over their health decision-making via enhanced health literacy (Bell et al., 2011; Parker & Ratzan, 2010). In particular, research shows an individual's perception of the information's credibility strongly influences digital information use in health decision-making contexts (N. Xiao et al., 2014). Finally, beyond an individual's personal value perceptions of digital information, data show the social influence of important others impacts consumers' acceptance and technology use, including social media (Borrero, Yousafzai, Javed, & Page, 2014; Venkatesh et al., 2012). Likewise, SDL suggests the marketer should facilitate and support consumers' digital information integration (Grönroos & Ravald, 2011). Therefore, the physicians' opinions of digital health information are likely to be viewed as a key social influence in a patient-provider SDM context (Baird & Nowak, 2015), which either facilitates or hinders consumers' digital health integration. Therefore, consumers who have higher perceptions of the benefits of and ease of using digital health information (digital usefulness), feel their health provider supports using digital health information (physicians' digital influence), and place a higher level of personal trust in digital health information (digital credibility) will be more likely to seek digital health information.

H4a: Physicians' support of digital information (digital influence) will be positively associated with provider-related digital health information seeking.

H4b: Physicians' support of digital information (digital influence) will be positively associated with external digital health information seeking.

H5a: Digital credibility will be positively associated with provider-related digital health information seeking.

H5b: Digital credibility will be positively associated with external digital health information seeking.



H6a: Digital health information's usefulness will be positively associated with provider-related digital health information seeking.

H6b: Digital health information's usefulness will be positively associated with external digital health information seeking.

Although consumers' value perceptions are likely to have positive effects on both digital health information sources, prior research on information provenance and presentation format suggests differential effects will exist between the two sources (Hibbard & Peters, 2003; Winterbottom et al., 2008; Zhao, Wang, & Fan, 2015). First, health providers' concerns on information provenance are likely to come through via the physicians' digital influence, thus exhibiting a stronger effect on motivating consumers to integrate provider-related rather than external digital health information sources (Moorhead et al., 2013). Meanwhile, when consumers consider digital health information more credible or useful they will see more value in integrating multiple information sources and thus increase their external digital health information seeking (Ghasemaghaei & Hassanein, 2016; M. Y. Yi, Yoon, Davis, & Lee, 2013). Therefore,

H4c: Physicians' support of digital information (digital influence) will be more strongly associated with provider-related digital health information seeking than external digital health information seeking.

H5c: Digital credibility will be more strongly associated with external digital health information seeking than provider-related digital health information seeking.

H6c: Digital usefulness will be more strongly associated with external digital health information seeking than provider-related digital health information seeking.

## **Model 2: Examining the antecedents to external digital health information seeking.**

The evolving digital landscape presents new marketing challenges and opportunities, compelling the need for research which examines the antecedents and consequences of digital-enabled consumer decision-making (King et al., 2014; Yadav & Pavlou, 2014). Acknowledging the digital-based information power shift from the marketer (i.e. health provider) to the consumer, increasing consumers' decisional empowerment (Hennig-Thurau et al., 2013; Labrecque et al., 2013), Model 2 investigates the direct and indirect antecedents leading to consumers' digital health information seeking. Specifically, Model 2 (see Figure 3) explores the direct and indirect co-created information flows that lead health consumers to seek both provider-controlled and external digital health information. Following the SDL value co-creation premises, Model 2 examines the central role health providers have on facilitating consumers' evaluation of digital health information inputs and digital health integration in the patient-provider SDM-environment.

Accordingly, Model 2 contributes to the marketing literature in a number of ways by identifying the antecedents and complex interrelationships that motivate consumers' external digital information seeking. First, the health value co-creation theoretical framework posits the initial prerequisite to increased digital health information use requires establishing a collaboration-orientation between patients and their health providers. Specifically, health providers may empower patients by delivering patient-centered care and encouraging patient involvement in the SDM process (Barry & Edgman-Levitan, 2012; Levinson et al., 2010). This decisional empowerment enhances consumers' personal health accountability (Williams, McClellan, & Rivlin, 2010) and establishes a co-created SDM-environment that is likely to increase digital health information integration during the value co-creation process (Grönroos &

Voima, 2013). The value co-creation literature also suggests that health providers perform the critical function of supporting value co-creation efforts by facilitating consumers' integration of relevant information sources (Grönroos & Ravald, 2011). As a result, physicians who are supportive and recommend specific digital health information in the SDM-environment will act as a mediating influence that enhances consumers' valuation of digital health information inputs and increases consumers' digital health information use (Sommerhalder et al., 2009). Finally, the subsequent information flow and consumer use from provider-related to external digital health sources reflects the digital power shift away from marketer-controlled (i.e. health provider-related) information (Labrecque et al., 2013). The following section outlines the additional posited direct and indirect effects on consumers' external digital health information seeking beyond the direct paths hypothesized in Model 1.

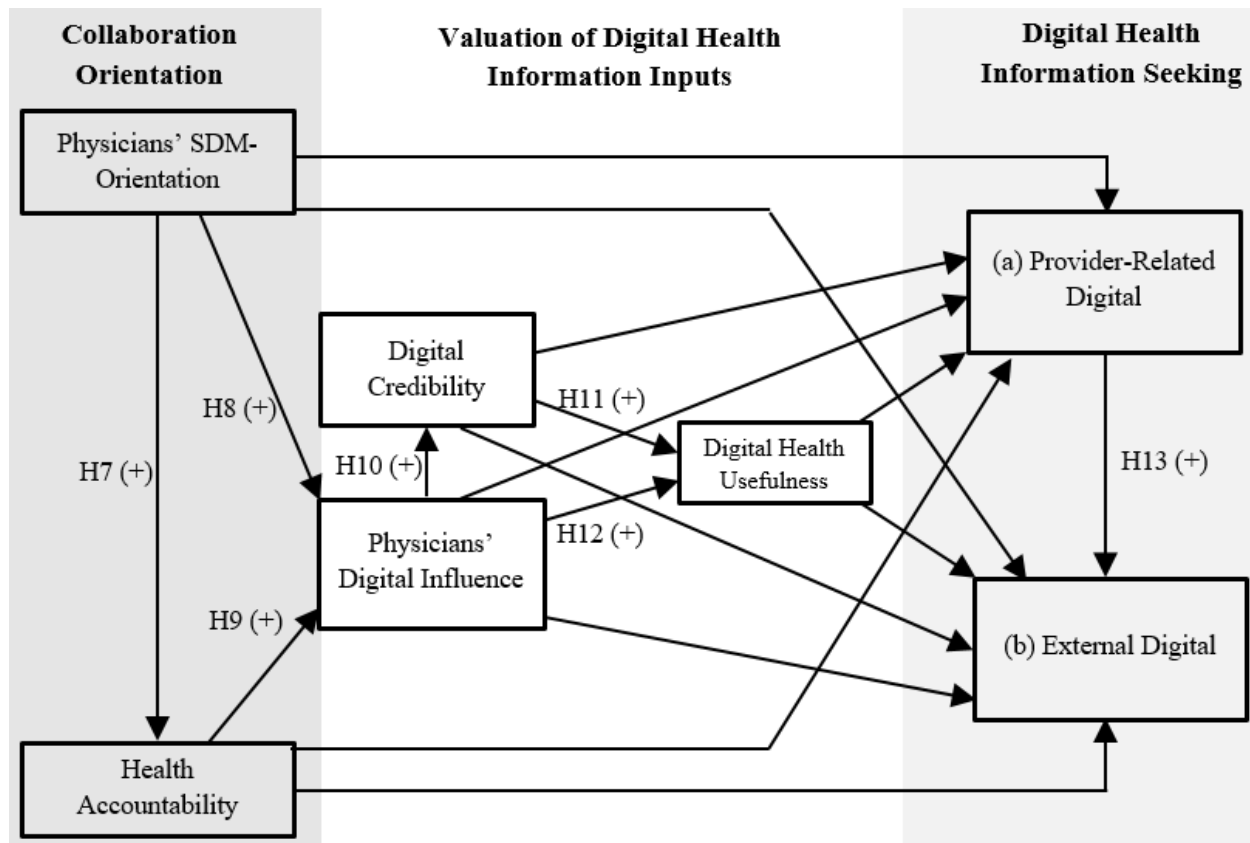


Figure 3. Model 2: Antecedents to external digital health information seeking. SDM = shared decision-making.

***Physicians' SDM-orientation and personal health accountability.*** Patients need to be sufficiently engaged in the health value co-creation process to alter health behaviors or follow physician recommendations for healthy lifestyle maintenance (Paasche-Orlow & Wolf, 2007; Roth, 1994). The SDL principles outlined in Table 1 indicate the customer-service provider interaction and overall relationship are critical to maximizing value co-creation through information integration (Grönroos, 2011), thus noting the significance of the patient-provider collaborative decision-making environment in value co-creation. The extant SDM literature indicates that physicians' support of patient-provider SDM enhances patient engagement (Fraenkel & McGraw, 2007; Pollard et al., 2015). Specifically, health providers increase patients' willingness and ability to take responsibility for their health by identifying and responding to patient concerns, treatment preferences, or values (Levinson et al., 2010; Politi et al., 2013), inviting patient input (Epstein & Gramling, 2013), and holding the consumer accountable for health-related lifestyle choices (Brownell et al., 2010). However, research indicates physicians may hinder patients' involvement if they misjudge patients' interest or ability for engaging in SDM (Légaré et al., 2008; Légaré & Thompson-Leduc, 2014; Légaré & Witteman, 2013) or by discounting patients' informational inputs (Wald et al., 2007). Hence, this study posits:

H7: Physicians' SDM-orientation will be positively associated with patients' health accountability.

***Antecedents to physicians' digital influence on digital health information's value.*** Research argues that enhancing consumers' health information integration as part of the patient-provider SDM process must consider both provider- and patient-centric factors (Hibbard & Greene, 2013; Joseph-Williams et al., 2014; Pollard et al., 2015). Value co-creation's

foundational premises claim health providers are likely to be the key facilitators of patients' information integration (Grönroos & Ravald, 2011; Grönroos & Voima, 2013). Recent health research calls for primary care providers to serve in this value-facilitating role by acting as digital information hubs (Baird & Nowak, 2015). Although there is a lack of research examining health providers' value-facilitating role (Agency for Healthcare Research and Quality, 2014), one way health providers exert their social influence on digital value perceptions and integration is via an information gatekeeper role. In a collaborative patient-provider SDM-environment, both the physicians' SDM-orientation and the consumers' personal health accountability may activate the physicians' digital influence gatekeeping role. For example, health providers can recommend or endorse digital health information resources, thereby supplementing information exchanged during the service encounter (Wald et al., 2007). Additionally, highly involved patients who feel accountable for their health are likely to engage their health providers in conversations about digital health resources (J. G. Anderson, Rainey, & Eysenbach, 2003; Diaz et al., 2002), particularly to help judge the information's relevance to their health (Bell et al., 2011).

H8: Physicians' SDM-orientation will be positively associated with physicians' support of digital information (digital influence).

H9: Personal health accountability will be positively associated with physicians' support of digital information (digital influence).

***Antecedents to digital credibility.*** Concerns regarding trust, source credibility, and quality of user-generated content on social media are widespread in the health literature given the potential harm to one's health that may occur if inaccurate online advice or information is followed (Adams, 2010; Chou, Hunt, Beckjord, Moser, & Hesse, 2009; Moorhead et al., 2013).

Consumers make personal judgments about information's credibility based on a number of factors including its believability, accuracy, trustworthiness, and reliability (Metzger, Flanagin, Eyal, Lemus, & McCann, 2003). Within a health context, consumers are often at a knowledge disadvantage when it comes to determining health information's accuracy (Kareklas et al., 2015) and consequently are likely to rely on source credibility, including referral sources, to assess information's credibility and value (Pan & Chiou, 2011). As part of health providers' role in facilitating consumers' digital health information integration, health providers exercise their social influence by confirming information quality, verifying the reliability of digital health information, or otherwise lending credibility to digital health information inputs (Antheunis et al., 2013; Baird & Nowak, 2015). In particular, health providers may exert digital influence through an explicit or implied endorsement of specific provider-related digital resources or by approving consumers' usage of external digital health resources during patient-provider interactions (Sommerhalder et al., 2009; Wald et al., 2007). Therefore,

H10: Physicians' support of digital information (digital influence) will be positively associated with digital credibility.

### ***Antecedents to consumers' perceptions of digital health information's usefulness.***

Digital information's value consists of consumers' judgment of its relevance and usefulness to their decision-making situation (Qiu et al., 2012). Research indicates consumers are more likely to consider health information relevant if they first deem the information is credible (Kareklas et al., 2015). Research also shows consumers' increased trust in digital health information affects consumer preferences for using digital sources (N. Xiao et al., 2014). Thus, consumers' assessment of digital health information's credibility will directly influence perceptions of the information's usefulness to their health (Antheunis et al., 2013). Likewise, the SDL premises

suggest physicians' digital influence impacts how consumers value, comprehend, and use informational inputs (Grönroos & Ravald, 2011). For example, research indicates health providers will increase consumers' perceptions of digital health information's usefulness when patients believe the health provider is an important social influence and values digital inputs in the SDM process (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh et al., 2012).

Additionally, a health provider may enhance consumers' value perceptions by identifying digital information sources which complement physician-provided information relevant to patients' specific health decision contexts (Wald et al., 2007).

H11: Digital credibility will be positively associated with digital health information's usefulness.

H12: Physicians' support of digital information (digital influence) will be positively associated with digital health information's usefulness.

***Antecedents to external information seeking.*** Despite a lack of empirical research, the extant literature appears to support a directional relationship from provider-related to external digital information seeking. Research shows patients place greater trust in physicians due to information asymmetry and thus are likely to turn first to provider-related digital sources (Hesse et al., 2005; Kareklas et al., 2015). Research also implies this information flow may occur when the individual health provider serves as a digital information hub referring the health consumer to relevant external information sources (Baird & Nowak, 2015). Moreover, the SDL premises suggest service providers enhance value co-creation by encouraging consumers' integration of informational inputs beyond those initially supplied by the service provider (Grönroos, 2011; Grönroos & Ravald, 2011). Content analysis of health providers' websites shows health providers are increasingly incorporating links to many external digital sources (Gallant et al.,



2011). Accordingly, provider-related digital properties such as a health provider's website or the e-health records portal may encourage consumers' external digital use by providing links or references to relevant external digital health information resources such as social media, blogs, and mobile health applications.

H13: Provider-related digital health information seeking will be positively associated with external digital health information seeking.

### **Model 3: Health co-creation chain and information flow to health behaviors.**

Despite growing interest in research exploring digital-enabled decision-making (King et al., 2014; Yadav & Pavlou, 2014), research is lacking that examines the antecedents and consequences of digital health information seeking in terms of health behavior change (Antheunis et al., 2013). Research indicates digital health resources have the potential to enhance consumers' health literacy (Parker & Ratzan, 2010) and consequently improve health decision-making and related health outcomes (Koh et al., 2012). Model 3 builds on Model 2 to explore the consequences of consumers' digital health information seeking on consumers' health decision-making. Specifically, Model 3 (see Figure 4) examines the direct and indirect effects of the value co-creation chain prompting health consumers to make dietary and physical activity changes to improve their health. Patient activation remains a key mechanism in achieving consumers' health behavioral changes (Greene, Hibbard, Alvarez, & Overton, 2016; Hibbard & Greene, 2013). Accordingly, Model 3 postulates health providers that facilitate consumers' external digital information seeking are more likely to help patients engage in positive health behavior changes. The following section outlines the hypothesized direct and indirect effects on consumers' health behaviors building on Models 1 and 2 to explore digital health information seeking's subsequent and additive impact on health behaviors.

## PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN

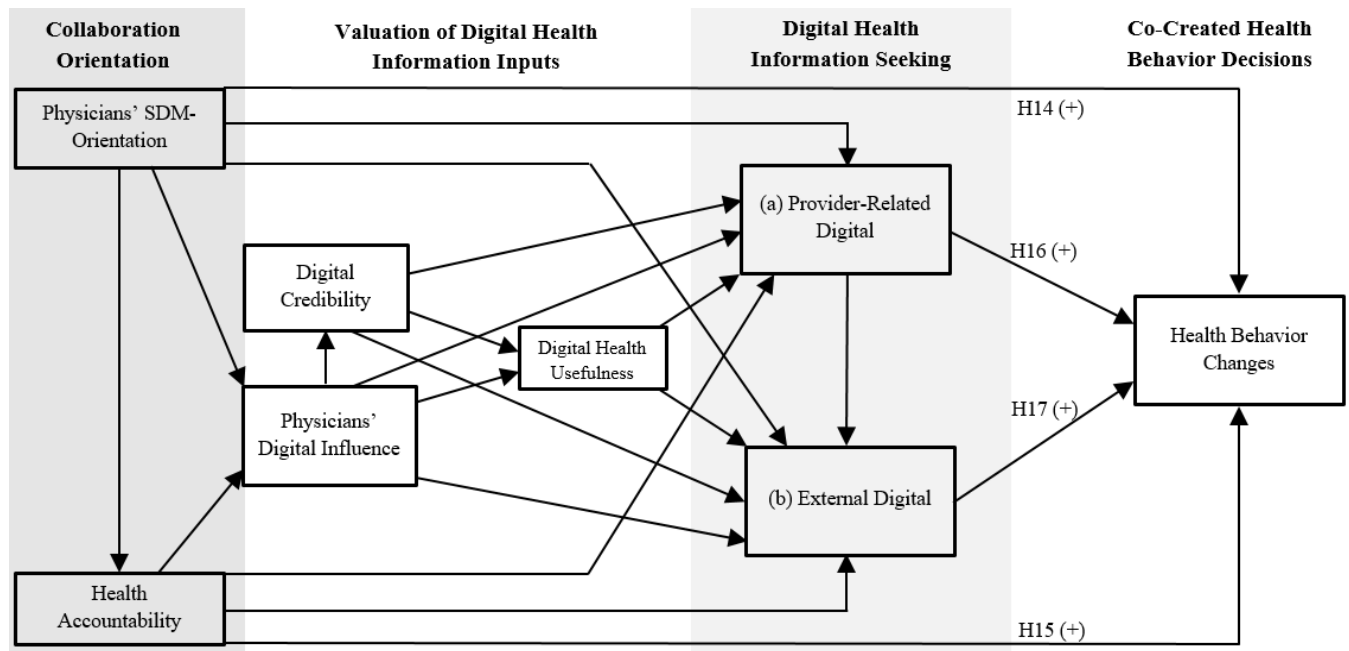


Figure 4. Model 3: Health co-creation chain and information flow to health behaviors. SDM = shared decision-making.

***Health behavior changes.*** Many chronic health conditions (i.e. heart disease, high blood pressure, obesity) and other negative health outcomes are a result of consumers' continued engagement in unhealthy behaviors (Centers for Disease Control and Prevention, 2015). Health behavior changes represent a wide variety of actions consumers utilize to improve their health and well-being, such as consuming a healthier diet, increasing exercise, quitting smoking, or reducing alcohol consumption (J. J. Prochaska, Spring, & Nigg, 2008; J. O. Prochaska, 2008). The current study focuses on two areas of health behavior change relevant to consumers' daily lifestyles which are likely to have a significant positive effect on overall health and wellness—eating a healthier diet and increasing physical activity (Parekh, Vandelanotte, King, & Boyle, 2012). Consumer changes to dietary and exercise behaviors are particularly important for preventative health and wellness regardless of whether or not the individual has a chronic condition or disease (Ferrer, Burge, Palmer, & Cruz, 2016; Goldstein, Whitlock, & DePue, 2004; Willett & Stampfer, 2013).

***Antecedents to health behavior changes.*** As noted earlier, SDM involves a patient-centric, collaborative decision-making process between the patient and the health provider (Politi et al., 2013). Consistent with SDL, health value co-creation occurs when the patient and health provider both share information including preferences to inform the treatment or lifestyle change decision (Stiggelbout et al., 2015). Although research is lacking that examines how patients' desired role in SDM impacts health behavior adherence (Clayman et al., 2016), the existing literature suggests patients engaged in collaborative decision-making have increased health knowledge and are thus more likely to make appropriate lifestyle choices (Durand et al., 2014; Dutta-Bergman, 2005). Physicians who empower patients as part of the patient-provider SDM process are thus likely to increase patient adherence to recommended health behavior changes

(Briss et al., 2004) and positively impact patients' overall health and well-being (Gallan et al., 2013). Finally, research shows transforming the health delivery process to encourage greater patient-provider participation in SDM is important to enhancing value co-creation including behavioral intentions (Sweeney et al., 2015). Therefore:

H14: Physicians' SDM-orientation will be positively associated with health behavior changes.

Recent health care legislation has placed greater focus on empowering patients to take more responsibility for managing chronic conditions and participating in preventative wellness efforts (Ory et al., 2013). As outlined earlier, health accountability refers to patients' willingness and ability to take control of managing their health (Hibbard & Greene, 2013). Hibbard and Greene's review indicates patients who feel responsible for their health care decisions experience improved health outcomes. Research also shows enhancing patients' involvement in their health decisions creates more buy-in for the recommended lifestyle changes and leads patients to take action (Briss et al., 2004). Likewise, research shows intrinsically motivated patients are more likely to follow treatment advice and make appropriate lifestyle changes aimed at improving their health (R. M. Anderson & Funnell, 2005, 2010). Similarly, patients are more likely to engage in health behaviors when they assume greater responsibility for their health outcomes (Godin, Valois, & Lepage, 1993; Kidwell & Jewell, 2003). Consequently, patients with a heightened sense of responsibility for their health decision-making will be more likely to engage in behavior changes which represent healthier lifestyle choices including improving their diet and increasing physical activity.

H15: Personal health accountability will be positively associated with health behavior changes.

Similar to other high involvement situations, patients are likely to seek digital health information to make informed decisions prior to any behavior change (J. O. Prochaska, 2008; J. O. Prochaska & Velicer, 1997). Beyond motivating health behavior changes, digital health information sources help model appropriate health behaviors while offering encouragement and support for healthy lifestyle maintenance (George, Rovniak, & Kraschnewski, 2013). In terms of healthy lifestyle choices, McKinley and Wright (2014) suggested that digital health information creates more informed consumers with increased motivation to engage in healthier eating, increased exercise, and related behaviors. Research shows consumers are likely to view health provider-related digital health information as a highly credible source for decisional support and motivating behavior change (Moral et al., 2015). Additionally, highly involved health consumers are likely to conduct external searches for health information when considering health behavior changes (Krebs, Prochaska, & Rossi, 2010). Finally, SDL suggests consumers will experience greater value co-creation when they integrate both provider-related and external information sources (Grönroos & Ravald, 2011). Consistent with the value co-creation framework, this study posits that consumers' digital health information seeking from both provider-related and external sources will motivate dietary and physical activity health behavior changes.

H16: Provider-related digital health information seeking will be positively associated with health behavior changes.

H17: External digital health information seeking will be positively associated with health behavior changes.

**Model 4: Digital health information seeking to co-created health decisions and outcomes.** Finally, Model 4 (see Figure 5) closes the health value co-creation chain by

## PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN

examining the value added to the health decision-making process when patients integrate provider-related and external digital health information sources into their health decisions and the resulting impact on health behavior changes and overall health. For parsimony, Model 4 focuses solely on the value co-creation that occurs once consumers engage in digital health information seeking as part of the health behavior change process. The following section builds on the direct and indirect paths from digital health information seeking to health behavior changes hypothesized in Model 3.

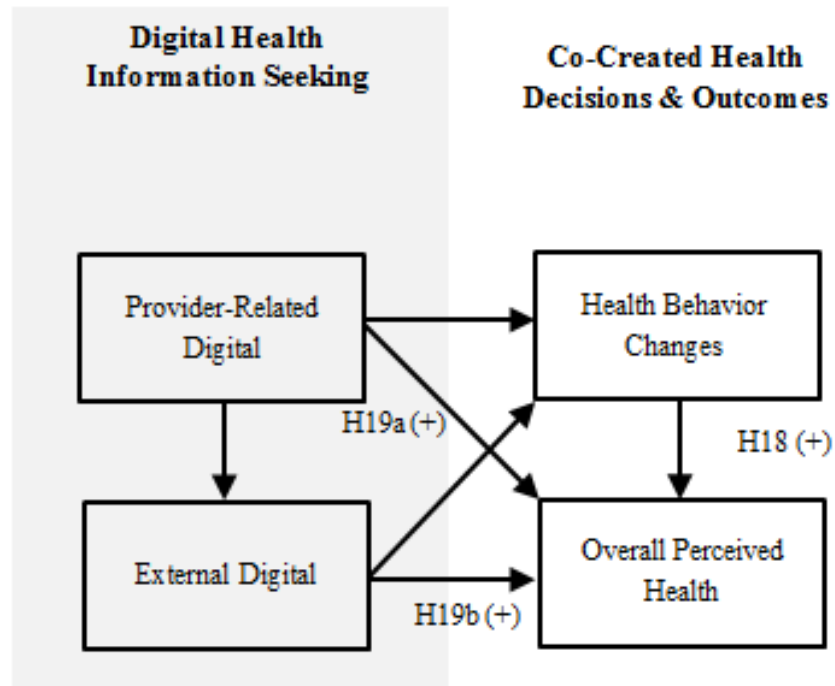


Figure 5. Model 4: Digital health information seeking to co-created health decisions and outcomes.

***Overall health.*** Overall health represents the final outcome variable in the health value co-creation chain framework. Consistent with the SDL literature, customers' value co-creation addresses patients' perceptions of the benefits to their well-being (Vargo et al., 2008), which in a health care context may include perceptions of both the physical and mental health status. Overall health reflects an individual's combined perceptions of overall physical and emotional or mental well-being (Hamer & Stamatakis, 2013) and is one of the most frequently used predictive indicators for other health outcomes (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Jylhä, 2009).

***Antecedents to overall health.*** Individuals may take a wide variety of actions to improve their overall health and well-being, including eating a healthier diet, reducing sugary beverages, increasing physical activity, quitting smoking, or reducing alcohol and drug consumption (J. J. Prochaska et al., 2008). The current study focuses on two specific categories of co-created health behavior changes consumers make—eating a healthier diet and increasing their physical activity or exercise. The two behavioral change categories are highly relevant to all consumers' daily lifestyles, and research shows changes to these behaviors can have a positive impact on overall health (Parekh et al., 2012). Furthermore, health research demonstrates changes to these two lifestyle behaviors can help prevent chronic conditions, improve health, and reduce health costs demonstrating their value to a co-created preventative health service model (Bray & Bouchard, 2014; Fleig, Lippke, Pomp, & Schwarzer, 2011; Villareal et al., 2011).

H18: Health behavior changes will be positively associated with overall health.

Health consumers' consumption and dissemination of digital health information signifies an emerging health value co-creation activity which reduces barriers to integrating relevant information in the collaborative decision-making process (McColl-Kennedy et al., 2012;



Sweeney et al., 2015). As consumers engage in more extensive digital health information seeking, they enhance their ability to make informed health decisions through increased understanding and assimilation of relevant information (Bolton, Bhattacharjee, & Reed, 2015; Zhao et al., 2015). Additionally, research indicates actively participating in health information integration is an important component of managing one's overall health and wellness (Scammon et al., 2011), leads to enhanced health outcomes (Frosch & Elwyn, 2014; Watson, Bluml, & Skoufalos, 2015), and enhances overall health perceptions (Koh et al., 2012; Sørensen et al., 2012). Conversely, research shows consumers' lack of access or use of digital health resources contributes to a decline in health outcomes (Wei, Teo, Chan, & Tan, 2011).

H19a: Provider-related digital health information seeking will be positively associated with overall health.

H19b: External digital health information seeking will be positively associated with overall health.

## **Methods**

### **Sample**

An in-person, door-to-door survey was conducted using a random sample of census blocks across the primary service area of a health care system in a Midwestern state. The survey represents the sixth year of the annual County Wellness Rankings study conducted by the health care system and included additional measures specific to this study's purpose. The health care system's primary service area encompasses parts of four counties with a total population of 69,450 (approximately 65% live within city limits referred to as "urban" areas). A stratified, random cluster sampling process was used to select census blocks from the primary service area to ensure a representative sample in terms of rural versus urban, income, and age. Table 3

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provides characteristics of the sample census blocks compared with the population universe based on 2010 census data.

Table 3  
*Population and Sample Characteristics*

	<b>Service Area</b>	<b>Census Block Sample</b>
Census blocks	1,856	100
Housing units	26,738	1,951
Rural	8,826	824
Urban	17,912	1,127
Total population	69,450	4,475
Rural	24,304	1,951
Urban	45,146	2,524

*Note.* Service area data reflect 2010 census block data for the primary service area of the health care system.

### **Data Collection**

Trained survey personnel visited each household in the drawn sample on weekdays and weekends over a four-week period. Field staff handed the survey to homeowners and renters and picked up approximately 20 to 30 minutes later after the survey personnel had visited other selected households. Field staff recorded someone who did not answer as “not home” and returned on a later date. After two attempts, the field staff left a self-addressed, stamped envelope for the household to complete the survey and return via mail. In total, 310 usable responses from households with a primary care provider were obtained. The analysis excluded responses from individuals without a primary care provider (n=33) since they are unable to score questions related to the physicians’ SDM-orientation or physicians’ digital influence. Table 4 shows the response profile from the survey, which closely matches the sample survey profile from the previous five years the survey was administered. The consistency in the respondent profile to the archival analysis suggests non-response bias is not a major concern (Rogelberg & Stanton, 2007).

Table 4  
*Respondent Profile*

	<b>Averages for Prior 5 Years</b>	<b>Sample % (N=310)</b>
<b><i>Location</i></b>		
Rural	34.7%	37.4%
Urban	65.3%	62.6%
<b><i>Gender</i></b>		
Male	47.3%	47.1%
Female	52.7%	52.9%
<b><i>Age</i></b>		
18–24	6.1%	5.8%
25–34	14.3%	14.8%
35–44	18.1%	21.6%
45–54	20.2%	21.6%
55–64	18.9%	18.7%
65+	22.4%	17.4%
<b><i>Annual Household Income</i></b>		
<\$25,000	13.0%	8.8%
\$25,000–34,999	12.8%	9.9%
\$35,000–49,999	17.9%	10.9%
\$50,000–74,999	26.2%	25.9%
\$75,000+	30.1%	44.5%
<b><i>Highest Level of Education</i></b>		
High school degree, GED, or less	37.6%	36.4%
Associate's or Bachelor's degree	45.2%	45.6%
Master's degree or higher	17.2%	18.0%
<b><i>Ethnicity</i></b>		
Caucasian	92.5%	90.3%

*Note.* GED = general education diploma.

### Measures

A multi-stage process informed the questionnaire and measure development. First, an extensive research process gathered input from an advisory committee of health administrators, health providers (doctors and nurses), and external community groups, including social agency staff, businesses, communities, and school leaders. Initial input from the qualitative stages identified important health behaviors and other areas to address in conjunction with a review of the County Health Rankings and its data sources (Remington et al., 2015). Though original in nature, because of the specific forms of digital media investigated, a review of the online health information-seeking literature informed the development of survey items measuring consumers' digital health media usage. A review of the SDL and SDM literature identified important constructs and measures related to a joint patient-provider collaboration orientation and relevant measures that influence consumers' valuation of digital information inputs (see Table 1). Scale items measuring the collaboration orientation and valuation of digital health information inputs were adapted from the existing literature (for constructs and measurement items, see Tables 5 and 6). A group of health care providers and administrators from the health care system reviewed and approved all survey items to ensure appropriateness. A confirmatory factor analysis (CFA) was used to validate the scales. Definitions and sources for each construct are provided in the following bulleted list.

Table 5

*Construct Definitions*

<b>Construct</b>	<b>Definition</b>
Physicians' SDM-Orientation	Eight items: Individuals' perceptions of their providers delivering patient-centered care and their involvement in their health care decisions with their health provider
Health Accountability	Eight items: Individuals' level of personal responsibility and desired involvement for managing their personal health
Health Self-Awareness	Three items: Individuals' mental orientation or concern about their health
Physicians' Digital Influence	Three items: Individuals' perceptions of how their health providers support the use of digital health information
Digital Credibility	Three items: Individuals' perceptions of the credibility or trustworthiness of digital health information
Digital Health Usefulness	Five items: Individuals' personal perceptions of the value and ease of using digital health information
Digital Health Information Seeking	Individuals' frequency of using health information from digital information sources <ul style="list-style-type: none"> <li>• <i>Provider-Related (Internal)</i>: Two sources of digital health information controlled by health provider (i.e. provider's website and electronic health records)</li> <li>• <i>External</i>: Eight sources of digital health information <u>not</u> controlled by health providers (i.e. social media, health applications)</li> </ul>
Health Behavior Changes	Summated five-item measure of the number of self-reported health and wellness improvements made to diet and physical activity levels in the past 12 months
Overall Perceived Health	Individuals' overall perception of their physical and mental health status
<b>Control Variables</b>	
Gender	Respondent's gender (0 = Male; 1 = Female)
Age	Respondent's age range (18-24; 25-34; 35-44; 45-54; 55-64; 65+)
Education	Respondent's highest education level (High school degree, GED, or less; Associate's/Bachelor's degree; Master's degree or higher)
Income	Household income level (<\$25,000; \$25,000-34,999; \$35,000-49,999; \$50,000-74,999; \$75,000+)
Chronic Conditions	Whether the household has one of five common chronic health conditions (diabetes, asthma, heart disease, high blood pressure, or cancer; 0 = No; 1 = Yes)
Insurance	Whether the respondent has health insurance coverage (0 = No; 1 = Yes)

*Note.* SDM = shared decision-making; GED = general education diploma.

Table 6  
Measurement Items

<b>Physicians' Shared Decision-Making (SDM) Orientation</b>
My health provider... (1 = Strongly Disagree to 5 = Strongly Agree)
1. Informs me of different options for improving my health
2. Works with me to make health-related decisions
3. Encourages me to take an active role in my health decisions
4. Empowers me to make decisions related to my health
5. Recommends I seek out more information about my health
6. Identifies specific health information sources I should use
7. Asks how involved I want to be in making my health decisions
8. Speaks positively of different health information sources
<b>Personal Health Accountability</b> (1 = Strongly Disagree to 5 = Strongly Agree)
1. I work hard to participate in my health decisions
2. I put a lot of effort into making good health decisions
3. I openly discuss my health status with my provider
4. I give my health provider accurate information about my health
5. I regularly follow all of my health provider's advice
6. I know when to seek advice/professional help related to my health
7. Good health takes active participation on my part
8. Living life in the best possible health is very important to me
<b>Health Self-Awareness</b> (1 = Strongly Disagree to 5 = Strongly Agree)
1. I'm very self-conscious about my health
2. I think about my health a lot
3. I'm concerned about my health all the time
<b>Physicians' Digital Influence</b> Using online/digital health information...(1 = Strongly Disagree to 5 = Strongly Agree)
1. Is something my provider encourages me to use
2. Is something my provider gives me specific recommendations on
3. Is something my provider believes is valuable for my health
<b>Digital Credibility</b> (1 = Strongly Disagree to 5 = Strongly Agree)
1. Online/digital health information is as trustworthy as other sources
2. Online/digital health information is just as credible as other sources
3. Online/digital health information is as reliable as other sources
<b>Digital Health Usefulness:</b> Using online/digital health information...(1 = Strongly Disagree to 5 = Strongly Agree)
1. Is useful for acquiring relevant health information
2. Is useful for emotional and social support on health issues
3. Is useful for motivating me to achieve my health goals
4. Gives me greater control over my health decisions
5. Overall, I find it easy to use online/digital health information



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### **Digital Health Information Seeking**

How often do you use each of the below for health/wellness purposes? (1 = Never to 5 = Frequently)

#### Provider-related Sources

1. My health provider's website
2. Electronic/online health records

#### External Sources

1. Other health/wellness websites
2. Health/wellness blogs
3. Social media sites that share health/wellness info
4. Online health/wellness community or forum
5. Health/wellness videos on YouTube or other sites
6. Health/wellness app on a mobile device
7. Wearable device/watch to monitor fitness and health readings
8. Share health-related information on social media

### **Health Behavior Changes**

*Summated Value: Range = 0–5*

Which of the following did you DO in the past 12 months? (0 = No, 1 = Yes)

1. Increased exercise/physical activity
2. Ate a healthier diet
3. Weight loss competition/program
4. Reduced sugary beverages
5. Run/walk/bike event

### **Overall Perceived Health**

(1 = Poor, 5 = Excellent)

1. Please rate your overall physical health
2. Please rate your overall emotional/mental health

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- **Physicians' SDM-Orientation:** This construct measures individuals' perceptions of their health providers delivering patient-centered care and the consumers' shared involvement in health care decisions with their health providers (Politi et al., 2013; Stiggelbout et al., 2015). The survey items were adapted from Kriston et al. (2010) to a general health and wellness decision-making environment (eight items; 1 = Strongly Disagree, 5 = Strongly Agree).
- **Personal Health Accountability:** Health accountability refers to individuals' willingness and ability to take control and personal responsibility for managing their health (Hibbard & Greene, 2013). Personal health accountability measures from Hong's reconceptualization of health consciousness (Hong, 2009, 2011) that included measures of individuals' perceived personal responsibility or locus of control (Gould, 1990) and personal health motivation (Dutta-Bergman, 2006) were adapted to a general health and wellness decision-making environment (eight items; 1 = Strongly Disagree, 5 = Strongly Agree).
- **Health Self-Awareness:** Health self-awareness reflects consumers' mental orientation or conscious thoughts, reflections, and concerns regarding their health status (Gould, 1988, 1990) measured via items from Hong's (2009, 2011) reconceptualization of health consciousness (three items; 1 = Strongly Disagree, 5 = Strongly Agree).
- **Physicians' Digital Influence:** Physicians' digital influence reflects consumers' perceptions of how their primary care providers feel about patients using digital health information inputs. The construct focuses on physicians' support of using digital information and uses items adapted from Venkatesh et al.'s (2003) measures of the social influence construct (three items; 1 = Strongly Disagree, 5 = Strongly Agree).
- **Digital Credibility:** Digital credibility reflects individuals' judgment of the credibility of digital health information based on their perceptions of its trustworthiness and reliability

(Metzger et al., 2003). The current study adapted Flanagin and Metzger's (2013) items measuring perceived credibility (three items; 1 = Strongly Disagree, 5 = Strongly Agree).

- **Digital Health Usefulness:** Digital health usefulness represents an individual's personal perceptions of the value and ease of using digital health information. Measurement items are adapted to the digital health and wellness context from Venkatesh et al.'s (2012) performance and effort expectancy measures (five items; 1 = Strongly Disagree, 5 = Strongly Agree).
- **Digital Health Information Seeking:** This construct measures an individual's frequency of using information from two distinct categories of digital health information across ten specific digital health information resources. Although all questions related to this variable are original in nature, a review of the literature and the qualitative process previously outlined helped identify the specific types of health and wellness digital media consumers may integrate. Scale points were adapted from Borrero et al. (2014) for frequency of use (1 = Never Use, 5 = Frequently Use).
  - **Provider-Related:** Two sources of digital health information controlled by the health provider or health care organization (i.e. provider's website and electronic health records).
  - **External:** Eight sources of digital health information from external sources not controlled by health providers (i.e. social media, health blogs, and videos).
- **Health Behavior Changes:** This measure sums five dummy variables (0 = No, 1 = Yes) to assess whether individuals reported making health and wellness improvements to their diet and physical activity in the past 12 months. The five actions included (1) ate a healthier diet, (2) increased exercise or physical activity, (3) participated in a weight loss competition or program, (4) reduced sugary beverages, and (5) participated in a run, walk, or bike event

(ranged from 0 to 5). Prior research shows changes to diet and physical activity are important to preventative health and wellness (Ferrer et al., 2016; Goldstein et al., 2004; Willett & Stampfer, 2013), have positive effects on overall health (Parekh et al., 2012), and other health outcomes (Bray & Bouchard, 2014; Fleig et al., 2011; Villareal et al., 2011). Although self-reported, the value co-creation literature indicates consumers ultimately determine the health value created from the health service delivery process (Grönroos, 2011; Grönroos & Ravald, 2011; Grönroos & Voima, 2013). Although using an index variable may result in biased or inconsistent estimators of coefficients, Bollen and Bauldry (2011) suggested using the index as a dependent variable will result in less severe biasing effects and argued it is acceptable to use such measures in SEM.

- Overall Health: Health value co-creation addresses individuals' perceptions of their physical and mental well-being (Vargo et al., 2008). Prior research indicates consumers' perceptions of their physical and mental well-being can more accurately predict actual health status and other health risk factors not captured by body mass index (Idler & Benyamini, 1997; Kaplan & Camacho, 1983). Notably, the extant health literature demonstrates that consumers' mental well-being can help protect consumers against illness, prevent unnecessary hospital visits, and reduce premature mortality in conjunction with improvements to consumers' physical health (Galloway & Henry, 2014; Stewart-Brown, 1998). For this two-item measure, respondents rated their overall physical health and overall emotional or mental health (1 = Poor, 5 = Excellent). The items were adapted from the Behavioral Risk Factor Surveillance System and other health research (Brown et al., 2003; Houston & Allison, 2002).

### **Control Variables**

Prior research on health information seeking suggests demographic factors such as gender and age along with individuals' socio-economic status all may impact the amount of health information seeking that takes place (Anker et al., 2011; Kim, 2015). Specifically, younger, more affluent, female consumers tend to engage in more digital health information seeking (Nölke et al., 2015). Research also shows the presence of chronic health conditions leads to more digital health information seeking (Ayers & Kronenfeld, 2007). Although research suggests there is a narrowing digital divide due to the rise of new digital health resources accessible to an expanding audience (Helander, Kaipainen, Korhonen, & Wansink, 2014; Lustria et al., 2011), the current study controls for potential socio-economic influences including consumers' gender, age, presence of chronic conditions, education, income, and insurance coverage.

### **Data Analysis Procedures**

The following section provides an overview of the data analysis methods employed in this study. Beyond basic descriptive statistics, the hypothesis testing across the five models used both multivariate multiple regression and SEM. Additionally, a common marker variable was added to the measurement model to check for common method bias. Table 7 outlines the various data analysis procedures used across the five models.

Table 7  
*Data Analysis Procedures*

Stage	Data Analysis Methods	Key Statistics
Measurement Model and Scale Development	Confirmatory Factor Analysis (CFA)	GFI, AGFI, CFI, NFI > .90; RMSEA < .08; Standardized Regression Weights
	Scale Reliability	Cronbach $\alpha$ > .7
	Convergent Validity	AVE > .5
	Discriminant Validity	MSV < AVE and ASV < AVE for each construct
	Descriptive Statistics	Standard deviation, means, and correlations for constructs
Model 1 Hypothesis Testing	Multivariate Multiple Linear Regression	Wilk's $\lambda$ ; Beta Coefficients; $R^2$
Models 2-5 Hypothesis Testing	Structural Equation Models (SEM) in AMOS	Measurement Fit: GFI, AGFI, CFI, NFI > .90; RMSEA < .08 Standardized Regression Weights

*Note.* GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation; AVE = average variance extracted; MSV = maximum shared variance; ASV = average shared variance.

**Measurement model and scale development.** First, EFA and CFA were used to identify the measurement model. AMOS 23 software was used to conduct the CFA to validate measure unidimensionality (Churchill, 1979). Following Anderson and Gerbing (1988), the measurement model was estimated by requiring each of the items to load on their a priori specified factors, with each factor allowed to correlate with the other factors. The measurement demonstrates good model fit and exceeds the .90 cutoffs for goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and normed fit index (NFI) outlined by Bentler and Bonett (1980). Additionally, the root mean square error of approximation (RMSEA) and its confidence interval were less than the .08 cutoff suggested by Hair Jr., Black, Babin, Anderson, and Tatham (2006). Significance tests of the individual item loadings followed the process outlined by Mathwick and Rigdon (2004). Coefficient alpha scores for all the interval scaled dimensions also exceeded the .7 benchmark (Hair Jr. et al., 2006; Nunnally, 1978) established for construct reliability for exploratory scales. Finally, discriminant and convergent validity were calculated with each construct having an average variance extracted (AVE) > .50, thus establishing convergent validity (Fornell & Larcker, 1981). Discriminant validity was established by verifying the maximum shared variance (MSV) and average shared variance (ASV) are both less than the AVE for each construct.

**Model 1 hypothesis testing.** Varimax rotation factor scores were generated using SPSS 24 to test Model 1. Multivariate multiple linear regression was used to test H1-H6 to determine the overall significance and differential main effects of the six independent factors and six controls presented in Model 1. Multivariate multiple linear regression allowed for simultaneous analysis of a regression model with two or more outcome variables and for testing of coefficients across the equations to examine the differential effects using Wilk's  $\lambda$  (Ho, 2014). Factor scores

for the six dimensions were calculated and saved using exploratory factor analysis (EFA) with Varimax rotation in SPSS. Equation 1 (1) shows the multivariate regression equation for provider-related digital health information seeking, while Equation 2 (2) shows the equation for the dependent variable external digital health information seeking. Gender, age, education, income, presence of chronic conditions, and insurance represent control variables in the model and are noted in italics in both equations.

$$\begin{aligned} \text{Provider-Related Digital Health Information Seeking} = & \beta_{0a} + \beta_{1a}\text{PhysiciansSDM} + \\ & \beta_{2a}\text{Accountability} + \beta_{3a}\text{Self-Awareness} + \beta_{4a}\text{PhysiciansDigitalInfluence} + \beta_{5a}\text{Credibility} + \\ & \beta_{6a}\text{UsefulnessDigital} + \beta_{7a}\textit{Gender} + \beta_{8a}\textit{Age} + \beta_{9a}\textit{Education} + \beta_{10a}\textit{Income} + \\ & \beta_{11a}\textit{Chronic} + \beta_{12a}\textit{Insurance} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{External Digital Health Information Seeking} = & \beta_{0b} + \beta_{1b}\text{PhysiciansSDM} + \\ & \beta_{2b}\text{Accountability} + \beta_{3b}\text{Self-Awareness} + \beta_{4b}\text{PhysiciansDigitalInfluence} + \beta_{5b}\text{Credibility} + \\ & \beta_{6b}\text{UsefulnessDigital} + \beta_{7b}\textit{Gender} + \beta_{8b}\textit{Age} + \beta_{9b}\textit{Education} + \beta_{10b}\textit{Income} + \\ & \beta_{11b}\textit{Chronic} + \beta_{12b}\textit{Insurance} \end{aligned} \quad (2)$$

**Models 2-5 hypothesis testing.** Hypothesis testing for Models 2-5 was conducted using SEM path analysis in AMOS 23 with each individual survey item loaded on its related construct. Unlike regression analysis, SEM path analysis allows for simultaneous testing of the measurement and structural models including complex models with multiple exogenous and endogenous variables (Hair Jr., Black, Babin, & Anderson, 2010). Specifically, SEM uses maximum likelihood to estimate model and parameter values resulting in the best fit and least difference between the sample and population covariance matrices (Hoyle, 2012b). Consequently, SEM allows researchers to test models with complex mediating interrelationships that incorporate the use of latent constructs with measurement errors. SEM path analysis requires strong theoretical basis for identifying relationships from exogenous to endogenous variables and requires a multi-step implementation process involving a priori model specification, estimation, model fit evaluation, respecification, and finally data interpretation



(Hoyle, 2012a). The data analysis procedures used SEM path analysis with each individual observed survey item loaded on its related latent construct (hereafter referred to as full SEM). The primary advantage of using full SEM path analysis is the capability of testing structural models with multiple latent factors (Ho, 2014).

**Other methodology concerns.** Two concerns arise from the data collection methods. First, non-response bias is a potential issue due to the data collection method. Second, common method bias is also a possible issue since this study used a cross-sectional data collection design to protect respondent anonymity. The following outlines procedures taken to address these potential concerns.

**Non-response bias.** The study included response facilitation techniques to increase the response rate and reduce non-response bias. First, pre-notification occurred to service area residents via press releases to community newspapers and news organizations. Second, multiple visits were made to households who were not home on the first visit on a separate date. Third, households who did not answer the door after multiple visits could mail in a response via a stamped reply envelope left at their front door. Although the procedural steps outlined above were designed to reduce non-response bias, statistical analysis was also employed to check for non-response bias. Two N-BIAS techniques were used during the pre-analysis stage to help check for non-response bias. First, archival analysis allowed respondent demographic data to be compared to the averages of the prior five years' responses to the health care organization's community survey (Rogelberg & Stanton, 2007). The archival analysis showed a consistent respondent profile relative to the prior door-to-door survey results (see Table 4). Second, wave analysis was used to check for differences between responses collected door-to-door (group 1) versus mailed-in responses (group 2). No significant differences existed across the psychosocial

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constructs when comparing door-to-door versus mailed-in responses (see Table 8). Finally, cross-tabulations compared the respondent demographic profile of the door-to-door versus mailed-in responses (see Table 9). No significant differences existed, although education was close ( $p < .051$ ) and indicates door-to-door respondents were more likely to include individuals with only a high school degree, GED, or less.

Table 8

*Wave Analysis of Constructs – Comparison of Means*

	<b>Mean Difference Between Groups</b>	<b>Standard Error</b>	<b><i>p</i>-values</b>
Physicians' SDM-Orientation	0.0756	0.1038	.467
Health Accountability	0.0161	0.1103	.884
Health Self-Awareness	0.1734	0.1027	.092
Physicians' Digital Influence	0.1694	0.1012	.095
Digital Credibility	-0.1062	0.1089	.330
Digital Usefulness	0.0376	0.0970	.698
Health Changes	0.1734	0.1856	.351
Provider-Related Digital	-0.0484	0.1685	.774
External Digital	0.0992	0.1369	.469
Overall Health	0.1734	0.2268	.445

*Note.* SDM = shared decision-making.

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Table 9

*Wave Analysis of Respondent Demographics - Crosstabs*

	<b>Pearson Chi-Square</b>	<b><i>p</i>-values</b>
Location (Rural vs. Urban)	0.279	.597
Gender (Male vs. Female)	0.829	.363
Age (18-54 vs. 55+)	0.171	.679
Went to see primary care provider in past 12 months	0.005	.944
Insurance Coverage	0.037	.848
Income (<\$50,000 vs. >\$50,000)	2.236	.135
Education	5.969	.051
Parental Status	1.344	.246
Presence of Chronic Conditions	1.177	.278

***Common method bias.*** Common methods variance is another concern with the research design especially in terms of common rater effects and measurement context effects (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Procedural methods to minimize common methods bias applied to the research design included the use of an anonymous survey and separation of the constructs of interest via the survey design. A cross-sectional design helped reduce social desirability bias related to health behaviors and was preferred due to anonymity concerns. Although procedural steps were employed to prevent common methods bias, it is not possible to eliminate all sources of potential common methods bias given the objectives of this consumer-focused research. Therefore, two post-hoc statistical techniques were used to check for common methods variance following the procedures outlined by Podsakoff et al. (2003). Specifically, the statistical procedures included (a) Harman's single-factor method to determine if the variance is largely attributed to one factor and (b) a common latent factor (CLF) in the CFA.

### **Results**

The following chapter provides statistical analysis of the cross-sectional survey including an EFA, multivariate regression, CFA measurement model, and structural path models. EFA and multivariate regression were used for Model 1 to examine the differential effects of six psychosocial constructs on two types of digital health information seeking. AMOS 23 was used to create the measurement model and structural path models for Models 2-5. Finally, bootstrapping, composite-based SEM, and the PROCESS SPSS macro analysis provided robustness checks. The following sections present the EFA and measurement model first, followed by the hypothesis testing of Models 1-5.

#### **Exploratory Factor Analysis (EFA)**

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An EFA with Varimax rotation in SPSS was used to identify the relevant psychosocial dimensions based on eigenvalues  $>1.0$ . Six factor dimensions surfaced that explain 73.3% of the variance. Coefficient alpha scores for all the interval scaled dimensions exceeded .77, meeting the .70 benchmark (Hair Jr. et al., 2006; Nunnally, 1978) established for construct reliability for an exploratory scale. Table 10 shows the results of the rotated component matrix for the six constructs along with the coefficient alpha scores. Table 11 provides the descriptive statistics, variable correlations, and significance levels for the six psychosocial factors and two types of digital health information seeking used in Model 1.

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Table 10  
*Exploratory Factor Analysis Rotated Component Matrix for Model 1*

	Factors					
	Physicians' SDM ( $\alpha = .960$ )	Health Accountability ( $\alpha = .886$ )	Digital Usefulness ( $\alpha = .870$ )	Digital Credibility ( $\alpha = .964$ )	Physicians' Digital Influence ( $\alpha = .941$ )	Health Self Awareness ( $\alpha = .770$ )
Works with me to make health-related decisions	.884					
Empowers me to make decisions related to my health	.869					
Speaks positively of different health information sources	.868					
Informs me of different options for improving my health	.856					
Encourages me to take an active role in my health decisions	.854					
Identifies specific health information sources I should use	.846					
Recommends I seek out more information about my health	.845					
Asks how involved I want to be in making my health decisions	.816					
I work hard to participate in my health decisions		.793				
I put a lot of effort into making good health decisions		.789				
I know when to seek advice/professional help related to my health		.704				
I give my health provider accurate information about my health		.696				
I openly discuss my health status with my provider		.681				
Living life in the best possible health is very important to me		.673				
I regularly follow all of my health provider's advice		.664				
Good health takes active participation on my part		.602				
Gives me greater control over my health decisions			.819			
Is useful for motivating me to achieve my health goals			.768			
Overall, I find it easy to use online/digital health information			.734			
Is useful for emotional and social support on health issues			.701			
Is useful for acquiring relevant health information			.700			
Online health information is just as credible as other sources				.912		
Online health information is as reliable as other sources				.909		
Online health information is as trustworthy as other sources				.886		
Is something my provider gives me specific recommendations on					.860	
Is something my provider encourages me to use					.790	
Is something my provider believes is valuable for my health					.783	
I'm concerned about my health all the time						.850
I think about my health a lot						.800
I'm very self-conscious about my health						.739

Note. SDM = shared decision-making. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in seven iterations.

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Table 11

*Descriptive Statistics, Variable Correlations, and Significance Levels for Model 1*

	Mean	Standard Deviation	Physicians' SDM- Orientation	Health Accountability	Health Self- Awareness	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider- Related Digital	External Digital
Physicians' SDM-Orientation	3.73	0.72	1							
Health Accountability	3.98	0.55	.425**	1						
Health Self-Awareness	3.38	0.73	.013	.279**	1					
Physicians' Digital Influence	3.05	0.71	.298**	.207**	.194**	1				
Digital Credibility	3.02	0.77	.133*	.192**	.092	.412**	1			
Digital Usefulness	3.34	0.62	.170**	.250**	.177**	.556**	.520**	1		
Provider-Related Digital	2.22	1.19	.232**	.255**	.040	.167**	.199**	.313**	1	
External Digital	1.87	0.98	-.056	.139*	.115*	.179**	.081	.409**	.467**	1

*Note.* SDM = shared decision-making

\*  $p < .05$ . \*\*  $p < .01$ .



## Measurement Model

**Model fit.** Figure 6 presents the final measurement model used for Models 2-5.

Although the chi-square minimum discrepancy (CMIN) divided by its degrees of freedom (DF) or CMIN/DF is less than the suggested value of 3.0, the overall Chi square statistic for the measurement model was significant ( $\chi^2 = 230.820$ ,  $DF = 162$ ,  $CMIN/DF = 1.425$ ,  $p < .001$ ).

However, the significant  $p$ -value result may be due to a larger sample size. Additionally, the other model fit statistics suggested a good model fit. Each of the following indices were above the .90 cutoffs suggested by Bentler and Bonett (1980), including the goodness of fit index (GFI = .933), adjusted goodness of fit index (AGFI = .905), comparative fit index (CFI = .987), and normed fit index (NFI = .957). Finally, the root mean square error of approximation (RMSEA = .037) and its confidence interval (CI=.025 to .048) were less than the .08 cutoff suggested by Hair Jr. et al. (2006). Of note, the CFI index of .987 also met Hu and Bentler's (1999) higher suggested cutoff of .95. In combination, these indices suggested a satisfactory model fit, allowing a valid test of the model. In line with the process Mathwick and Rigdon (2004) outlined, all the individual item loadings were significant ( $p < .001$ ), and the completely standardized solution for all items ranged from .722 to .975 (see Table 12). These results met the minimum guidelines of .5, with all 21 standardized loadings above the preferred .7 guideline (Cortina, 1993). The AVE value was .750, and each construct had an AVE  $> .617$ , meeting Fornell and Larcker's (1981) convergent validity criterion of .5. In order to assess discriminant validity, construct values for MSV, ASV, and AVE were compared to verify  $MSV < AVE$  and  $ASV < AVE$  for each of the constructs (see Table 13). Table 14 reports the construct means, standard deviations, and correlations for the reduced scales using the CFA measurement model.

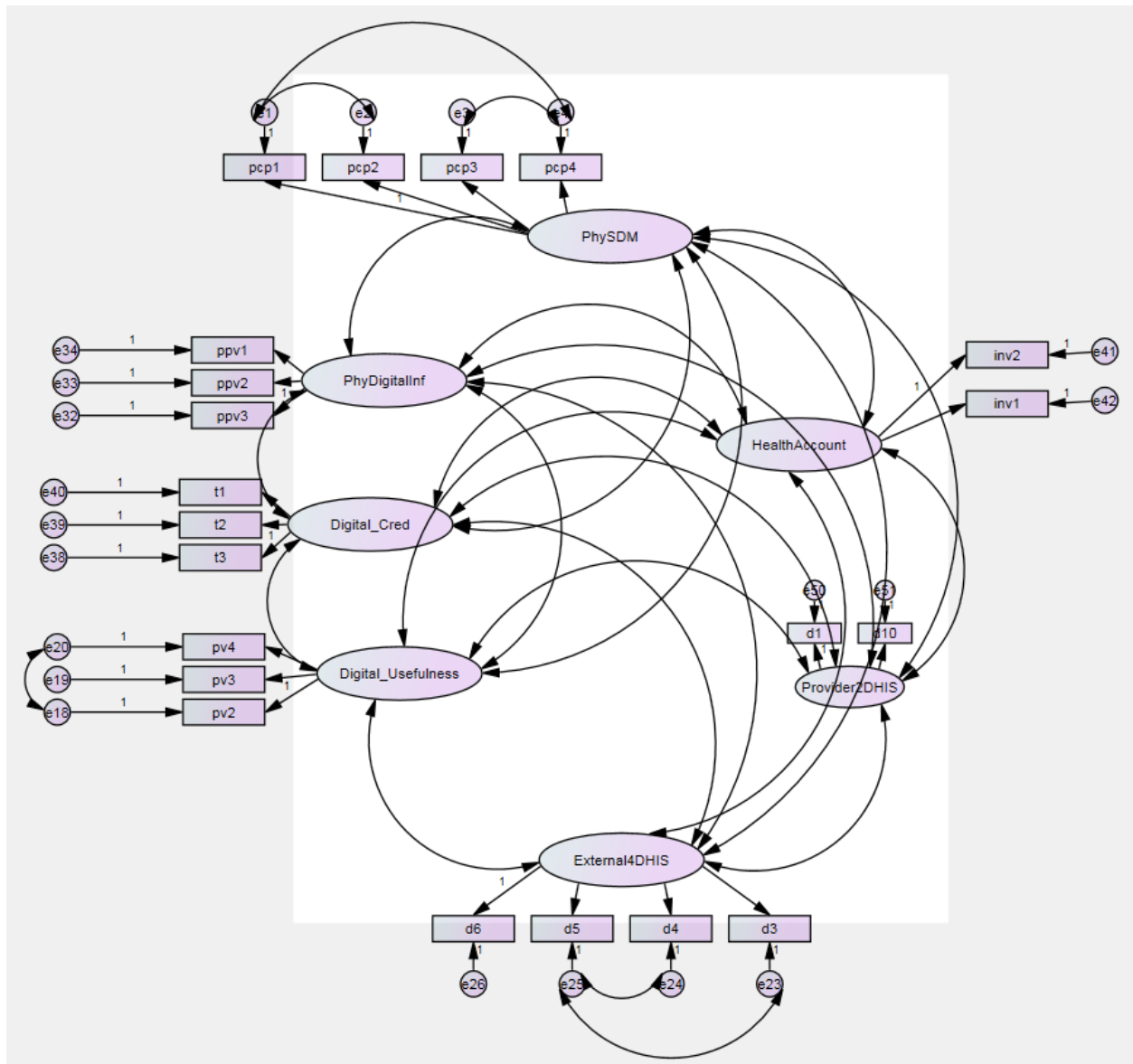


Figure 6. Confirmatory factor analysis measurement model.

Table 12  
*Standardized Factor Loadings of Measurement Model*

Construct and Measurement Item	Standardized Loadings	p-value
<b><i>Physicians' SDM-Orientation</i></b>		
Informs me of different options for improving my health	.903	.001
Works with me to make health-related decisions	.942	.001
Encourages me to take an active role in my health decisions	.890	.001
Empowers me to make decisions related to my health	.901	.001
<b><i>Health Accountability</i></b>		
I work hard to participate in my health decisions	.874	.001
I put a lot of effort into making good health decisions	.898	.001
<b><i>Physicians' Digital Influence</i></b>		
Is something my provider encourages me to use	.928	.001
Is something my provider gives me specific recommendations on	.940	.001
Is something my provider believes is valuable for my health	.872	.001
<b><i>Digital Credibility</i></b>		
Online health information is as trustworthy as other sources	.891	.001
Online health information is just as credible as other sources	.975	.001
Online health information is as reliable as other sources	.962	.001
<b><i>Digital Usefulness</i></b>		
Is useful for emotional and social support on health issues	.802	.001
Is useful for motivating me to achieve my health goals	.844	.001
Gives me greater control over my health decisions	.821	.001
<b><i>Provider-Related Digital Health Information Seeking</i></b>		
My health provider's website	.722	.001
Electronic/online health records	.844	.001
<b><i>External Digital Health Information Seeking</i></b>		
Health/wellness blogs	.824	.001
Social media sites that share health/wellness info	.808	.001
Online health/wellness community or forum	.745	.001
Health/wellness videos on YouTube or other sites	.767	.001

*Note.* SDM = shared decision-making

Table 13  
*Scale Reliability and Validity Statistics*

	<b><math>\alpha</math></b>	<b>AVE</b>	<b>MSV</b>	<b>ASV</b>
Physicians' SDM-Orientation	.954	.827	.141	.050
Health Accountability	.880	.785	.141	.064
Physicians' Digital Influence	.937	.835	.350	.127
Digital Credibility	.959	.890	.269	.099
Digital Usefulness	.843	.677	.350	.176
Provider-Related DHIS	.750	.617	.327	.108
External DHIS	.878	.619	.327	.143

*Note.*  $\chi^2 = 230.820$ ; DF = 162; GFI = .933; AGFI = .905; CFI = .987; NFI = .957; RMSEA = .037. SDM = shared decision-making; DHIS = digital health information seeking; AVE = average variance extracted; MSV = maximum shared variance; ASV = average shared variance; DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

# PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN

Table 14

*Descriptive Statistics, Variable Correlations, and Significance Levels*

	Mean	Standard Deviation	Physicians' SDM- Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider- Related Digital	External Digital
Physicians' SDM-Orientation	3.88	0.73	1						
Health Accountability	3.92	0.78	.343**	1					
Physicians' Digital Influence	3.05	0.71	.202**	.195**	1				
Digital Credibility	3.02	0.77	.085	.155**	.412**	1			
Digital Usefulness	3.25	0.68	.099	.172**	.545**	.485**	1		
Provider-Related Digital	2.22	1.19	.267**	.227**	.167**	.199**	.238**	1	
External Digital	1.87	0.98	.015	.213**	.293**	.237**	.476**	.467**	1

*Note.* SDM = shared decision-making.

\*  $p < .05$ . \*\*  $p < .01$ .

**Common method bias.** Procedurally, the research design attempted to minimize common methods bias by using an anonymous survey and separating the constructs of interest on the survey. However, it was not possible to eliminate all potential sources of common methods bias given the use of a cross-sectional design to minimize social desirability bias. Two post-hoc statistical techniques were used to check for common methods variance following the procedures outlined by Podsakoff et al. (2003). First, Harman's single-factor method was conducted to determine if the single factor accounted for most of the variance. Using an EFA with no rotation, the single factor explained only 28.7% of the variance suggesting common method variance was not an issue. Next, a CLF was created in the CFA. Each individual item was allowed to load on its latent construct and the CLF. Two methods were used to analyze the results of the CFA with CLF following Gaskin's (2012) recommendations. First, each path was constrained and the square of the common variance was calculated as  $.32^2$  or  $.1024$ . Second, the deltas of the standardized regression weights were calculated by subtracting the betas from the CFA model without the CLF from the betas obtained from the CFA model with the CLF (see Table 15). No deltas were greater than the .2 cutoff suggested by Gaskin (absolute values of the deltas ranged from .003 to .077). Based on the two statistical techniques, common method bias does not appear to be a concern. Therefore, the final measurement model and path models did not control for common method bias.

Table 15

*Comparison of Confirmatory Factor Analysis With and Without Common Latent Factor (CLF)*

Construct and Measurement Item	Standard Estimates No CLF	Standard Estimates With CLF	Delta
<b><i>Physicians' SDM-Orientation</i></b>			
Informs me of different options for improving my health	.903	.926	-.023
Works with me to make health-related decisions	.942	.974	-.032
Encourages me to take an active role in my health decisions	.890	.862	.028
Empowers me to make decisions related to my health	.901	.871	.030
<b><i>Health Accountability</i></b>			
I work hard to participate in my health decisions	.898	.884	.014
I put a lot of effort into making good health decisions	.874	.846	.028
<b><i>Physicians' Digital Influence</i></b>			
Is something my provider encourages me to use	.928	.925	.003
Is something my provider gives me specific recommendations on	.940	.945	-.005
Is something my provider believes is valuable for my health	.872	.869	.003
<b><i>Digital Credibility</i></b>			
Online health information is as trustworthy as other sources	.891	.876	.015
Online health information is just as credible as other sources	.975	.986	-.011
Online health information is as reliable as other sources	.962	.947	.015
<b><i>Digital Usefulness</i></b>			
Is useful for emotional and social support on health issues	.802	.859	-.057
Is useful for motivating me to achieve my health goals	.844	.813	.031
Gives me greater control over my health decisions	.821	.785	.036
<b><i>Provider-Related Digital Health Information Seeking</i></b>			
My health provider's website	.722	.662	.060
Electronic/online health records	.844	.767	.077
<b><i>External Digital Health Information Seeking</i></b>			
Health/wellness blogs	.824	.769	.055
Social media sites that share health/wellness info	.808	.771	.037
Online health/wellness community or forum	.745	.694	.051
Health/wellness videos on YouTube or other sites	.767	.800	-.033

*Note.* SDM = shared decision-making.

### Model 1: Multivariate Regression Results

The multivariate regression results outlined the relationships between the six factors and digital health information seeking. Additionally, gender, age, income, education, insurance coverage, and chronic conditions were used as control variables. The analyses included individual regressions for provider-related digital health information seeking and external digital health information seeking to test the 18 hypothesized relationships from Model 1. Overall, 12 of the 18 hypothesized relationships were significant, including four of the six differential hypotheses. The following section provides a discussion first of the individual regression results, followed by the differential effects.

Table 16 shows results of the multivariate regression for provider-related and external digital health information seeking. The individual regressions for provider-related and external digital health information seeking were used to test the main effect hypothesized relationships (H1a, H1b...H6a, H6b), while Wilk's  $\lambda$  was used to test the third hypothesis for each psychosocial factor (H1c...H6c). The following sections discuss the univariate and multivariate results. Table 17 provides a summary of hypothesis testing for Model 1.

**Model 1: Provider-related digital health information seeking.** Table 16 provides the multiple regression results for provider-related digital health information seeking using a one-tailed significance test to reflect the directional hypotheses. The overall model was significant ( $F = 5.491$ ;  $p < .001$ ) and the model explained 20.4% of the variation in provider-related digital health information seeking. Three of the six hypothesized positive, direct effects on provider-related digital health information seeking were supported. Physicians' SDM-orientation ( $\beta_{1a} = 0.247$ ;  $p < .001$ ; H1a supported), personal health accountability ( $\beta_{2a} = 0.185$ ;  $p < .050$ ; H2a supported), and digital usefulness ( $\beta_{6a} = 0.328$ ;  $p < .001$ ; H6a supported) were all positive and in the



hypothesized direction. However, health self-awareness ( $H3a$ ;  $\beta_{3a} = -0.014$ ;  $p > .050$ ), physicians' digital influence ( $H4a$ ;  $\beta_{4a} = 0.044$ ;  $p > .050$ ), and digital credibility ( $H5a$ ;  $\beta_{5a} = 0.062$ ;  $p > .050$ ) did not have significant relationships with provider-related digital health information seeking. Therefore,  $H3a$ ,  $H4a$ , and  $H5a$  were not supported. Gender, age, income, education, chronic conditions, and insurance coverage were included as control variables. However, none of the control variables had significant relationships with provider-related digital health information seeking.

**Model 1: External digital health information seeking.** The regression model explained 28.4% of the variance in external digital health information seeking ( $F = 8.477$ ;  $p < .001$ ; see Table 16). Five of the six hypothesized direct effects on external digital health information seeking were supported using a one-tailed significance test. Positive and significant relationships were noted for personal health accountability ( $\beta_{2b} = 0.156$ ;  $p < .010$ ;  $H2b$  supported), health self-awareness ( $\beta_{3b} = 0.137$ ;  $p < .050$ ;  $H3b$  supported), physicians' digital influence ( $\beta_{4b} = 0.161$ ;  $p < .010$ ;  $H4b$  supported), digital credibility ( $\beta_{5b} = 0.100$ ;  $p < .05$ ;  $H5b$  supported), and digital usefulness ( $\beta_{6b} = 0.389$ ;  $p < .001$ ;  $H6b$  supported). However, the physicians' SDM-orientation ( $H1b$ ;  $\beta_{1b} = -0.015$ ;  $p > .050$ ) did not have a significant relationship with external digital health information seeking. Likewise, the control variables, gender, age, income, education, chronic conditions, and insurance coverage did not have significant relationships with external digital health information seeking.

**Model 1: Multivariate tests.** The third hypothesis for each psychosocial factor tested whether there was a stronger association with either provider-related or external digital health information seeking ( $H1c \dots H6c$ ). The Wilk's  $\lambda$  multivariate tests showed that five of the six psychosocial factors have significant differential effects and thus jointly affected provider-related

and external digital health information seeking. Four of the five significant differential effects for the psychosocial dimensions were in the hypothesized direction. First, physicians' SDM-orientation (H1c: Wilks  $\lambda = .938$ ;  $p < .001$ ) and personal health accountability (H2c: Wilks  $\lambda = .965$ ;  $p < .050$ ) both had significantly stronger associations with provider-related digital health information seeking as hypothesized; thus, H1c and H2c were supported. Next, health self-awareness (H3c: Wilks  $\lambda = .969$ ;  $p < .050$ ) and digital usefulness (H6c: Wilks  $\lambda = .831$ ;  $p < .001$ ) both had significantly stronger associations with external digital health information seeking, supporting H3c and H6c.

H4c provided an unexpected finding in regard to physicians' digital influence. H4c was reversed in that physicians' digital influence (H4c: Wilks  $\lambda = .968$ ;  $p < .050$ ) was more strongly associated with external digital health information seeking than provider-related information seeking. The other psychosocial construct, digital credibility (H5c: Wilks  $\lambda = .987$ ;  $p > .050$ ), did not have a significant differential impact on provider-related and external digital health information seeking. Thus, H5c was not supported.

Finally, multivariate tests on the control variables provided additional insight on the potential digital divide for digital health information seeking. Both age (Wilks  $\lambda = .976$ ;  $p < .050$ ) and education (Wilks  $\lambda = .972$ ;  $p < .050$ ) had significant differential effects. Age exhibited a stronger, negative association with external digital information seeking with older patients less likely to seek external digital health information. Education had a stronger, positive association with provider-related digital health information seeking indicating more highly educated individuals are more likely to seek provider-related digital health information. The other control variables (gender, income, chronic conditions, and insurance coverage) did not have differential effects on the two types of digital information seeking.

# PREREQUISITES TO DEVELOPING A HEALTH VALUE CO-CREATION CHAIN

Table 16

*Tests of the Multivariate Regression Hypotheses for Model 1*

Parameter	Multivariate Test Wilks $\lambda$	Provider- Related Digital Std. $\beta$	External Digital Std. $\beta$
Constant	.821***	1.062**	2.083***
Physicians' SDM-Orientation	.938***	0.247***	-0.015
Personal Health Accountability	.965*	0.185*	0.156**
Health Self-Awareness	.969*	-0.014	0.137*
Physicians' Digital Influence	.968*	0.044	0.161**
Digital Credibility	.987	0.062	0.100*
Digital Usefulness	.831***	0.328***	0.389***
Gender	.991	0.198	0.157
Age	.976*	0.046	-0.034
Income	.988	0.073	0.049
Chronic Conditions	.987	0.068	-0.155
Education	.972*	0.172	-0.078
Insurance Coverage	.992	0.259	-0.125
	<b>F-value (sig.)</b>	5.491***	8.477***
	<b>R<sup>2</sup></b>	.204	.284

*Note.* SDM = shared decision-making; Std. = standardized.

\*  $p < .050$ . \*\*  $p < .010$ . \*\*\*  $p < .001$ .

Table 17

*Summary of Model 1 Hypothesis Testing*

	<b>Hypothesized Relationship</b>	<b>Supported</b>
H1a	Physicians' SDM-Orientation ( $\beta_{1a} +$ ) $\rightarrow$ Provider-Related	Yes
H1b	Physicians' SDM-Orientation ( $\beta_{1b} +$ ) $\rightarrow$ External	No
H1c	Physicians' SDM-Orientation $\beta_{1a} > \beta_{1b}$	Yes
H2a	Health Accountability ( $\beta_{2a} +$ ) $\rightarrow$ Provider-Related	Yes
H2b	Health Accountability ( $\beta_{2b} +$ ) $\rightarrow$ External	Yes
H2c	Health Accountability $\beta_{2a} > \beta_{2b}$	Yes
H3a	Health Self-Awareness ( $\beta_{3a} +$ ) $\rightarrow$ Provider-Related	No
H3b	Health Self-Awareness ( $\beta_{3b} +$ ) $\rightarrow$ External	Yes
H3c	Health Self-Awareness $\beta_{3a} < \beta_{3b}$	Yes
H4a	Physicians' Digital Influence ( $\beta_{4a} +$ ) $\rightarrow$ Provider-Related	No
H4b	Physicians' Digital Influence ( $\beta_{4b} +$ ) $\rightarrow$ External	Yes
H4c	Physicians' Digital Influence $\beta_{4a} > \beta_{4b}$	Reversed
H5a	Digital Credibility ( $\beta_{5a} +$ ) $\rightarrow$ Provider-Related	No
H5b	Digital Credibility ( $\beta_{5b} +$ ) $\rightarrow$ External	Yes
H5c	Digital Credibility $\beta_{5a} < \beta_{5b}$	No
H6a	Digital Usefulness ( $\beta_{6a} +$ ) $\rightarrow$ Provider-Related	Yes
H6b	Digital Usefulness ( $\beta_{6b} +$ ) $\rightarrow$ External	Yes
H6c	Digital Usefulness $\beta_{6a} < \beta_{6b}$	Yes

*Note.* SDM = shared decision-making.

**Model 1: Post-hoc statistical power analysis.** Statistical power analysis was completed post-hoc to confirm the sample size was large enough to detect significant effects. The observed statistical power was calculated separately for the two types of digital health information seeking and included the six psychosocial factors and six controls as predictor variables. Table 19 provides the observed statistical power calculated using Soper's post-hoc statistical power calculator at a 95% confidence level (.05 probability level) and the study's sample size ( $N = 310$ ; Soper, 2017). As shown, the observed power was  $>.99$  for both provider-related and external digital health information seeking. Thus, within the context of the current study, the regression model provided enough power to detect significant effects (Cohen, 1988).

Table 18  
*Post-Hoc Statistical Power for Model 1*

	<b>Number of Predictors</b>	<b>Observed <math>R^2</math></b>	<b>Observed Statistical Power</b>
Provider-Related Digital	12	.204	.999
External Digital	12	.284	1.000

*Note.* 95% confidence; N = 310

**Summary discussion of multivariate results and implications.** Integrating informational inputs during the service delivery process represents a core value co-creation process that is also important to providing patient-centered care (Grönroos & Ravald, 2011; Lusch & Vargo, 2011). While informational inputs are a valuable part of the health care SDM process, research suggests physicians prefer to have informational control (Friedberg et al., 2013; Kareklas et al., 2015). However, patients increasingly have access to a variety of digital health information resources including health applications and fitness trackers (Gallant et al., 2011; Pandey et al., 2013). The emergence of these devices and other external digital health informational inputs requires health providers and marketers to consider how facilitating consumers' utilization of provider-related and external digital health information sources differs (Hennig-Thurau et al., 2013; Labrecque et al., 2013). The multivariate results contribute to the literature by identifying how psychosocial constructs differently affect the two types of digital health information seeking.

The results of Model 1 highlight that different considerations are necessary when attempting to facilitate the two types of digital health resource integration. The differential effects on provider-related and external digital health information seeking offer initial insights into how the facilitation process is likely to differ. Health service providers need to be cognizant of how their patient interactions can help facilitate patients' digital information seeking. While the physicians' SDM-orientation had a stronger, positive relationship with provider-related digital information seeking, the physicians' digital influence had a stronger, positive relationship with external digital information seeking. Although counter to the hypothesized relationship, the stronger association between physicians' digital influence and external digital information seeking suggests physicians may be more open to recommending external digital health

information than prior research suggests (Adams, 2010; Moorhead et al., 2013) when it comes to general health and wellness information. Although research advocates for a patient-centered SDM-environment (Grande et al., 2014; Makoul & Clayman, 2006), the multivariate results suggest the two collaborative orientation related constructs (physicians' SDM-orientation and personal health accountability) tend to have a stronger relationship with consumers' provider-related digital health information seeking. This finding suggests health care providers are likely to direct consumers to provider-approved digital information sources during the SDM process, maintaining more of a paternalistic health care service delivery model (Fowler et al., 2013).

Combined with the unexpected result related to physicians' digital influence, these findings imply there is a need to enhance the health provider-controlled digital presence. Gallant et al.'s (2011) content analysis of health providers' websites suggested health marketers are already taking steps to increase the firm's digital presence by linking to a variety of external digital sources. Efforts to integrate relevant and physician-approved external digital resources on e-health portals and the health providers' website, social media, and other digital efforts may help consumers identify appropriate external digital health information resources.

Beyond the physicians' impact, several patient factors also contribute differently to the two types of digital health information seeking. Consequently, health providers and marketers should account for these differences when facilitating consumers' digital health information seeking. First, two patient psychosocial factors differentially affected the two types of digital information seeking. Patients' personal health accountability had a stronger, positive association with provider-related digital health information seeking, while perceptions of digital's usefulness had a stronger, positive association with external digital health information seeking. Health providers should ascertain patients' health accountability and digital health information



usefulness perceptions during patient interactions to better understand how to facilitate patients' integration of digital health information. Additionally, research is needed that further explores how physicians affect the consumers' evaluation of informational inputs along with other factors.

Second, while no differences existed in terms of gender, presence of chronic conditions, or income across either provider-related or external digital health information seeking, there are differential effects based on age and education. Age had a differential impact on the two sources, with a stronger, negative association with external digital information seeking. Meanwhile, education had a stronger, positive association with provider-related digital health information seeking. While not hypothesized, the age and education findings align with some of the prior research on a digital divide. While research suggests the digital divide in terms of health information seeking in general is narrowing (Lustria et al., 2011), the multivariate results indicated a divide may exist in terms of the types of digital health information sources to which patients turn.

In combination, the findings from the multivariate regression analysis offer several implications for health marketers and providers. From a consumer welfare and public policy perspective, health providers and policymakers need to account for these demographic differences in order to help older and less educated patients identify appropriate external digital health information sources. Research suggests health care providers should act as digital information hubs (Baird & Nowak, 2015) and direct patients to relevant digital information sources (Rains, 2014; Rains & Karmikel, 2009). Importantly, this aligns with the foundational premises of SDL, suggesting health providers need to help facilitate integration of operant resources such as patients' digital information seeking (Grönroos & Ravald, 2011). In combination, understanding how the different psychosocial and demographic characteristics

affect digital health information seeking should lead to added value from the service encounter (Grönroos & Voima, 2013).

Digital credibility affected both sources of digital health information equally and had a significant direct relationship with external digital health information seeking. Prior research suggests credibility plays a vital role in assessing information sources (N. Xiao et al., 2014). Consumers may possess different credibility perceptions specific to the two types of digital health information seeking. Further research is necessary which investigates how specific credibility perceptions differ between the two types. Although the findings point to the differential effects on the two types of digital health information seeking, research is also needed that further explores how this process unfolds and how health marketers or health care service providers might directly and indirectly influence these psychosocial factors. In particular, research that explores the process through which health providers and marketers might influence consumers' health accountability and perceptions of digital health information's usefulness is of value.

### **Model 2: SEM Path Results**

Model 2 examined the antecedents of facilitating and integrating consumers' external digital health information seeking in the health decision-making process. Model 2 included 17 hypothesized direct and indirect relationships leading to external digital health information seeking. Full SEM path analysis with bootstrapping was conducted using AMOS 23 with each individual survey item loaded on its related construct. The primary advantage of using full SEM path analysis is the capability of testing structural models with multiple latent factors (Ho, 2014). Bootstrapping the sample allows for significance testing of the total, direct, and indirect

standardized effects. The bootstrapping method used 2000 bootstraps with 95% bias-corrected confidence intervals.

The GFI (.932) and AGFI (.906) met the minimum threshold requirements for a satisfactory model (Baumgartner & Homburg, 1996; Bentler & Bonett, 1980). Although the Chi square statistic is significant, this may be due to the larger sample size ( $\chi^2 = 233.963$ ,  $DF = 166$ ,  $CMIN/DF = 1.409$ ,  $p < .001$ ). Other fit indices ( $CFI=.987$ ,  $NFI=.957$ ,  $RMSEA=.036$ ) indicated that the model fits the data and presented a logical basis to test the theorized relationships (Hair Jr. et al., 2006; Hu & Bentler, 1999). Finally, alternative models were tested by varying the ordering of latent constructs, reversing directional paths, and adding or eliminating paths. None of the alternative models performed as well as Model 2 or aligned better with SDL theory (Blunch, 2008).

Overall, 12 of the 17 hypothesized relationships in Model 2 were significant and in the hypothesized direction using one-tailed directional significance tests. However, one relationship was counter to expectations. Table 19 provides the structural model parameter estimates and corresponding  $t$ -values, while Figure 7 shows the reduced model with significant pathways.

**Model 2: Direct effects.** Three of the six direct effects on external digital health information seeking were positive and significant as hypothesized. Health accountability ( $H_{2B}$ :  $\beta = .118$ ,  $p < .023$ ), digital usefulness ( $H_{6B}$ :  $\beta = .459$ ;  $p < .001$ ), and provider-related digital health information seeking ( $H_{13}$ :  $\beta = .501$ ;  $p < .001$ ) each had positive, direct relationships with external digital health information seeking. Unexpectedly, physicians' SDM-orientation ( $H_{1B}$ :  $\beta = -.227$ ;  $p < .001$ ) had a negative, direct relationship with external digital health information seeking. However, the total standardized effects of physicians' SDM-orientation ( $\beta = .026$ ) on external digital health information seeking was positive. The bootstrap analysis results also demonstrated

physicians' SDM-orientation had a positive, indirect influence on consumers' external digital health information seeking that cancels out the negative, direct effect. Finally, the direct paths from physicians' digital influence ( $H_{4B}$ :  $\beta = .040$ ;  $p > .050$ ) and digital credibility ( $H_{5B}$ :  $\beta = -.116$ ;  $p > .050$ ) to external digital health information seeking were not supported.

**Model 2: Indirect effects.** Nine of the 11 hypothesized indirect pathways were supported. First, all three of the hypothesized indirect effects from physicians' SDM-orientation were supported. The physicians' SDM-orientation had a positive path to provider-related digital health information seeking ( $H_{1a}$ :  $\beta = .225$ ;  $p < .001$ ), health accountability ( $H_7$ :  $\beta = .379$ ;  $p < .001$ ), and physicians' digital influence ( $H_8$ :  $\beta = .159$ ;  $p < .007$ ). Second, health accountability's two hypothesized indirect pathways were both supported. Health accountability had a positive pathway to provider-related digital health information seeking ( $H_{2a}$ :  $\beta = .152$ ;  $p < .018$ ) and physicians' digital influence ( $H_9$ :  $\beta = .158$ ;  $p < .009$ ). Third, two of the three hypothesized indirect pathways from physicians' digital influence were supported. Physicians' digital influence had a significant positive path to digital credibility ( $H_{10}$ :  $\beta = .430$ ;  $p < .001$ ) and digital usefulness ( $H_{12}$ :  $\beta = .453$ ,  $p < .001$ ). However, the hypothesized indirect path from physicians' digital influence to provider-related digital information seeking was not significant ( $H_{4a}$  not supported). In terms of digital credibility's indirect effects, only one of the two hypothesized relationships was significant. Digital credibility had a significant, positive indirect pathway to digital usefulness ( $H_{11}$ :  $\beta = .324$ ,  $p < .001$ ), but an insignificant pathway to provider-related digital information seeking ( $H_{5a}$  not supported). This indicates digital credibility's impact on both types of digital health information seeking is fully mediated by the perceptions of digital usefulness. Finally, digital usefulness had a positive, significant path to provider-related digital information seeking ( $H_{6a}$ :  $\beta = .229$ ,  $p < .007$ ).

**Model 2: Bootstrap analysis.** Bootstrap analysis of the structural path model was used to identify the total, direct, and indirect effects and test for full or partial mediation. Table 20 provides the bootstrapped estimates using 95% bias-adjusted confidence intervals (2,000 samples, bootfactor = 4). The bootstrapped results provided further insight on the unexpected negative relationship from physicians' SDM-orientation to external digital health information seeking. Both the direct ( $\beta = -.227$ ;  $p < .001$ ) and indirect ( $\beta = .253$ ;  $p < .001$ ) effects of physicians' SDM-orientation on external digital health information seeking were statistically significant. While both the direct and indirect effects were significant, the bootstrap results indicated the physicians' SDM-orientation's total effect ( $\beta = .026$ ;  $p > .050$ ) on external digital health information seeking was not significant. This suggests a complex relationship may exist in terms of a physicians' SDM-orientation and digital health information seeking.

Additionally, the bootstrap analysis confirmed that digital health usefulness fully mediated the effects of digital credibility and physicians' digital influence on both types of digital health information seeking. The direct effects for both the physicians' digital influence and digital credibility on the two types of digital health information seeking were not significant. However, the physicians' digital influence and digital credibility both had positive, significant indirect effects on provider-related and external digital health information seeking.

Physicians who establish an SDM-friendly environment are likely to focus on evidence-based informational inputs and thus may express cautious views toward patients' external digital health information seeking (Stiggelbout et al., 2015). However, by recommending specific digital resources both on providers' controlled digital platforms and externally, along with encouraging patients to be more involved in the SDM process, physicians may counterbalance any negative views they express toward consumers' utilization of external digital health

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resources. Combined, the results demonstrate that physicians, health marketers, and others are likely to have an impact on the consumers' evaluation process of digital health information inputs through efforts that help establish the relevance and usefulness of the digital health resources available to consumers.

Table 19

*Tests of the SEM Path Hypotheses for Model 2*

Hypotheses and Paths				Standardized Coefficient	t-value	p-value
<b>Direct Paths to External Digital Health Information Seeking (DHIS)</b>						
H1b	Physicians' SDM-Orientation	→	External DHIS	-.227	-3.801	.001
H2b	Health Accountability	→	External DHIS	.118	1.999	.023
H4b	Physicians' Digital Influence	→	External DHIS	.040	0.583	n.s.
H5b	Digital Credibility	→	External DHIS	-.116	-1.899	n.s.
H6b	Digital Health Usefulness	→	External DHIS	.459	5.527	.001
H13	Provider-Related DHIS	→	External DHIS	.501	6.781	.001
<b>Indirect Paths to External DHIS</b>						
H1a	Physicians' SDM-Orientation	→	Provider-Related DHIS	.225	3.152	.001
H2a	Health Accountability	→	Provider-Related DHIS	.152	2.103	.018
H4a	Physicians' Digital Influence	→	Provider-Related DHIS	-.092	-1.096	n.s.
H5a	Digital Credibility	→	Provider-Related DHIS	.099	1.329	n.s.
H6a	Digital Health Usefulness	→	Provider-Related DHIS	.229	2.485	.007
H7	Physicians' SDM-Orientation	→	Health Accountability	.379	5.907	.001
H8	Physicians' SDM-Orientation	→	Physicians' Digital Influence	.159	2.461	.007
H9	Health Accountability	→	Physicians' Digital Influence	.158	2.369	.009
H10	Physicians' Digital Influence	→	Digital Credibility	.430	7.667	.001
H11	Digital Credibility	→	Digital Health Usefulness	.324	5.787	.001
H12	Physicians' Digital Influence	→	Digital Health Usefulness	.453	7.576	.001

Note.  $\chi^2 = 233.963$ ; DF = 166; GFI = .932; AGFI = .906; CFI = .987; NFI = .957; RMSEA = .036. SDM = shared decision-making; DHIS = digital health information seeking; n.s. = not significant; DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

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Table 20

*Bootstrapped Total, Direct, and Indirect Effects for Model 2*

<b>Total Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital
Health Accountability	.379***					
Physicians' Digital Influence	.219**	.158*				
Digital Credibility	.094**	.068*	.430***			
Digital Usefulness	.130**	.094*	.592***	.324***		
Provider-Related Digital	.302***	.166*	.086	.173*	.229*	
External Digital	.026	.243**	.305***	.120	.574***	.501***
<b>Direct Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital
Health Accountability	.379***					
Physicians' Digital Influence	.159*	.158*				
Digital Credibility	-	-	.430***			
Digital Usefulness	-	-	.453***	.324***		
Provider-Related Digital	.225**	.152*	-.092	.099	.229*	
External Digital	-.227***	.118	.040	-.116	.459***	.501**
<b>Indirect Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital
Health Accountability	-					
Physicians' Digital Influence	.060*	-				
Digital Credibility	.094**	.068*	-			
Digital Usefulness	.130**	.094*	.139***	-		
Provider-Related Digital	.077**	.014	.178**	.074*	-	
External Digital	.253***	.125**	.265***	.235***	.115*	-

*Note.* SDM = shared decision-making.

\*  $p < .050$ . \*\*  $p < .010$ . \*\*\*  $p < .001$ .



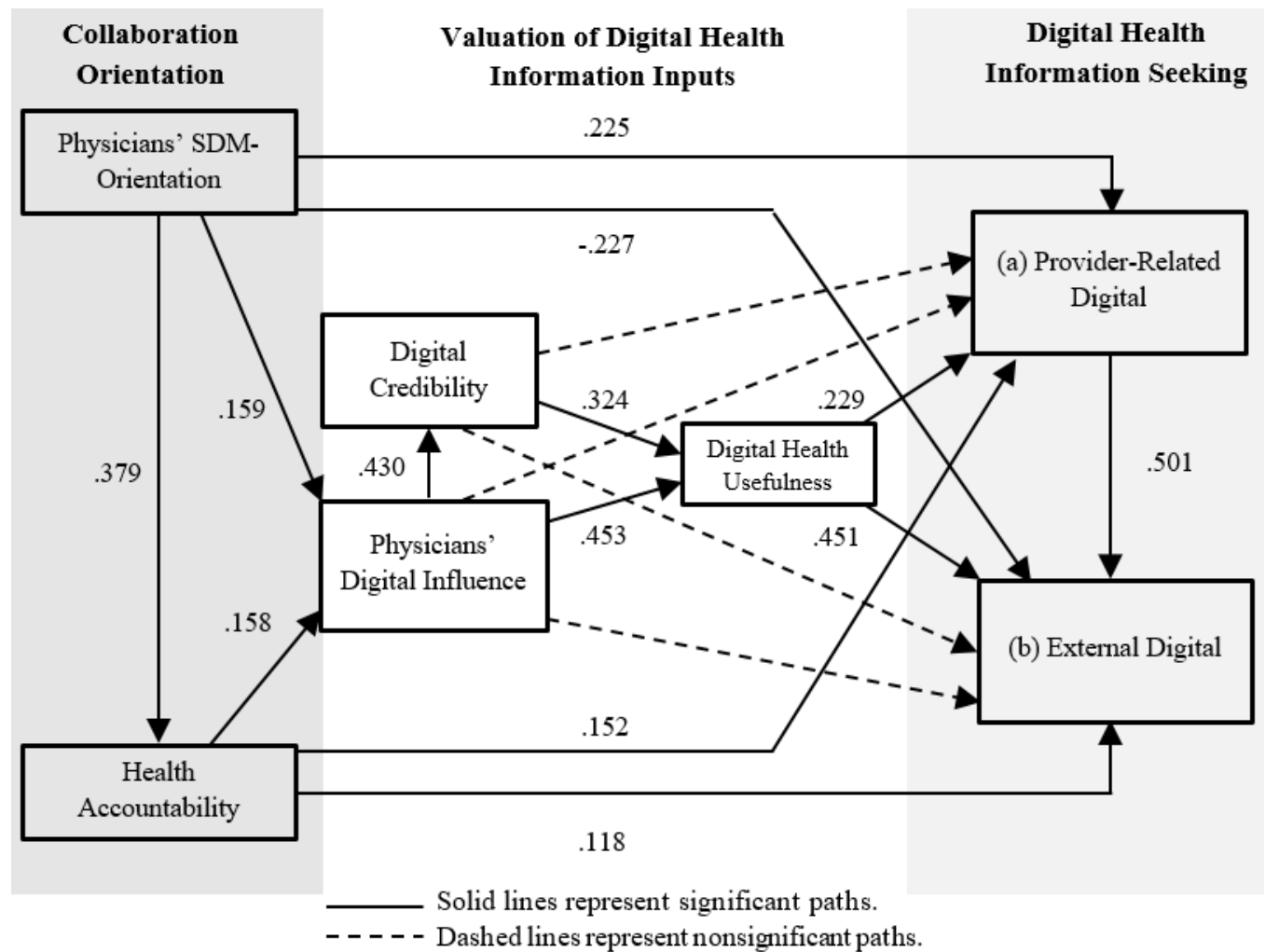


Figure 7. Reduced model showing significant pathways for Model 2. SDM = shared decision-making.

**Model 2: Post-hoc statistical power analysis.** Finally, post-hoc statistical power analysis was calculated to determine if Model 2 was strong enough to detect significant effects. The observed statistical power was calculated separately for each endogenous variable in the model using Soper's post-hoc statistical power calculator (2017). Table 21 provides the observed statistical power for each endogenous variable using a 95% confidence and the model's sample size (N=310). As shown, the observed power was  $> .99$  for all endogenous variables in Model 2. Thus, within the context of the current study, Model 2 provided enough power to detect significant effects (Cohen, 1988).

Table 21

*Post-Hoc Statistical Power for Model 2*

<b>Total Effects</b>	<b>Number of Predictors</b>	<b>Observed <math>R^2</math></b>	<b>Observed Statistical Power</b>
Health Accountability	1	.144	.999
Physicians' Digital Influence	2	.069	.993
Digital Credibility	1	.184	1.000
Digital Usefulness	2	.436	1.000
Provider-Related Digital	5	.176	1.000
External Digital	6	.542	1.000

*Note.* 95% confidence. N = 310.

**Summary discussion of Model 2 results and implications.** Model 2 contributes to the SDL literature by outlining the antecedents to patients' external digital health information seeking. Consistent with SDL theory, consumer engagement in knowledge acquisition and integration into the health decision-making process is a vital part of the health value co-creation process (Lusch & Vargo, 2011). Model 2's results highlighted that encouraging consumers to integrate external digital health information into the SDM-environment is a complex process. As SDL suggests, facilitating consumers' digital health information seeking involves a series of information flows that extend the health care service providers' value creation role beyond the health service encounter (Grönroos & Voima, 2013).

The results demonstrated that health care providers and patients must first share similar views toward creating and participating in a collaborative decision-making environment. Additionally, the two parties must place similar value assessments on digital health information inputs in terms of information credibility and usefulness. Without these jointly held perspectives, consumers' efforts to seek out and integrate digital health information will be reduced. Finally, health providers' digital presence needs to point consumers to relevant and credible external sources.

The results of Model 2 also shed light on the complex process through which health care providers can create provider-patient agreement on the value of integrating digital health information inputs. The results showed consumers' perceptions of digital health information's usefulness fully mediate the relationship between the other two informational input valuation constructs. Hence, consumers' value assessment of digital health's usefulness starts by creating a patient-physician relational culture that empowers patients in the SDM process and enhances patients' accountability for their health decisions. Moreover, physicians play a central role in

facilitating consumers' value assessments of digital health information by specifically recommending digital health resources to patients. In turn, physicians' digital influence enhances consumers' perceptions of credibility and usefulness of the digital health information and increases consumers' efforts to seek out and utilize both provider-related and external digital health information resources.

Moorhead et al. (2013) indicated physicians tend to be more skeptical of external digital health information. The SDM literature suggests health providers also tend to have narrow views of patients' desires and motivations for getting involved (Légaré & Witteman, 2013; Stiggelbout et al., 2012). Hence, even when patients perceive that their health provider engages in SDM, patients may feel restricted in the type of information their physician is willing to accept, thus limiting patient activation (Clayman et al., 2016). This in part may explain the negative, direct path from physicians' SDM-orientation to external digital health information seeking. Importantly, physicians' SDM-orientation had a strong, positive indirect effect on external digital health information seeking. The finding confirms that physicians' SDM-orientation has a complex relationship that involves positive relationships with the other antecedents leading to more external digital health information seeking.

Physicians and health marketers should pay careful attention to patient-directed communications that can enhance the credibility and usefulness of digital health information. During the health service encounter, physicians and other health providers can specifically influence consumers' value perceptions by reviewing digital health information that consumers reference (McColl-Kennedy et al., 2012; Sweeney et al., 2015). Additionally, physicians may potentially impact the informational input valuation process by promoting specific digital health resources that are relevant to the patients' health decision-making (Wald et al., 2007). Finally,

health providers and marketers may seek to influence this evaluation process through implied endorsements of external digital health information by placing links to recommended external resources on provider-related digital platforms (Baird & Nowak, 2015). In combination, Model 2 demonstrates physicians perform a critical value-facilitating role in encouraging consumers to integrate both types of digital health information. Models 3, 4, and 5 extend Model 2 to examine the consequences of consumers' two types of digital health information seeking.

### **Model 3: SEM Path Results**

Model 3 extends Model 2 to examine the consequences of facilitating and integrating consumers' digital health information seeking on consumers' health behavior changes. Model 3 explores how the value co-creation chain incorporating provider-related and external digital health information seeking triggers health consumers to improve their health through dietary and physical activity behavior changes. Model 3 included 21 hypothesized direct and indirect relationships leading to consumers' health behavior changes. Similar to Model 2, full SEM path analysis was first conducted using AMOS 23. Bootstrap analysis and composite-based SEM path analysis were also completed as part of the Model 3 analysis. The following section discusses the structural model's fit followed by the hypothesis testing results of Model 3.

Although the CMIN/DF was less than the suggested value of 3.0, the structural model's chi square statistic was significant ( $\chi^2 = 258.758$ ,  $DF = 183$ ,  $CMIN/DF = 1.414$ ,  $p < .001$ ). Similar to Model 2, other goodness of fit indices were used to assess the measurement model's fit as the significant  $p$ -value result may be due to a larger sample size. The GFI (.929) and AGFI (.901) both met the minimum threshold requirement (.90) for a satisfactory model (Baumgartner & Homburg, 1996; Bentler & Bonett, 1980). Additionally, the other fit indices ( $CFI = .986$ ,  $NFI = .953$ ,  $RMSEA = .037$  with  $CI = .026 - .047$ ) indicated the model fits the data (Hair Jr. et al.,

2006; Hu & Bentler, 1999). In combination, despite the significant chi square statistic, the other model fit indices suggested a satisfactory model fit allowing a valid test of the structural model.

Table 22 provides the structural model parameter estimates and corresponding *t*-values. Table 23 provides the bootstrapped total, direct, and indirect effects. Figure 8 shows the reduced Model 3 with significant pathways. Finally, Table 24 provides the post-hoc statistical power analysis for Model 3.

**Model 3: Direct and indirect effects.** Model 3 extends the core findings of Model 2 to demonstrate the importance of engaging consumers in external digital health information seeking. Overall, 16 of the 21 hypothesized relationships in Model 3 were significant and in the hypothesized direction. All of the significant paths from Model 2 remained significant and in a similar direction. Similar to Model 2 results, physicians' SDM-orientation ( $H_{1B}$ :  $\beta = -.224$ ;  $p < .001$ ) had a significant, negative direct relationship with external digital health information seeking—counter to the hypothesized relationship.

Model 3 offered four new hypotheses extending Model 2 to examine the consequences of digital health information seeking on co-created health behavior decisions. Three of the four hypothesized relationships were significant and in the proposed direction using a one-tailed directional significance test. First, as expected health accountability ( $H_{15}$ :  $\beta = 0.242$ ;  $p < .001$ ) had significant, positive direct effects on consumers' health behavior changes. The other collaboration construct, physicians' SDM-orientation, also had a significant direct effect on health behavior changes ( $H_{14}$ :  $\beta = 0.110$ ;  $p < .050$ ). Next, external digital health information seeking ( $H_{17}$ :  $\beta = 0.156$ ;  $p < .050$ ) had a significant, positive direct impact on health behavior changes. Finally, the hypothesized relationship from provider-related digital information seeking

to health behavior changes was not significant ( $H_{16}: \beta = 0.015; p > .050$ ), thus H16 was not supported.

**Model 3: Bootstrap analysis.** The bootstrap analysis (see Table 21) offered additional insight on the mediation effects exhibited in significant pathways of Model 3. First, the bootstrap analysis showed that provider-related digital information seeking's influence on health behavior changes is fully mediated through consumers' external digital health information seeking. Second, the relationship of physicians' SDM-orientation with health behavior changes is partially mediated through its relationship to health accountability and the sequential effects on digital health information seeking. Third, the bootstrap analysis confirmed that health accountability's impact on health behavior changes is partially mediated as both the direct and indirect effects are significant. Combined, these mediated relationships reveal the importance of motivating consumers' external digital health information seeking to fully activate patients' health behavioral changes. Therefore, external digital health information seeking has an additive effect on consumers' co-created health decisions beyond the jointly created patient-physician collaborative environment. Of significance, the findings suggest physicians can extend their value co-creation role through the extent to which physicians encourage consumers to be more accountable for their health and help consumers integrate digital health information resources into the decision-making process.

**Model 3: Composite-based SEM path analysis.** Additionally, composite-based SEM path analysis provided a final robustness check for Model 3. According to Bollen and Bauldry (2011), SEM path analysis using composite-based measures is more appropriate to use when combining models incorporating single-item constructs. Model 3 used a single-item index variable as the final endogenous variable (health behavior changes) in the model. Therefore,



composite-based SEM path analysis was used to confirm the hypothesized relationships demonstrated by the full SEM path analysis results. Table 29 in the Appendix provides Model 3's composite-based SEM path results. The model fit statistics for the composite-based SEM model demonstrated the structural path model had satisfactory fit. All 16 of the significant hypothesized relationships from the full path analysis remained significant and in a similar direction. No additional pathways were significant. Consequently, the composite-based path analysis confirmed the results of the full SEM path analysis.

Table 22

*Tests of the SEM Path Hypotheses for Model 3*

Hypotheses and Paths				Standardized Coefficient	t-value	p-value
<b>Direct Paths to Health Behavior Changes</b>						
H14	Physicians' SDM-Orientation	→	Health Behavior Changes	.110	1.694	.045
H15	Health Accountability	→	Health Behavior Changes	.242	3.715	.001
H16	Provider-Related DHIS	→	Health Behavior Changes	.015	0.173	n.s.
H17	External DHIS	→	Health Behavior Changes	.156	1.958	.025
<b>Indirect Paths to Health Behavior Changes</b>						
H1a	Physicians' SDM-Orientation	→	Provider-Related DHIS	.224	3.147	.001
H1b	Physicians' SDM-Orientation	→	External DHIS	-.224	-3.773	.001
H2a	Health Accountability	→	Provider-Related DHIS	.153	2.121	.017
H2b	Health Accountability	→	External DHIS	.116	1.967	.025
H4a	Physicians' Digital Influence	→	Provider-Related DHIS	-.096	-1.146	n.s.
H4b	Physicians' Digital Influence	→	External DHIS	.037	0.537	n.s.
H5a	Digital Credibility	→	Provider-Related DHIS	.101	1.355	n.s.
H5b	Digital Credibility	→	External DHIS	-.119	-1.947	n.s.
H6a	Digital Health Usefulness	→	Provider-Related DHIS	.228	2.481	.007
H6b	Digital Health Usefulness	→	External DHIS	.467	5.611	.001
H7	Physicians' SDM-Orientation	→	Health Accountability	.374	5.979	.001
H8	Physicians' SDM-Orientation	→	Physicians' Digital Influence	.157	2.447	.007
H9	Health Accountability	→	Physicians' Digital Influence	.166	2.486	.007
H10	Physicians' Digital Influence	→	Digital Credibility	.430	7.668	.001
H11	Digital Credibility	→	Digital Health Usefulness	.324	5.782	.001
H12	Physicians' Digital Influence	→	Digital Health Usefulness	.453	7.574	.001
H13	Provider-Related DHIS	→	External DHIS	.498	6.774	.001

Note.  $\chi^2 = 258.758$ ; DF = 183; GFI = .929; AGFI = .901; CFI = .986; NFI = .953; RMSEA = .037. SDM = shared decision-making; DHIS = digital health information seeking; n.s. = not significant; DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

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Table 23

*Bootstrapped Total, Direct, and Indirect Effects for Model 3*

<b>Total Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital	External Digital
Health Accountability	.374***						
Physicians' Digital Influence	.219**	.166*					
Digital Credibility	.094**	.071*	.430***				
Digital Usefulness	.130**	.098*	.592***	.324***			
Provider-Related Digital	.299***	.167**	.083	.175*	.228**		
External Digital	.026	.243***	.304***	.120*	.581***	.498***	
Health Behavior Changes	.209***	.283***	.048*	.021	.094*	.092	.156*
<b>Direct Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital	External Digital
Health Accountability	.374***						
Physicians' Digital Influence	.157*	.166*					
Digital Credibility	-	-	.430***				
Digital Usefulness	-	-	.453***	.324***			
Provider-Related Digital	.224**	.153*	-.096	.101	.228**		
External Digital	-.224***	.116*	.037	-.119	.467***	.498***	
Health Behavior Changes	.110*	.242**	-	-	-	.015	.156*
<b>Indirect Effects</b>	Physicians' SDM-Orientation	Health Accountability	Physicians' Digital Influence	Digital Credibility	Digital Usefulness	Provider-Related Digital	External Digital
Health Accountability	-						
Physicians' Digital Influence	.062*	-					
Digital Credibility	.094**	.071*	-				
Digital Usefulness	.130**	.098*	.139***	-			
Provider-Related Digital	.076**	.014	.179**	.074**	-		
External Digital	.250***	.127**	.267***	.238***	.114**	-	
Health Behavior Changes	.099*	.040*	.048*	.021	.094*	.078*	-

\*  $p < .050$ . \*\*  $p < .010$ . \*\*\*  $p < .001$ .

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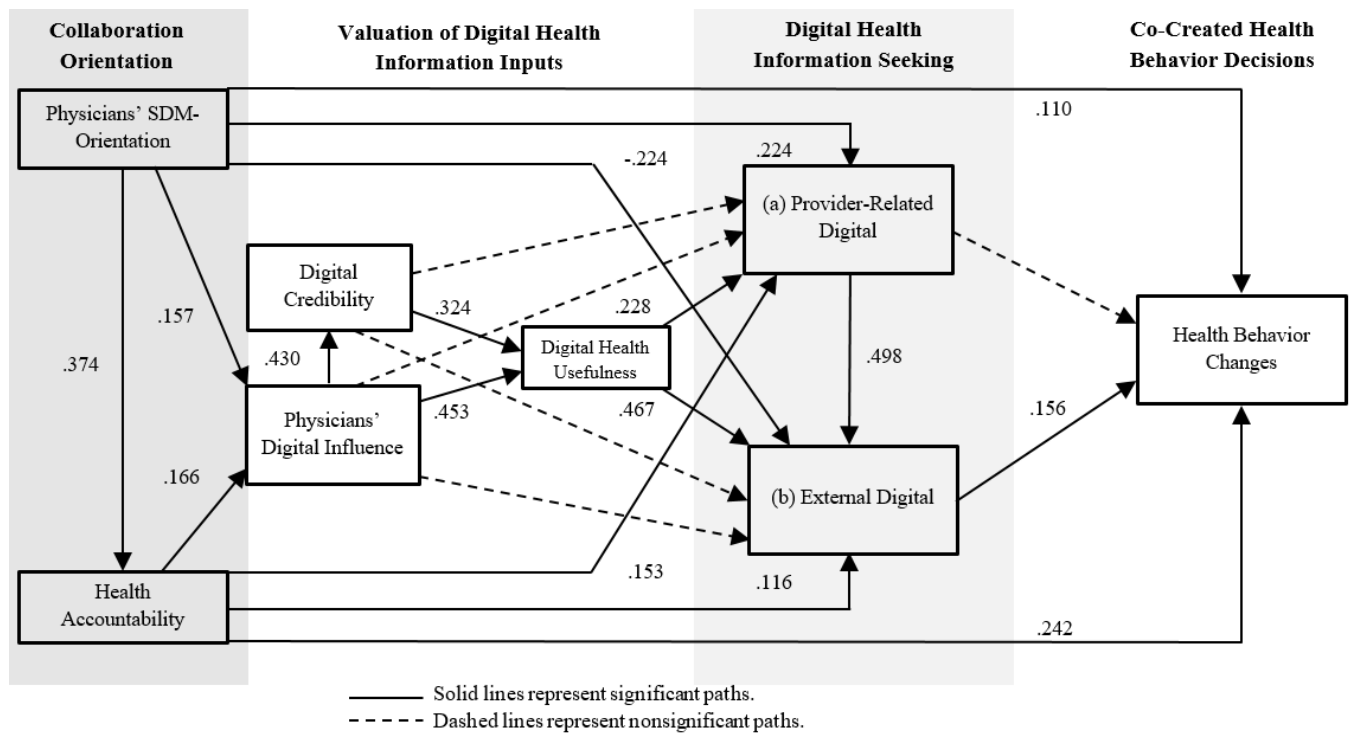


Figure 8. Reduced model showing significant pathways for Model 3. SDM = shared decision-making.

**Model 3: Post-hoc statistical power analysis.** The observed statistical power was calculated post hoc for Model 3 following similar procedures to Model 2. Table 24 provides the observed statistical power for each endogenous variable using a 95% confidence (.05 probability level) and the model's sample size (N=310). Model 3's observed power was >.99 for all endogenous variables, providing enough statistical power to detect significant effects.

Table 24

*Post-Hoc Statistical Power for Model 3*

<b>Total Effects</b>	Number of Predictors	Observed $R^2$	Observed Statistical Power
Health Accountability	1	.140	.9999
Physicians' Digital Influence	2	.072	.9952
Digital Credibility	1	.185	1.0000
Digital Usefulness	2	.436	1.0000
Provider-Related Digital	5	.174	.9999
External Digital	6	.544	1.0000
Health Behavior Changes	4	.138	.9999

*Note.* 95% confidence. N = 310.

**Model 3: Tests for moderation.** Prior research suggests there may be a digital divide in terms of consumers' health information seeking, although recent research suggests this gap is closing (Lustria et al., 2011). After analyzing Model 3 without any moderators, a series of moderators were added to the full structural path model to test for meaningful differences. Gender, age, income, education, presence of chronic conditions, and insurance coverage were added separately as moderators. First, a chi-square difference test was conducted to determine if the overall structural path models were significantly different at a global level. None of the moderators exhibited significant differences at this global level. Second, the critical ratio values were compared to determine if individual pathways were significantly different between the groups. The following section discusses the results and implications of these moderation tests.

**Gender.** Differences in the structural path model were examined for males (47.1% of the sample) and females (52.9%). The chi-square difference test indicated the overall structural path models were not significantly different ( $DF = 35$ ,  $CMIN$  difference = 44.743,  $p > .050$ ). However, upon closer examination four pathways exhibited significant differences using the critical ratio values. First, the pathway from physicians' SDM-orientation to physicians' digital influence was significantly different and had a significantly stronger effect for females ( $z$ -score = 2.392,  $p < .050$ ). Next, two indirect pathways to provider-related digital information seeking were also significantly different: physicians' SDM-orientation to provider-related digital information seeking ( $z$ -score = 2.159,  $p < .050$ ) and digital usefulness to provider-related digital information seeking ( $z$ -score = 2.184,  $p < .050$ ). Combined, these differences suggest physicians' value-facilitating role through establishing an SDM-environment and specifically recommending digital health informational inputs is likely to be stronger when interacting with female patients. Meanwhile, the path from provider-related digital health information to external

digital health information seeking was significantly stronger for males ( $z$ -score = 2.542,  $p < .050$ ). This finding suggests health providers may therefore be able to influence males' external digital health information seeking through information and links to relevant external digital health resources placed on the health provider-controlled digital platforms. Perhaps these findings demonstrate differences in interpersonal communications between physicians and consumers. Future research might explore how males and females differ in terms of their direct communications with their health providers and what impact this has on digital health information seeking.

**Age.** Moderation effects were also examined based on age groups. The sample was divided into two groups: consumers under 45 years old (42.3%) and those over 45 years old (57.7%). The chi-square difference test indicated no significant differences in the overall model ( $DF = 35$ , CMIN difference = 37.442,  $p > .050$ ). However, the critical ratios test suggested two pathways have significant differences between consumers under 45 years old and consumers over 45 years old. First, the pathway from physicians' SDM-orientation to provider-related digital was only significant for consumers over 45 years old ( $\beta = .485$ ,  $p < .001$ ,  $z = 3.251$ ,  $p < .010$ ). This suggests the SDM-environment and physicians' efforts to involve patients is particularly important in facilitating older consumers' utilization of provider-related digital information. Second, while the pathway is statistically significant for both age groups from digital usefulness to external digital ( $\beta_{<45} = .892$ ,  $p < .001$  vs.  $\beta_{45+} = .426$ ,  $p < .010$ ), the critical ratio test indicated a significant difference between the two groups ( $z = 1.962$ ,  $p < .050$ ). This finding shows that younger consumers' value assessments of digital health information's usefulness had a significantly stronger positive effect on external digital health information seeking. Combined, the two significantly different pathways provided results consistent with



prior research showing a digital divide based on age (Lustria et al., 2011). Prior research notes there are diverse health information needs as people age (Kim, 2015). Importantly, the differential pathways in the current study offer insight into how health providers through an SDM-environment might help older patients integrate more digital health information resources. First, the provider's digital presence appears to be a critical information gateway to further patient activation through external digital health information seeking. Additionally, health providers and marketers can also help elderly consumers by specifically recommending digital health information resources that are the most relevant to their specific health issues. Health marketers and policymakers may also consider devoting specific sections of health websites to age-related health issues to make it easier for these elderly consumers to find relevant information. Pediatric health and wellness represents another aspect that requires different informational inputs. More research is needed that explores the health value co-creation chain in this context, including how health providers might influence digital health information seeking among parents.

***Household Income.*** According to census data, the median household income for the population from which the sample was drawn was \$54,232. The sample was divided into two income groups closely approximating the area's median household income since income was asked using a categorical variable on the survey ( $<\$50,000 = 29.6\%$ ;  $>\$50,000 = 70.4\%$ ). At a global level, the model comparison chi-square difference test indicated there were no significant differences in the overall model ( $DF = 35$ ,  $CMIN$  difference = 40.936,  $p > .050$ ). Additionally, none of the critical ratio values for the individual pathways were  $> \pm 1.96$ . Therefore, at both a global and local level there were no moderating effects of income on the structural path model.

***Education Level.*** Respondents were divided into two groups based on their highest level of education completed including a high school degree, GED, or less (36.4%) and a college degree (63.6%). The chi-square difference test was not significantly different ( $DF = 35$ ,  $CMIN$  difference = 34.704,  $p > .050$ ), indicating the overall structural model was not significantly different between the two education levels. However, one pathway was significantly different based on education level when examining the critical ratio values. Specifically, the pathway from health accountability to external digital health information seeking was significantly different ( $z = 2.118$ ;  $p < .050$ ), with a significant, positive path existing only for those with higher education levels. The pathway was not significant for those with a high school degree, GED, or less ( $p = .414$ ). This suggests there may be a digital divide in terms of education level and the direct impact a consumers' health accountability has on external digital health information seeking. While this may reflect less access to external digital sources, physicians may also need to assist these disadvantaged consumers with lower education levels to help them better identify and assess relevant external digital health information. This appears to be an important mechanism for physicians to help consumers be more actively involved in the SDM process. However, even when consumers' desires for greater involvement exists, lower educated patients may deal with lower health literacy or other barriers that make it more difficult for them to integrate external digital health information. Future research that examines different interventions designed to increase disadvantaged consumers' digital health literacy may be particularly valuable given the importance of external digital health information seeking to behavior changes and other co-created health outcomes.

***Presence of chronic conditions in household.*** Respondents noted whether someone in their household had a chronic condition. Moderation was tested between respondents with no

chronic conditions present (44.8%) and those with chronic conditions present in the household (55.2%). The results of the critical ratio test indicated no individual pathways were significantly different based on the presence of chronic conditions. Future research might explore how digital health information seeking differs based on the presence of specific chronic conditions. For example, much of the existing literature examines health information seeking in the context of cancer patients (Hesse et al., 2005; N. Xiao et al., 2014). Research that examines if meaningful differences exist for consumers with cancer and other specific chronic conditions may be particularly useful to health providers and policymakers in addressing the health information needs of disadvantaged groups.

***Insurance coverage.*** Respondents self-identified whether all members of their household had insurance coverage. In part due to the Affordable Care Act, a high percentage of the respondents indicated having health insurance coverage (92.5%). Unfortunately, the small sample size of respondents lacking insurance coverage generated errors in the model estimation process. Of significance, insurance companies and employers are increasingly offering consumers rebates or other incentives to participate in wellness programs or integrate fitness trackers into their daily lives (Mattke et al., 2013). Through these programs, health insurance providers and employers may have a value-facilitating role similar to physicians that influences consumers' digital health information seeking and co-created health behavior changes. Unfortunately, the current study did not identify whether respondents' health insurance or employers offered these health and wellness programs. The value-facilitating role of insurance providers or employer sponsored wellness programs offers a valuable extension to the health value co-creation framework. In particular, future research that examines the moderating

influence of specific types of insurance coverage, deductibles, wellness programs, or other elements may be of value.

**Summary discussion of Model 3 results and implications.** Model 3 extends Model 2 and contributes to the SDL literature by outlining the prerequisite conditions to increase patient activation and adherence to dietary and physical activity behavioral changes. Model 3 demonstrates that encouraging patients to seek out digital health information enhances the physicians' impact on these co-created health behavior decisions. Similar to Model 2, the results of Model 3 offer further support outlining how service providers can extend their role in the customer value creation process by supporting consumers' integration of informational inputs into the decision-making process (Grönroos & Voima, 2013).

Of significance, Model 3 demonstrated it is the facilitation and integration of external digital health information seeking that has an additive effect on health behavior changes beyond the collaborative orientation and not provider-related digital information seeking. Instead, provider-related digital health information seeking had an indirect effect on health behavior changes through encouraging consumers' external digital health information seeking. This finding further supports the need for health care providers and health marketers to use the health provider's digital presence to direct patients to relevant external digital health resources (Baird & Nowak, 2015). Additionally, this aligns with the evolving consumer-marketer dyad resulting from the rise in digital health informational resources (Labrecque et al., 2013).

The results demonstrate physicians and health marketers may be able to increase patient adherence to jointly made health decisions through activating patients' sense of accountability and digital health information seeking. Prior research demonstrates that even when an SDM-environment exists, patient engagement and adherence to behavior changes is mixed (Légaré &

Wittman, 2013; Makarem et al., 2014; Oshima Lee & Emanuel, 2013). The results of Model 3 provide some additional insight into this relationship, suggesting that SDM's influence on health behavior changes is enhanced when physicians leverage the SDM-environment to increase patients' accountability and engage in more external digital health information seeking.

Model 3 advances the current understanding of SDM by delineating how health providers and health marketers can enhance patient adherence to make healthy lifestyle choices. Consistent with SDL theory, by facilitating consumers' external information seeking, the physician extends the open-process beyond the health service encounter in the physicians' office (Grönroos & Voima, 2013). Given the rise of telemedicine and other digital resources, this finding demonstrates the value of health marketers increasing the digital presence of health providers. Specifically, health providers' websites should focus on creating linking directories to reputable external health information sources (Baird & Nowak, 2015). Physicians' websites can also provide guidelines to assist consumers' evaluation of external digital health information sources. Of concern is the limited time physicians have to keep updated on the variety of digital health resources available to patients. Policymakers and consumer welfare advocates may help ease the burden on physicians and patients by implementing a process for evaluating the growing list of digital health information resources. This is particularly important given recent findings that suggest a significant amount of false information exists on social media related to certain health and wellness topics (Kata, 2012) and the impact of biased online information on health decisions (Wittman, Fagerlin, Exe, Trottier, & Zikmund-Fisher, 2016).

### **Model 4: SEM Path Results**

Model 4 completes the health value co-creation chain. The model explores the co-created health value that occurs when patients integrate provider-related and external digital health

information into the behavior change process. Model 4 investigates a parsimonious model with six hypothesized direct and indirect relationships leading to consumers' overall health. Full SEM path analysis with bootstrapping was conducted using AMOS 23.

Similar to Models 2 and 3, the model fit indices for the structural model suggested a satisfactory model fit allowing a valid test of the structural model. First, the chi square statistic for the model was not significant ( $\chi^2 = 20.147$ ,  $DF = 14$ ,  $CMIN/DF = 1.439$ ,  $p > .050$ ). Additionally, other goodness of fit indices also showed a satisfactory model fit. The GFI (.984), AGFI (.958), CFI (.993), NFI (.978), and RMSEA (.038) all met the requirements for a satisfactory model (Baumgartner & Homburg, 1996; Bentler & Bonett, 1980; Hair Jr. et al., 2006). Table 25 provides the structural model parameter estimates and corresponding  $t$ -values. Table 26 provides the bootstrapped results, and Figure 9 shows the reduced Model 4 with significant pathways.

**Model 4: Direct effects.** Only one of the three hypothesized direct effects on overall health was positive and significant. Health behavioral changes ( $H_{18}$ :  $\beta = .148$ ;  $p < .050$ ) had a positive, direct relationship with overall health using a one-tailed directional significance test. The direct paths from provider-related digital health information seeking ( $H_{19a}$ :  $\beta = .061$ ;  $p > .050$ ) and external digital health information seeking ( $H_{19B}$ :  $\beta = -.030$ ;  $p > .050$ ) to overall health were not supported.

**Model 4: Indirect effects.** Two of the three hypothesized indirect pathways were supported. Provider-related digital health information seeking had a positive indirect effect through external digital health information seeking ( $H_{13}$ :  $\beta = .583$ ;  $p < .001$ ). However, similar to Model 3, the indirect path from provider-related digital health information seeking to health behavior changes was not significant ( $H_{16}$ :  $\beta = .195$ ;  $p > .050$ ). Finally, the indirect path from

external digital health information seeking to health behavior changes was positive and significant ( $H_{17}$ ;  $\beta = .212$ ;  $p < .050$ ).

**Model 4: Bootstrap analysis and PROCESS analysis.** The bootstrap analysis confirmed the effects of digital health information seeking were fully mediated. First, provider-related digital information seeking's effect on health behavior changes was fully mediated by external digital health information seeking. Second, the effects of external digital health information seeking on overall health were fully mediated by health behavior changes. Consequently, the full mediation reinforces the importance of provider-related digital health information prompting consumers to seek out relevant external digital health information that assist patients in making healthier diet and exercise-related behavioral changes. In turn, this leads to greater health value creation in terms of the consumers' overall perceived health.

Additionally, serial mediation was confirmed with 1,000 bootstrap samples and 95% confidence intervals using Hayes' PROCESS Macro-Model 6 in SPSS (Hayes, 2013). First, the relationship from provider-related digital to external digital was significant ( $\beta = .387$ ,  $p < .001$ ). Second, the mediating relationship from external digital information seeking to health behavior changes was significant ( $\beta = .187$ ,  $p < .050$ ). Third, the relationship from changes to overall health was significant ( $\beta = .147$ ,  $p < .050$ ). Finally, looking at the indirect effects of provider-related digital health information seeking on overall health, only the serial mediation path from (a) provider-related digital health information to (b) external digital health information to (c) health behavior changes to (d) the final outcome variable overall perceived health was significant (see Table 30 in Appendix). In combination with the AMOS results, the PROCESS macro analysis suggested there was a serial mediation relationship.

Table 25

*Tests of the SEM Full Path Hypotheses for Model 4*

Hypotheses and Paths				Std. Coefficient	<i>t</i> -value	<i>p</i> -value
<b>Direct Paths to Overall Health</b>						
H18	Health Behavior Changes	→	Overall Health	.148	2.083	.019
H19a	Provider-Related DHIS	→	Overall Health	.118	0.759	n.s.
H19b	External DHIS	→	Overall Health	-.080	-0.546	n.s.
<b>Indirect Paths to Overall Health</b>						
H13	Provider-Related DHIS	→	External DHIS	.583	7.379	.001
H16	Provider-Related DHIS	→	Health Behavior Changes	.195	1.561	n.s.
H17	External DHIS	→	Health Behavior Changes	.212	1.792	.037

*Note.*  $\chi^2 = 20.147$ ; DF = 14; GFI = .984; AGFI = .958; CFI = .993; NFI = .978; RMSEA = .038. DHIS = digital health information seeking; n.s. = not significant; DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.



Table 26

*Bootstrapped Total, Direct, and Indirect Effects for Model 4*

<b>Total Effects</b>	Provider-Related Digital	External Digital	Health Behavior Changes
External Digital	.564**		
Health Behavior Changes	.207**	.142*	
Overall Health	.063	-.027	.121*
<b>Direct Effects</b>	Provider-Related Digital	External Digital	Health Behavior Changes
External Digital	.564***		
Health Behavior Changes	.127	.142*	
Overall Health	.063	-.044	.121*
<b>Indirect Effects</b>	Provider-Related Digital	External Digital	Health Behavior Changes
External Digital	-		
Health Behavior Changes	.080*	-	
Overall Health	.000	.017*	-

\*  $p < .050$ . \*\*  $p < .010$ . \*\*\*  $p < .001$ .

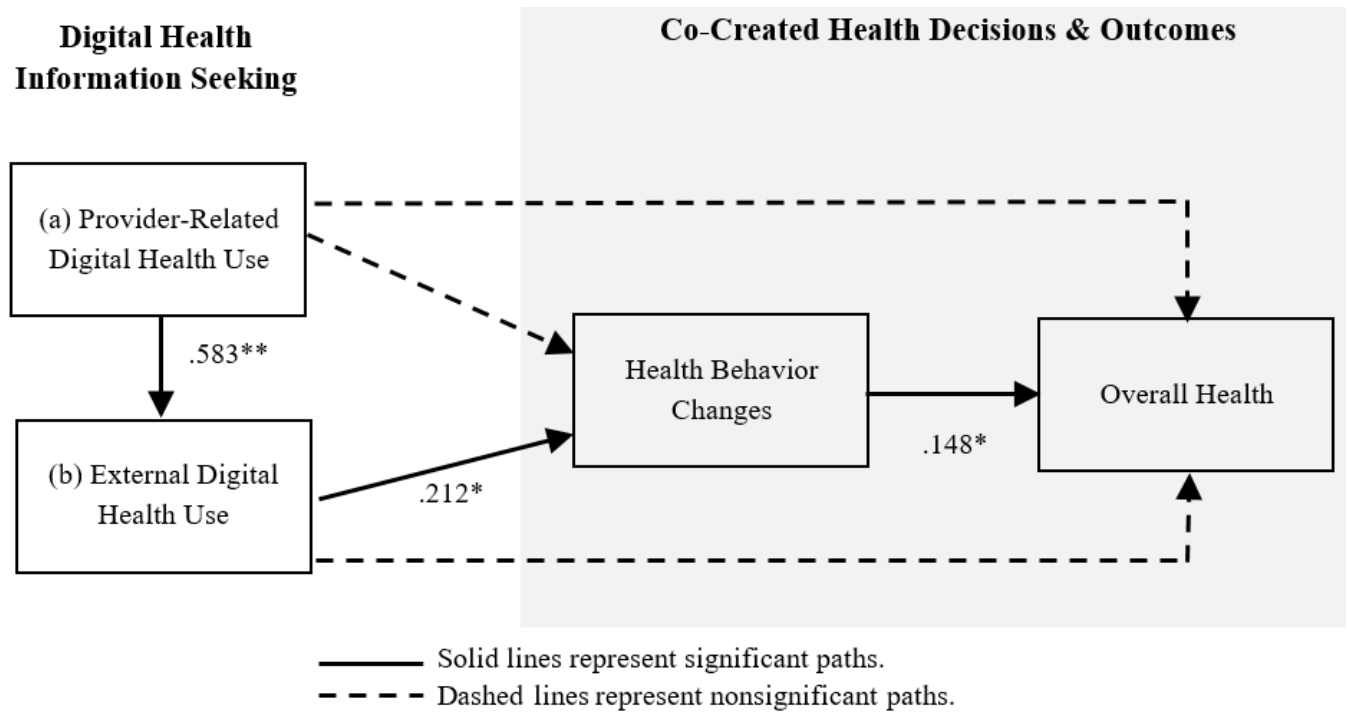


Figure 9. Reduced model showing significant pathways for Model 4.

**Summary discussion of Model 4 results and implications.** Model 4 contributes to the SDL literature by examining how digital health information seeking contributes to value creation through the SDL premise of value-in-use (Grönroos, 2011). A specific focus is placed on examining the value co-created in terms of consumers' overall health once consumers engage in digital health information seeking. In accordance with SDL, value creation focuses on customers' evaluation of a process that improves their well-being (Vargo et al., 2008). Model 4 suggests a sequential process at the end of the digital health value co-creation chain leading to improved health decisions through behavioral changes that enhance overall health confirmed by PROCESS analysis (Hayes, 2013). The fact the direct pathways from provider-related and external digital health information seeking to overall health were not significant may reflect that consumers become more aware or conscious of their health status relevant to the additional information found during increased information searches. However, it is through this realization and further activation in terms of health behavior changes that consumers ultimately realize improvements to their overall health. Health applications and other tracking devices that allow consumers to continuously monitor their health may also enhance the overall understanding.

Combined with the earlier SEM models, the results provide initial empirical evidence of the value co-created from consumers' digital health information seeking. The sequential value co-creation chain outlined in Figure 9 supports prior research that demonstrates patient activation is vital to health behavioral changes (Greene et al., 2016; Hibbard & Greene, 2013). Future research should investigate what other mediating relationships may exist between digital health information seeking and overall health in accordance with the value-in-use concept of SDL (Grönroos, 2011). In particular, research is necessary that parses out consumers' process for integrating digital health information. For example, future research may examine other

psychosocial constructs that impact the behavior change and subsequent health value co-creation beyond the patient-provider interaction (Ledford et al., 2015). Given the limited time spent during patient health visits, identifying factors that are external to the SDM-environment that impact health behavior change remains critical to enhancing the effectiveness of patient-centered care (Légaré & Witteman, 2013; Oshima Lee & Emanuel, 2013).

### **Model 5: Collaborative Orientation on Co-Created Health Decisions and Outcomes**

Although not originally proposed, an additional parsimonious model (Model 5, see Figure 10) examined the health value co-creation framework absent the shared valuation of digital health information inputs (physicians' digital influence, digital credibility, and digital health usefulness). Hence, Model 5 contributes to the literature on the health value co-creation chain by examining the value added to the health decision-making process originating from a shared collaboration orientation that integrates consumers' digital health information seeking. The model builds on previously hypothesized direct and indirect pathways to health behavior changes and consumers' overall physical health outlined by Models 2, 3, and 4, while using a parsimonious model. Therefore, Model 5 enhances our understanding of the health value co-creation chain beyond the findings of Models 3 and 4. Similar to earlier models, full SEM path analysis was conducted using AMOS 23.

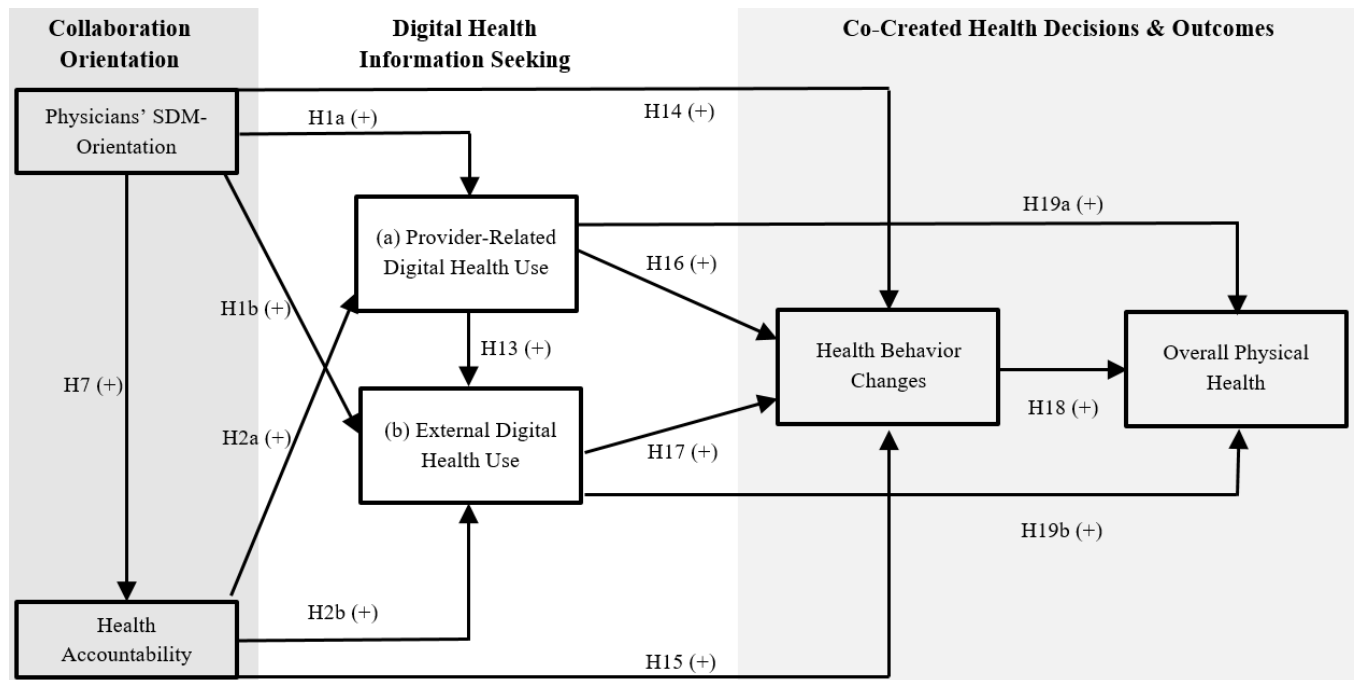


Figure 10. Model 5: Collaboration orientation and digital health information seeking to co-created health decisions and outcomes. SDM = shared decision-making.

The model fit indices confirmed a satisfactory model fit allowing a valid test of Model 5. Although the chi-square statistic for model was significant ( $\chi^2 = 138.902$ ,  $DF = 90$ ,  $CMIN/DF = 1.543$ ,  $p < .001$ ), other goodness of fit indices indicated a satisfactory model fit existed for testing the structural path model. The GFI (.951), AGFI (.926), CFI (.985), NFI (.958), and RMSEA (.042) all met the requirements for a satisfactory model (Baumgartner & Homburg, 1996; Bentler & Bonett, 1980; Hair Jr. et al., 2006). Table 27 provides the structural model parameter estimates and corresponding  $t$ -values. Figure 11 shows the reduced Model 5 with significant pathways.

**Model 5: Direct effects.** Similar to Model 4, only one of the three hypothesized direct effects on overall physical health was positive and significant. Health behavioral changes ( $H_{18}$ :  $\beta = .112$ ;  $p < .050$ ) had a positive, direct relationship with overall physical health. The hypothesized direct paths from provider-related digital health information seeking ( $H_{19a}$ :  $\beta = 0.068$ ;  $p > .050$ ) and external digital health information seeking ( $H_{19B}$ :  $\beta = -0.002$ ;  $p > .050$ ) to overall health were not supported.

**Model 5: Indirect effects.** Six of the eight hypothesized indirect pathways were significant and in the expected direction and thus supported. Starting with the physicians' SDM-orientation, two of the three proposed pathways were positive and significant as expected. The physicians' SDM-orientation had a significant, positive relationship with health accountability ( $H_7$ ;  $\beta = .385$ ;  $p < .001$ ) and provider-related digital health information seeking ( $H_{1a}$ ;  $\beta = .231$ ;  $p < .001$ ). However, the pathway from physicians' SDM-orientation to external digital health information seeking was unexpectedly negative and significant ( $H_{1b}$ :  $\beta = -.228$ ;  $p < .001$ ). Next, health accountability had a positive, significant pathway to both provider-related ( $H_{2a}$ ;  $\beta = .189$ ;  $p < .001$ ) and external digital health information seeking ( $H_{2b}$ ;  $\beta = .166$ ;  $p < .006$ ).

In terms of the added value from digital health information seeking, provider-related digital health information seeking had a positive indirect effect through external digital health information seeking ( $H_{13}$ ;  $\beta = .599$ ;  $p < .001$ ). However, similar to Model 3, the indirect path from provider-related digital health information seeking to health behavior changes was not significant ( $H_{16}$ ;  $\beta = .014$ ;  $p > .050$ ). Finally, the indirect path from external digital health information seeking to health behavior changes was positive and significant ( $H_{17}$ ;  $\beta = .152$ ;  $p < .010$ ).

**Summary discussion of Model 5 results and implications.** The findings of Model 5 contribute to the SDL literature by answering calls for research examining the physicians' and patients' value co-creation efforts (Sweeney et al., 2015). Similar to Model 4, the results of Model 5 further demonstrate the importance of motivating and facilitating consumers' external digital health information seeking. The results confirm the importance of helping consumers integrate diverse informational inputs into the decision-making process (Grönroos & Ravald, 2011) as a way of extending the physicians' impact on health value co-creation (Grönroos & Voima, 2013). The results demonstrate that the impact of physicians' SDM-orientation and patients' health accountability on health behavioral changes are partially mediated through consumers' digital health information seeking. Particularly noteworthy, this partial mediation occurs through the extent to which physicians motivate consumers to be more involved in the health decision-making process and acquire external digital health information that support consumers' health behavioral changes. The findings suggest health providers should therefore attempt to promote consumers' external digital health information searching during the SDM process to enhance patient activation leading to healthier lifestyle choices that improve overall health. Although this model begins to shed light on the consumers' value co-creation efforts in a

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collaborative decision-making context with their physician, additional research is necessary that examines other constructs that affect the two parties' health co-creation efforts.



Table 27

*Tests of the SEM Full Path Hypotheses for Model 5*

Hypotheses and Paths				Std. Coefficient	t-value	p-value
<b>Direct Paths to Overall Health</b>						
H18	Health Behavior Changes	→	Overall Physical Health	.112	1.976	.024
H19a	Provider-Related DHIS	→	Overall Physical Health	.068	0.800	n.s.
H19b	External DHIS	→	Overall Physical Health	-.002	-0.024	n.s.
<b>Indirect Paths to Overall Health</b>						
H1a	Physicians' SDM-Orientation	→	Provider-Related DHIS	.231	3.195	.001
H1b	Physicians' SDM-Orientation	→	External DHIS	-.228	-3.511	.001
H2a	Health Accountability	→	Provider-Related DHIS	.189	2.547	.001
H2b	Health Accountability	→	External DHIS	.166	2.508	.006
H7	Physicians' SDM-Orientation	→	Health Accountability	.385	6.200	.001
H13	Provider-Related DHIS	→	External DHIS	.599	7.252	.001
H14	Physicians' SDM-Orientation	→	Health Behavior Changes	.115	1.890	.030
H15	Health Accountability	→	Health Behavior Changes	.244	3.685	.001
H16	Provider-Related DHIS	→	Health Behavior Changes	.014	0.156	n.s.
H17	External DHIS	→	Health Behavior Changes	.152	2.513	.006

*Note.*  $\chi^2 = 138.902$ ; DF = 90; GFI = .951; AGFI = .926; CFI = .985; NFI = .958; RMSEA = .042. SDM = shared decision-making; DHIS = digital health information seeking; n.s. = not significant; DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

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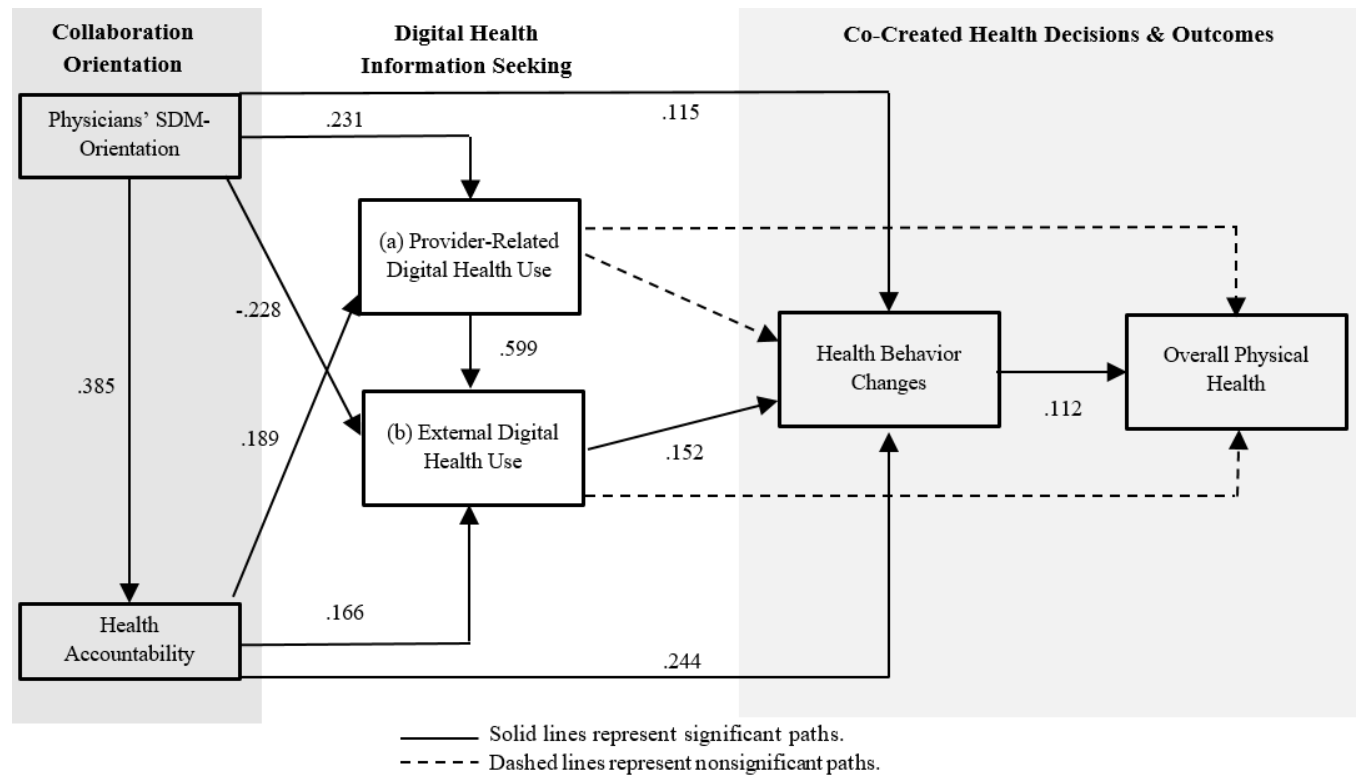


Figure 11. Reduced model showing significant pathways for Model 5. SDM = shared decision-making.

## **Discussion, Limitations, and Future Research**

### **Discussion**

The results of this study provide important theoretical and practical insights for the marketing and health care domains. The rise of digital media offers opportunities for reducing the information deficit consumers often experience across a number of digitally-enabled decision-making contexts (Hennig-Thurau et al., 2013; Labrecque et al., 2013). As consumers become more informed and cognizant of their health status and gain access to digital health devices and information sources, patients are likely to demand more empowerment in their health care decisions, thus requiring a continued movement toward a patient-centric care process involving patient-provider SDM (Stiggelbout et al., 2015; Stiggelbout et al., 2012). Accordingly, the current study extends marketers' understanding of consumers' evolving health decision-making process by identifying the antecedents and consequences of digital health information seeking when sparked by the patient-provider SDM-environment. The findings show how digital health information seeking enhances the effects on health behavior changes when physicians involve patients in collaborative health decision-making and the patients feel a sense of personal accountability for their health. Moreover, the results show health providers perform a key value-facilitating role by conveying their support of digital health information to patients.

In particular, the study contributes a number of valuable insights on how digital-enabled decision-making leads to better health and wellness, currently missing in the extant transformative health literature (Royne, Fox, Deitz, & Gibson, 2014; Scammon et al., 2011; Walsh, Fitzgerald, Gurley-Calvez, & Pellillo, 2011). First, the significant paths from the health value co-creation model indicate that positive health behavior changes and health outcomes are co-created between patients and their health providers via SDM. However, this co-creation

occurs only when patients are also personally accountable for their health. Second, the models demonstrate that integrating both provider-related and external digital resources partially mediates the health value co-creation process. Hence, the extent to which patients are motivated to seek out and integrate digital resources in their daily lives has an additive effect on the health behaviors and outcomes beyond those generated solely by a patient-provider SDM-environment. Third, the study clarifies elements of the patient-provider SDM relationship that lead to digital health information seeking. As such, the sequential relationships underscore the importance of the physicians' influential value-facilitating role in motivating digital resource integration, engaging patients in health behavior change and improving overall health consistent with the SDL literature (McColl-Kennedy et al., 2012). Moreover, the data suggest physicians might extend their influence on health value co-creation beyond the patient-provider interactions during patients' office visits when encouraging patients' efforts to integrate digital health resources (Sweeney et al., 2015). In fact, all of the significant paths from the physicians' SDM-orientation to digital information seeking and health behaviors are reflective of value co-creation involving both the health provider and patient.

The results of Model 1 also provide important implications regarding specific types of consumers' digital health information seeking. Most notably, the data demonstrated there are two distinct digital health information resources researchers and health practitioners must account for when examining digital-enabled health decision-making – provider-related and external digital health resources. Additionally, the results indicated the SDM factors that motivate each type are different and require that health providers and marketers adjust marketing and communication efforts to facilitate patients' integration of both digital sources. This is particularly important given the SEM findings related to the consequences of provider-related

and external digital information seeking. Specifically, the data suggest there is a sequential information flow from provider-controlled to external digital health information sources, which further activates patient involvement in their health decisions and improvement in related health outcomes. Unexpectedly, the study found no significant, direct path from provider-related digital to health behavior changes (Model 3) or overall health (Model 4). However, the path from external digital to health behavior changes was significant and thus signifies the particular importance of motivating consumers' external digital health information seeking. Further analysis indicated provider-related digital health information seeking had an indirect effect through motivating patients to seek out more external information. In combination, these findings provide evidence of value co-creation through increasing consumers' access to both provider-related and external digital resources.

As noted previously, one of the co-creation relationships highlighted in the model was that between the SDM-environment, personal health accountability, and patients' digital information-seeking behavior. The results indicated a physicians' SDM-orientation alone does not directly lead to greater health behavior changes. This finding is consistent with prior research demonstrating an SDM-environment alone is not enough to fully activate consumers' health behavior changes (Makarem et al., 2014). Beyond directly impacting behavior change, SDM indirectly influences behavior change by increasing patients' personal accountability for their health and motivating consumers to increase the level of digital health information integration. As health providers face increased patient loads and spend less time with patients during the service visit, patients will increasingly be expected to take on a greater role in learning about their health as part of the SDM process (M. F. Chen, 2013). Health providers must increasingly understand this dynamic, and the current findings show physicians can help

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facilitate patients' information gathering and integration. In particular, patients need to receive encouragement from their health care provider to seek out provider-related and external digital health information to supplement the limited amount of information exchanged during the office visit. Table 28 outlines the study's theoretical contributions and practical implications.

Table 28

*Summary of Theoretical Contributions and Practical Implications*

<b>Theoretical Contribution</b>	<b>Practical Implication</b>
Consumers' digital information seeking is reflective of value co-creation involving both the service provider and consumer. Consistent with SDL theory, facilitating consumers' information seeking extends the service provider's influence beyond the service encounter.	Health providers need to be cognizant of the five prerequisites to digital health information seeking in order to extend their influence on consumers' health decisions and outcomes outside of the health service encounter.
An SDM-environment alone only has partial influence on behavior change, consistent with prior research. Digital information seeking activates consumers' involvement in decision-making and creates an additive effect on behavior change.	Health providers need to help patients integrate digital health information to maximize value co-creation.
At least two types of digital health information seeking exist (provider-related and external) and the SDM factors motivating each type differ.	Health providers and marketers need to account for differences including adjusting marketing communication efforts and the service delivery process to help consumers integrate both types.
SDL theory aligns with the movement from paternalistic care toward patient-centered care. The physicians' SDM-orientation has a larger total effect on provider-related information seeking, while health accountability has a larger total effect on external information seeking and health behavior changes. This supports the SDL perspective on value co-creation.	Establishing a collaborative decision-making orientation culture requires involvement from both the service provider and consumer. The patient plays a central role in health value creation, while the health care provider plays a key value-facilitating role. In order to leverage SDM's benefits, health providers need to empower patients to take on a greater role in the health decision-making process. One way to do this is to encourage digital health information seeking.
Although both types of digital health information seeking are important to improve health decisions and outcomes, helping consumers integrate external digital health information is vital and runs counter to SDM's greater focus on provider-related digital health information.	Health providers and marketers need to increase efforts to help patients integrate both types of digital health information, particularly external. Health providers and marketers should seek to (a) enhance their digital presence and (b) provide specific recommendations to increase external information seeking.
Service providers perform a critical value-facilitating role via specific recommendations that enhance digital information's credibility and usefulness.	Health providers will benefit from training programs that strengthen providers' skillsets for facilitating digital health information seeking. Policymakers can also assist health providers by establishing a digital health information rating scheme.

*Note.* SDL = service-dominant logic; SDM = shared decision-making.

**Reconciling the SDL and SDM perspectives.** Theoretically, the study contributes to the literature by resolving three contradictory insights suggested by the SDL and SDM perspectives. As noted previously, the two research streams differ in terms of who performs a more influential role in value co-creation, the value of different digital health resources, and how physicians facilitate consumers' valuation of different digital health resources (see Table 2). The study's results suggest the SDL perspective on value co-creation is more consistent than the SDM perspective and aligns with the transformative health care movement shifting from paternalistic care toward patient-centered care (Scammon et al., 2011; Seiders, Flynn, Berry, & Haws, 2015; Zhao et al., 2015). The results confirm that establishing a collaborative decision-making environment requires involvement from both the health care provider and consumer in line with both SDL and SDM. However, the consumers' health accountability has a larger total effect on both external information seeking and health behavior changes. Consistent with SDL, the data suggest that patients perform a more pivotal health value creation role, while health service providers function in more of a value-facilitating role (Sweeney et al., 2015). In particular, service providers' value-facilitating role occurs when health providers empower patients to be more involved in their health care decision-making via encouraging and facilitating the integration of consumers' digital health information seeking.

Notably, the additive effect of consumers' co-creation efforts on health behavior change and health outcomes differs between the two types of digital health resources that consumers might integrate into the SDM process. While the SDM literature emphasizes provider-related digital information inputs as more valuable to SDM, consistent with the SDL perspective, maximizing value co-creation occurs when the health service provider helps patients integrate external digital health information more so than integrating provider-related information.



However, the resulting impact on health behavior change and improved health outcomes that occurs through the sequential relationship from provider-related to external digital health information seeking indicates the importance of facilitating patients' integration of both types of digital health resources. The results also contribute to the extant literature by demonstrating the resource integration process differs based on the source of the digital health resource. Health providers need to be cognizant of the differing prerequisites to the two types of digital health information seeking in order to extend health providers' influence beyond the health service encounters (Grönroos & Ravald, 2011; Grönroos & Voima, 2013) and maximize value co-creation efforts (McColl-Kennedy et al., 2012; Sweeney et al., 2015).

The results also offer an interesting perspective on the physicians' value-facilitating role via digital influence on consumers' valuation of information inputs. As noted in Table 2, the SDL perspective suggests physicians' digital influence should affect the valuation of both provider-related and external digital health information equally, while the SDM perspective suggests physicians are likely to favor provider-related health information. Surprisingly, the results show the physicians' digital influence has a stronger association with consumers' external digital health information seeking. Although unexpected given prior research demonstrating health providers consider provider-related information more credible (Adams, 2010; Moorhead et al., 2013), the finding suggests health service providers may increasingly be open to recommending specific external digital health information. Future research should explore what factors motivate health providers to make specific recommendations to external digital health sources in an SDM-environment.

In combination, the study demonstrates the SDL's premises offer valuable insights on the value co-creation process and service providers' value-facilitating role. Although the study

focused on a health care context, the theoretical implications may also apply to other high involvement service contexts where information asymmetry places consumers at a knowledge disadvantage. In these contexts, the consumers' decision-making process may benefit from greater integration of both service provider-related and external digital information sources.

Future research may adapt the health value co-creation framework involving digital information seeking to high involvement professional service environments such as financial services, legal services, and others where integrating informational inputs may lead to improved decision-making and related outcomes (J. J. Xiao, Ahn, Serido, & Shim, 2014).

**Practical implications.** The data clearly show the importance of physicians to health value co-creation and facilitating patients' digital information seeking. The results imply that physicians need to be educated on appropriate resources to recommend to their patients, knowing that greater support on the physicians' part will lead to greater search and value co-creation efforts on the patients' end. Consequently, health marketers and health providers should enhance their digital health presence by linking to external digital health resources deemed by physicians to be credible and relevant to consumers. While some health care organization websites might link to health information from well-known health organizations (i.e. Johns Hopkins, Mayo Clinic, National Institutes of Health), this study's data along with recent consumer surveys indicate patients are increasingly interested in integrating more interactive, external digital elements such as mobile health applications, fitness trackers, and social media (eMarketer, 2013a, 2015; Salesforce, 2016). Furthermore, the results show the added value to health behavior changes and overall health co-created by integrating these external digital resources. Therefore, health marketers and physicians will benefit from an increased focus on identifying

credible and relevant external digital resources to promote via health providers' digitally controlled properties (i.e. health providers' websites and online health portals).

Physicians, and by extension the marketers who help design and update health organization websites, must take a more proactive approach to identifying and recommending valid digital health resources patients should utilize (Adams, van Veghel, & Dekker, 2015). Although patients can enhance their health literacy through seeking out provider-related or external digital information (Bolton et al., 2015; Zhao et al., 2015), most physicians need to adjust their stance on external digital health information's overall value. Research shows health providers are often skeptical of digital health information due to concerns about credibility and legal or privacy issues (Adams, 2010). Undoubtedly, this has slowed physicians' adoption and use of digital health information, lowered physicians' support of digital information expressed to patients, and thus hindered consumers' integration of digital health resources in the SDM process.

In order to address the skepticism and other structural inhibitors, health practitioners, policymakers, and marketers will need to address patients' needs for specific recommendations and decision tools to facilitate patients' evaluation of digital health information's credibility and usefulness (Adams et al., 2015). As a starting point, health care organizations and primary care providers should seek to expand their digital presence by identifying appropriate digital resources (Baird & Nowak, 2015). However, policymakers and practitioners outside of primary care organizations likely need to take a more central role in this process to assist both health providers and patients. Prior research suggests even health providers have a difficult time ascertaining appropriate digital health resources in part due to the speed at which new health information is shared in today's digital information environment (Revere et al., 2007).

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Therefore, specific actions from a public policy perspective might include (1) establishing a shared digital health resource rating scheme, (2) creating a branded seal noting health provider approval, (3) developing consumer and physician-targeted digital health literacy programs, and (4) establishing new communication and privacy guidelines covering patient-provider digitally-enabled interactions. Additionally, educational and on-going training programs targeting health practitioners are likely needed that strengthen health practitioners' skillsets for facilitating consumers' external digital health information (Levinson et al., 2010).

In summary, the current study contributes empirical evidence for digital information's role in helping activate patients' internal motivation for health behavior change. The study also highlights the critical value-facilitating role health providers perform by supporting consumers' digital health information seeking and helping integrate the information into the SDM and behavioral change processes. The results outline five prerequisites that must exist to generate patient-provider co-created health outcomes. First, providers must establish a collaborative health decision-making environment by empowering patients to take an active and informed role in their health decisions. Second, in conjunction with the patient-provider SDM-environment, health consumers must be activated in terms of feeling a stronger sense of responsibility for their health and related-decisions. Together, these first two conditions help establish a collaborative orientation culture between the patient and health provider conducive to health value co-creation. Third, consumers must have favorable perceptions of digital health information and health information technologies as valuable inputs to the health decision-making process. Once again, providers play an influential role through their social influence on perceived credibility and overall usefulness. Fourth, the aforementioned conditions help motivate consumers to integrate both provider-related and external digital health information resources. Finally, health

consumers can achieve value co-created health decisions and outcomes when they use the digital health information as decisional support or motivation to take action as part of healthier lifestyle choices designed to improve their overall health.

### **Limitations and Future Research**

As with all research, this study has limitations. Although not in a rural setting, the sample was not from a large urban center and the population in the service area is primarily Caucasian. As such, further research is necessary to determine whether the findings differ in more urban settings and with a more diverse respondent base. The study also included a limited set of health behavior changes and focused on a preventative health and wellness decision-making context while controlling for individuals' chronic health conditions. Future research should examine how patients dealing with diverse chronic health conditions may benefit from digital health information sources, which was outside of the scope of the current study. Research exploring a wider array of pro-health behaviors and information sources is also warranted, especially with regard to the relative importance of varied digital information sources for learning about and promoting healthful activities. Social desirability and self-report bias is also a concern, as these self-report measures may not reflect actual health behaviors or digital information seeking. Research using a longitudinal design may also increase understanding of the framework, reduce common methods bias, and provide a mechanism for measuring digital information seeking and health behavior changes. Finally, the model examines value co-creation as the resulting health behavior changes and overall health perceptions resulting from the combination of collaborative health decision-making orientation and valuation of digital health information inputs. Further research could explore other patient-provider co-creation opportunities, especially those that increase care providers' motivation to facilitate and

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encourage patients to seek information and take greater responsibility for managing their own health. In particular, future research might examine health providers' views of the co-creation chain and what affects their perceptions of digital information's usefulness and credibility, along with other psychosocial factors that in turn would appear to greatly impact consumers' perceptions and use. Additionally, research evaluating digital-based health marketing restrictions, privacy guidelines, and consumer-focused digital literacy programs will help health officials increase consumer protection from false or dangerous digital health information while improving digital health information management systems. Finally, future research might examine the impact on other relevant service delivery outcomes such as the relationship of the digital health information value co-creation chain and consumers' perceptions of overall service quality and access to care.

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## Appendix

Table 29

*Tests of SEM Path Hypotheses for Model 3 Using Composite-Based SEM*

Hypotheses and Paths				Std. Coefficient	t-value	p-value
<b>Direct Paths to Health Behavior Changes</b>						
H14	Physicians' SDM-Orientation	→	Health Behavior Changes	.119	2.086	.037
H15	Health Accountability	→	Health Behavior Changes	.236	2.411	.016
H16	Provider-Related DHIS	→	Health Behavior Changes	.030	0.483	n.s.
H17	External DHIS	→	Health Behavior Changes	.137	2.521	.012
<b>Indirect Paths to Health Behavior Changes</b>						
H1a	Physicians' SDM-Orientation	→	Provider-Related DHIS	.205	3.620	.001
H1b	Physicians' SDM-Orientation	→	External DHIS	-.168	-3.446	.001
H2a	Health Accountability	→	Provider-Related DHIS	.123	2.163	.031
H2b	Health Accountability	→	External DHIS	.116	2.411	.016
H4a	Physicians' Digital Influence	→	Provider-Related DHIS	-.028	-0.423	n.s.
H4b	Physicians' Digital Influence	→	External DHIS	.058	1.046	n.s.
H5a	Digital Credibility	→	Provider-Related DHIS	.093	1.506	n.s.
H5b	Digital Credibility	→	External DHIS	-.049	-0.945	n.s.
H6a	Digital Health Usefulness	→	Provider-Related DHIS	.197	3.672	.001
H6b	Digital Health Usefulness	→	External DHIS	.381	8.257	.001
H7	Physicians' SDM-Orientation	→	Health Accountability	.343	6.427	.001
H8	Physicians' SDM-Orientation	→	Physicians' Digital Influence	.153	2.607	.009
H9	Health Accountability	→	Physicians' Digital Influence	.143	2.426	.015
H10	Physicians' Digital Influence	→	Digital Credibility	.412	7.956	.001
H11	Digital Credibility	→	Digital Health Usefulness	.314	6.385	.001
H12	Physicians' Digital Influence	→	Digital Health Usefulness	.415	8.438	.001
H13	Provider-Related DHIS	→	External DHIS	.397	8.286	.001

*Note.*  $\chi^2 = 12.982$ ;  $DF = 12$ ;  $p = .370$ ;  $CMIN/DF = 1.082$ ;  $GFI = .990$ ;  $AGFI = .969$ ;  $CFI = .998$ ;  $NFI = .975$ ;  $RMSEA = .016$  [.000-.061]. SDM = shared decision-making; DHIS = digital health information seeking; n.s. = not significant; DF = degrees of freedom; CMIN/DF = chi-square minimum discrepancy (CMIN) divided by its degrees of freedom (DF); GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

Table 30

*PROCESS SPSS Macro Serial Mediation Results for Model 4*

<b>Variables<sup>a</sup></b>	<b>Step 1 DV=External Digital</b>	<b>Step 2 DV=Health Behavior Changes</b>	<b>Step 3 DV=Overall Health</b>
Constant	1.0119 (.1050)**	1.3855 (.1765)**	6.4161 (.2399)**
Provider-Related Digital	.3871 (.0417)**	.1164 (.0696)	.0826 (.0867)
External Digital		.1869 (.0840)*	-.0492 (.1050)
Health Behavior Changes			.1469 (.0708)*
<i>R</i> -Square	.2183	.0447	.0185
<i>F</i> (sig.)	86.0011**	7.1823**	1.9268

<b>Step 4: Indirect Effect(s) of X on Y<sup>a, b</sup></b>	<b>Effect</b>	<b>Bootstrapped LLCI</b>	<b>Bootstrapped ULCI</b>
Provider → External → Overall Health	-.0191 (.0413)	-.1019	.0627
Provider → External → Changes → Overall Health	.0106 (.0075)*	.0007	.0341
Provider → Changes → Overall Health	.0171 (.0130)	-.0003	.0502

<b>Completely Std. Indirect Effect of X on Y<sup>a, b</sup></b>	<b>Effect</b>	<b>Bootstrapped LLCI</b>	<b>Bootstrapped ULCI</b>
Provider → External → Overall Health	-.0142 (.0306)	-.0749	.0473
Provider → External → Changes → Overall Health	.0079 (.0055)*	.0005	.0237
Provider → Changes → Overall Health	.0127 (.0095)	-.0002	.0371

*Note.* DV = dependent variable; LLCI = lower level confidence interval; ULCI = upper level confidence interval.

<sup>a</sup> Standard errors are given in parentheses and are approximated to four decimal places.

<sup>b</sup> Bootstrap samples for bias corrected 95% CI = 1,000

\*  $p < .050$ . \*\*  $p < .001$ .

**Vita**

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