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The undersigned, approved by the Doctoral Faculty Council, have examined the dissertation entitled

TOWARDS A THEORY OF PATIENT SATISFACTION: STUDIES ON THE IMPACTS OF PATIENT-TECHNOLOGY FIT AND ELECTRONIC PATIENT PORTAL USE ON PATIENT SATISFACTION OUTCOME

presented by Aaron P. Kinney

a candidate for the degree of Doctor of Business Administration

and hereby certify that in their opinion it is worthy of acceptance.

Balaji Sankaranarayanan, Ph.D.
Assistant Professor of Information Technology and Supply Chain Management
Committee Chair

SIGNATURE: _____

K. Praveen Parboteeah, Ph.D.
Professor of Management
Second Committee Member

SIGNATURE: _____

Alana Platt, Ph.D.
Assistant Professor of Computer Science
Reader

SIGNATURE: _____

TOWARDS A THEORY OF PATIENT SATISFACTION: STUDIES ON THE IMPACTS OF
PATIENT-TECHNOLOGY FIT AND ELECTRONIC PATIENT PORTAL USE ON PATIENT
SATISFACTION OUTCOME

A Dissertation

Presented to

The Graduate Faculty of

The University of Wisconsin—Whitewater

In Partial Fulfillment

Of the Requirements for the Degree

Doctor of Business Administration

By

AARON P. KINNEY

Dr. Balaji Sankaranarayanan, Dissertation Chair

DECEMBER 2017

ACKNOWLEDGEMENTS

This work would not have been possible without the diligent guidance, expertise, and encouragement from the members of my dissertation committee, Dr. Balaji Sankaranarayanan (Chair), Dr. K. Praveen Parboteeah, and Dr. Alana Platt (Reader). In particular, I would like to thank Dr. Sankaranarayanan for the countless hours spent emailing, talking on the phone, reading, suggesting new angles, and most of all encouraging me. You helped me to not only understand the dissertation process (and I apologize for how painful that might have been for you), but also helped me to feel excited and enjoy it. Thank you for your enthusiasm while teaching and the diligence and passion you have for developing others. I will be eternally grateful for the sacrifices you made to prioritize my dissertation and am humbled forever by your assistance.

In addition, I would like to thank the faculty and staff who came together to establish the first cohort within the Doctorate of Business Administration program at the University of Wisconsin-Whitewater. The hours, weeks, months, and now years spent under your tutelage and care has been a tremendously rigorous and rewarding experience. I would be remiss if I did not mention here a sincere thanks to my fellow students who kept me motivated throughout the process, turning misery into comedy; the knowledge that the suffering was shared made the work all the more achievable.

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Most importantly, thank you to my family: my wife Ashley, our son Ari, and our daughter Alexandra. I know this journey has taken a significant amount of sacrifice from each of you; from the bottom of my heart, thank you.

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TOWARDS A THEORY OF PATIENT SATISFACTION: STUDIES ON THE IMPACTS OF PATIENT-TECHNOLOGY FIT AND ELECTRONIC PATIENT PORTAL USE ON PATIENT SATISFACTION OUTCOME

AARON P. KINNEY

Dr. Balaji Sankaranarayanan, Dissertation Chair

ABSTRACT

Recent attention upon patient satisfaction within health care has increased the complexity of organizational management in hospitals. Recent regulatory changes, such as the Medicaid value based purchasing program, no longer allow leaders to focus only upon health outcomes and fiscal bottom lines; a critical concern is the perception of the health care experience from the patient perspective. This dissertation theorizes and builds a nomological network of antecedents to patient satisfaction from distinct theoretical perspectives, to move towards a theory of patient satisfaction, and to contribute to and extend existing work in health care research. To this end, this dissertation first examines patient satisfaction as an outcome variable, seeking to establish a robust and consistent outcome variable. Second, this research introduces the concept of patient-technology fit, and the impacts of its antecedents, expanding previous research on task-technology fit to the patient experience. Finally, a direct examination of the impact of cognitive and affective factors on patient satisfaction is studied, to explain post-adoptive use of health information technologies and their impact on patient satisfaction. Primary survey instruments were used to assess patient satisfaction scores, as well as utilization of existing and adapted scales to measure key variables. Structural equation modeling using PLS was used to test the

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hypothesized relationships. Findings from the dissertation confirm the dimensionality of patient satisfaction, while illustrating the importance of patient-technology fit, cognitive and affective factors in predicting patient satisfaction. These findings have research and practical implications, as healthcare organizations strive to improve their patient satisfaction through patient-centric care.

Keywords: Patient Satisfaction, patient-technology fit, electronic patient portals, cognitive factors, affective factors, post-adoptive use.

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CHAPTER 1 – SUMMARY OF RESEARCH

The ability to provide patient centered health care has been accepted as an important indicator of quality amongst health care systems (Corrigan, Donaldson, & Kohn, 2001). One of the most often cited references for the need for increased efforts to improve quality in health care has been *To Err is Human* (Kohn, Corrigan, & Donaldson, 2000), which highlighted the nearly 98,000 preventable medical errors that occur annually. Nearly a decade later these same figures have been suggested to be overly conservative due to measurement error, and researchers have suggested preventable medical errors are nearly ten times the original estimate when measured with tools not based upon voluntary reporting (Classen et al., 2011). In measuring patient centered care and quality, patient satisfaction has been often used as an indicator due to several suggested relationships with the variable: improved clinical outcomes (Kane, Maciejewski, & Finch, 1997), increased patient retention (Garman, Garcia, & Hargreaves, 2004), decreased medical malpractice claims (Levinson, 1994), higher conformity to treatment plans (Cecil & Kwelleen, 1997), willingness to share medical concerns (Parchman, Noël, & Lee, 2005), improved care coordination (Thiedke, 2007), reduced length of stay (Tsai, Orav, & Jha, 2015), or readmission rates (Tsai et al., 2015), and higher surgical quality (Tsai et al., 2015). This characteristic has become even more important due to the provisions of Hospital *Value Based Purchasing* regulations which dictate that reimbursement from Medicare enact a 2% withhold that can be earned back in part via high levels of patient satisfaction (Petrullo, Lamar, Nwankwo-Otti, Alexander-Mwells, & Viola, 2012). While critics of patient satisfaction as a quality indicator correctly cite its inability to measure qualities such as the skill of a surgeon (Birkmeyer et al., 2013), research has found that patient satisfaction has a positive relationship with reduced rates of readmission and reduced length of stay, both of which are considered important surgery

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quality indicators (Tsai et al., 2015). As prior research has indicated, patient satisfaction is an important metric of quality, and yet there is a paucity of research on the predictors of patient satisfaction from multiple perspectives.

Despite the well documented acceptance that patient satisfaction is a key metric by which to assess quality, it remains criticized as an incomplete and difficult to test variable (Kupfer & Bond, 2012). Critics have applauded the ability of high levels of patient satisfaction to be associated with positive clinical outcomes, such as increased ability to meet perceived needs (Kupfer & Bond, 2012), increased patient compliance with provider instructions (Ware & Hays, 1988), and even identification of problem areas as assessed from the patient perspective so solutions may be pursued (Sitzia & Wood, 1997). While the many positives associated with patient satisfaction are applauded and it is seemingly important enough to encourage hospitals to embrace patient satisfaction as a measure of interest (Aragon & Gesell, 2003; Boissy et al., 2016b; Jarvis et al., 2013), the nuances of these positive relationships are not fully understood despite more than thirty years of academic inquiry (Kupfer & Bond, 2012). As such, more work is needed to build towards the nomological network of factors that predict patient satisfaction. Simply put, a variety of circumstances and conditions impact patient satisfaction; the current state of knowledge does not delineate what routinely affects or combines with other circumstances to impact feelings of patient satisfaction. This dissertation will assist in not only clarifying the significance of the measure, but also offering a full understanding of its relationship with the care continuum across a multitude of contexts.

Prior research provides a substantial foundation upon which to build towards a general theory of patient satisfaction (Aragon & Gesell, 2003; Linder-Pelz, 1982a, 1982b), however there remains little consistency or academic inquiry building towards a true general theory. In

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response to consistent calls for additional research in this domain (Tsai et al., 2015), this research seeks to address this gap in three ways. First, in acknowledgement of the dearth of literature supporting the variety of ways in which patient satisfaction is measured as an outcome variable (Boissy et al., 2016b; Chang, Tseng, & Woodside, 2013; Chen, Birkmeyer, Saint, & Jha, 2013; Cohen, 1996; Fenton, Jerant, Bertakis, & Franks, 2012; González et al., 2005; Larsen, Attkisson, Hargreaves, & Nguyen, 1979; Raposo, Alves, & Duarte, 2009; Raup, 2008; Ross, Steward, & Sinacore, 1995; Williams, Inman, & Dale, 1998), this research seeks to define clearly the patient satisfaction outcome variable. Second, information technology research provides a roadmap to better understand the role of technology and fit (P.-S. Chen, Yu, & Chen, 2015; Crean, 2010; Dishaw & Strong, 1999; Fuller & Dennis, 2009; Furneaux, 2012; Furukawa & Poon, 2011; Goodhue & Thompson, 1995; Lin & Huang, 2008; Zigurs & Buckland, 1998). Building off this research, the concept is extended through definition of patient-technology fit and also measure its impact upon our proposed patient satisfaction outcome. Finally, electronic patient portal usage is posited as an important factor of health information technologies' inconsistent relationship with patient satisfaction (Rozenblum et al., 2013). This research extends the technology acceptance model (Davis, Bagozzi, & Warshaw, 1989) to posit that patient portal usage positively affects patient satisfaction through altering attitude towards the technology and behavioral intentions, ultimately changing usage patterns and impacting patient satisfaction. These research efforts will combine to strengthen the understanding of the nomological network of factors that predict patient satisfaction. Figure 1 depicts the proposed relationship of all three concepts set forth in this dissertation, with a focus on patient satisfaction throughout each essay. Thus, Essay 1 focuses upon patient satisfaction as a concept, while Essay 2 focuses upon how patient characteristics and technology orient one's attitudes, and finally in Essay 3 electronic patient

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portals are examined as a specific health information technology and in turn their impact upon patient satisfaction is measured.

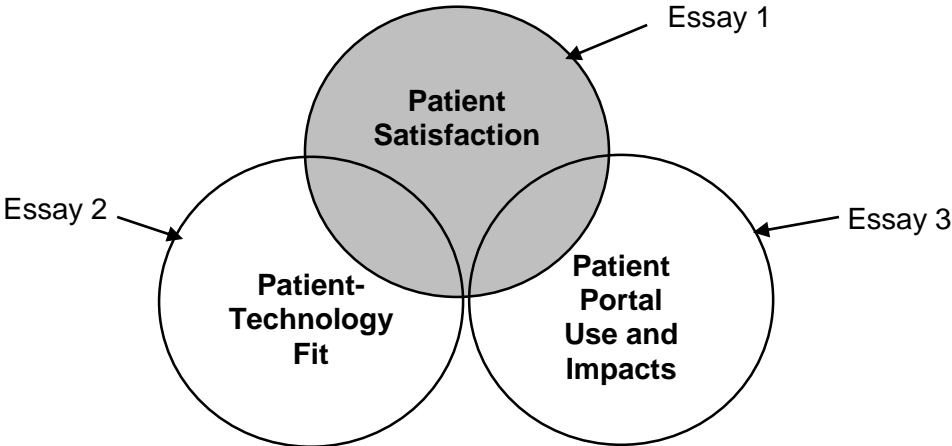


Figure 1. Towards a theory of patient satisfaction: Three essays. This figure illustrates the overall concept of each essay and how they overlap.

Background

Essay 1: Patient Satisfaction as an Outcome Variable

Patient satisfaction has long been understood to have a strong correlation with improved clinical outcomes throughout the health care domain (Manary, Boulding, Staelin, & Glickman, 2013). This underscores the significance of the concept, but also highlights patient satisfaction as an outcome variable that is not measured consistently. Prior literature frequently has found overall rating of hospital and willingness to recommend as single item proxy measures for patient satisfaction (Boulding, Glickman, Manary, Schulman, & Staelin, 2011; Chatterjee, Joynt, Orav, & Jha, 2012; Lyu, Wick, Housman, Freischlag, & Makary, 2013). The two items frequently have been found to be highly correlated, leading some researchers to select one or the other as the variable of interest (Tsai et al., 2015). Other times, alternate satisfaction outcomes are used, such as custom satisfaction composite scores focused upon communication (Abdul-Razzak, Brazil, Sherifali, Simon, & You, 2015; Fenton et al., 2012), satisfaction with a specific technology (Cottrell, Cox, O'Connell, & Chambers, 2015), the reporting of negative experiences by patients (Rozental, Boettcher, Andersson, Schmidt, & Carlbring, 2015), and other composite patient satisfaction constructs (Kullberg, Sharp, Johansson, & Bergenmar, 2015). This myriad of outcomes contributes valuable knowledge to the network of antecedents and consequences of patient satisfaction, but demonstrates that a consistent measurement of the outcome to allow proper theoretical development is required.

Essay 2: Patient-Technology Fit

Patient-technology fit is a new concept introduced in this dissertation and is defined as the ability of the information technology utilized by patients and providers to enable the patients to accomplish their tasks related to health care. Adapting the information processing theories

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from human processing and organizational perspectives (Atkinson & Shiffrin, 1968; Daft, Lengel, & Trevino, 1987; Galbraith, 1974; Simon, 1978) to the health care context, and building on prior work in the technology fit domain (Chen et al., 2015; Furneaux, 2012; Goodhue & Thompson, 1995; Zigurs & Buckland, 1998), I define patient-technology fit as consisting of the following dimensions: a) patient's information gathering, b) provider-patient coordination, c) provider-patient communication, and d) patient's social sharing. Building upon the task-technology fit literature through the lens of information processing provides a robust framework to understand how health information technologies can impact the proposed patient satisfaction outcome.

Essay 3: Electronic Patient Portal Usage

While patient satisfaction has been embraced by the medical community as a pertinent quality measure, federal regulation requiring the implementation of health information technologies to improve clinical care have had mixed results on this important measure, with up to 45% of recent studies into the effectiveness of HIT upon patient satisfaction showing no effect or inconclusive results (Rozenblum et al., 2013). This information highlights the fact that health systems are increasingly implementing HIT, such as electronic health portals, without a complete understanding of how they may interact with other important outcome measures such as patient satisfaction (Blumenthal, 2011). In response to consistent calls for more inquiry into the impact of pursuing higher levels of patient satisfaction, it seems prudent to examine raw measures of patient satisfaction from hospitals that have implemented electronic health records and achieved varying levels of meaningful use as defined by the Health Information Technology for Economic and Clinical Health (HITECH) Act.

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The main purpose of this research is to increase understanding of patient satisfaction in relation to its measurement as an outcome variable, patient-technology fit, and the impact of health information technologies such as electronic health portals. Another aim of this dissertation is to examine under which contexts this conceptualization of patient satisfaction outcome variables can be applied, in an effort to move towards a more generalizable model. Primary and secondary research was combined in this research in order to understand relationships at the individual level, but also at the group and organizational level when available.

Therefore, the research questions this dissertation seeks to address are as follows:

- What is the appropriate way to measure patient satisfaction as an outcome variable?
- What is the impact of patient-technology fit upon patient satisfaction?
- What is the impact of electronic patient portal usage upon patient satisfaction?
- What are the other factors that influence these relationships and what are their impacts on patient satisfaction?

In summary, this dissertation will contribute to our understanding of the nomological network of factors affecting patient satisfaction in three ways. First, inquiry into patient satisfaction as an outcome variable will end the decades-long pattern of inconsistent measurement of this critical variable. It also provides practitioners and academics alike with guidance as to the key antecedents to the standardized outcome variable, which can also be compared across organizations. Second, building from task-technology fit literature helps to demonstrate the significance of the nuances associated with technologies used in the patient care experience and how they can impact patient satisfaction. From an academic perspective, information processing theory helps to understand how patients make decisions related to

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evaluating the care they have received, and practitioners gain a new perspective on evaluating fit of proposed health information technologies. Third, increased understanding of the relationship of patient portal usage and patient satisfaction provides a more complete understanding of patient satisfaction theory. Significant research involving technology acceptance may prove applicable in this setting, substantially advancing patient satisfaction theory. For practitioners, this research will allow greater understanding of how to implement patient portals, but also inform as to which factors are the most important when seeking to use patient portals as a vehicle to satisfy patients. These three contributions combine to provide a substantially greater understanding of the network of factors impacting patient satisfaction, providing rigorous support to the development of a theory of patient satisfaction.

CHAPTER II – ESSAY 1

Defining Patient Satisfaction as a Consistent Outcome Variable

Abstract

Despite high levels of academic and practitioner interest in patient satisfaction, there is no definitive model to explain the construct of patient satisfaction. Current Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction scoring surveys are frequently used as a proxy for patient satisfaction, despite measuring other quality and patient centered care outcomes. This research proposes to build from the HCAHPS methodology, hypothesizing a re-conceptualized Patient Satisfaction Scale (PSS) consisting of three dimensions: instruction effectiveness, atmosphere, and care team communications. Data was collected using a patient population survey. Structural equation modeling was used to validate factor loadings and propose a patient satisfaction scale. This reconceptualization of the patient satisfaction construct will assist researchers in moving towards a more generalizable model of patient satisfaction.

Keywords: Patient Satisfaction, patient satisfaction index, HCAHPS

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The decision by the Centers for Medicare and Medicaid Services (CMS) to include Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction scores as a key factor in their value based purchasing program underscores the significance of patient satisfaction, potentially putting up to 2% of an organization's Medicare payments at risk for poor HCAHPS scores by 2017 (Tsai et al., 2015), close to \$2 billion annually on a national level. While there has been a lack of agreement for decades as to the role patient satisfaction should play with regards to measuring quality of care (Cleary & McNeil, 1988; Manary et al., 2013), there continues to be a focus on the topic from academics and policymakers alike (Lyu et al., 2013). Continued efforts to understand the network of important antecedents that impact patient satisfaction scores and in particular the HCAHPS domains of care are important, especially given the financial benefits of high scores. In an era of constrained resources and declining reimbursement (Dusetzina, Basch, & Keating, 2015), understanding which antecedent relationships can most positively impact patient satisfaction scores will prove incredibly helpful to organizations struggling to select the best strategies to improve scores.

Current research into patient satisfaction is staggering; for example, a search isolated to the PubMed database, limited to publications from January through October 2016 with the keyword "patient satisfaction," revealed 4,377 publications; a search of calendar year 2015 with the same criteria found 5,763 articles. When seeking to understand the variables used to measure satisfaction, a curious trend arises in that patient satisfaction is not measured consistently as an outcome variable. It is common for numerous proxies of patient satisfaction to be used, including: likeliness to recommend (Tsai et al., 2015), global rating of hospital (Chatterjee et al., 2012; L. M. Chen et al., 2013), satisfaction with nursing (Kutney-Lee et al., 2009), satisfaction

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with physician communication (Abdul-Razzak, Sherifali, You, Simon, & Brazil, 2015; Fenton et al., 2012), and numerous unique satisfaction scales such as the Patient Satisfaction Scale (Yellen, Davis, & Ricard, 2002). While these examples demonstrate important contributions to understanding satisfaction, they are distinct aspects of patient satisfaction and demonstrate a lack of consistency regarding the variable as an outcome. Even when all aspects of the HCAHPS dimensions have been used in studies as variables of interest (L. M. Chen et al., 2013; Kutney-Lee et al., 2009; Lyu et al., 2013; Tsai et al., 2015), the endogenous variables have been frequently comprised of single item responses to either overall satisfaction or willingness to recommend. Further, while the limitations of HCAHPS as designed and measured are continuously pointed out, reimbursement is tied to these tools and as such the tools are used.

This study contributes to the body of knowledge in two ways. First, this study postulates the factors which precede the patient satisfaction outcome variable. Despite established research regarding the acceptability of single item outcome variables (Bowling, 2005), the primary justification for doing so is on the basis of limiting survey items; in HCAHPS, other survey items are already being asked but not always considered as part of the satisfaction outcome. The present research suggests an index rather than a single item indicator. Second, this conceptualization allows the consistent measurement of satisfaction as an outcome to enable the movement towards a theory of patient satisfaction. Therefore, the two specific research questions asked in this study are as follows:

- What are the appropriate dimensions of the patient satisfaction outcome construct?
- Which dimensions should the current HCAHPS measures be assigned to?

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This research will first review the current HCAHPS scoring methodology, followed by a review of patient satisfaction and its relationship to patient-centered care, and then offer a review of the frequent outcomes commonly used to evaluate patient satisfaction. Next, theoretical background the hypotheses will be provided, as well as a discussion on the methodology to build this construct towards a model of patient satisfaction. Finally, the implications to practitioners and future research will be discussed.

Literature Review

Hospital Consumer Assessment of Healthcare Providers and Systems Scoring

It is important to examine the etiology of HCAHPS surveys, as well as the method in which they are calculated to support the present research questions. HCAHPS patient satisfaction surveys were created in an effort to set a national standard for patient satisfaction surveys to improve transparency, allow for comparisons, and ultimately improve the quality of care provided. Voluntary collection of HCAHPS scores began in 2006, with mandatory public reporting beginning in 2008. Surveys are intended for all types of patients over 18 years of age, including commercial, government, and self-pay, with minimal exclusion factors to ensure a broad pull of patient satisfaction with the eight domains of care. It is important to note that one of the requirements for HCAHPS eligibility is an overnight stay; for outpatient and clinic satisfaction surveys there are other items used. Patients are randomly sampled from all eligible discharges and aggregated on a quarterly basis, which is then used to create a rolling four quarter profile—the score for the organization. There are currently six composite topics measuring nurse communication, doctor communication, responsiveness of hospital staff, pain management, communication about medicines, and discharge information. There are two individual items regarding cleanliness and quietness of the hospital which are made into an

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additional composite score, as well as two global items allowing for overall rating of the hospital and the willingness to recommend the hospital. The full survey can be seen in Appendix A for reference.¹ Willingness to recommend is not used to calculate patient satisfaction overall scores for an organization.

Based upon the composite scores and the overall rating of hospital item, hospitals can then earn up to 80 points, 10 for each dimension of care. This becomes interesting due to the equal weighting of each of the domains and the single item overall score. Not only is it possible that one of the seven composite scores more strongly influences an individual's perception of the single item overall rating of the hospital and thus potentially has the ability to achieve extra weight, but the concern of omitted variable bias is raised in understanding patient satisfaction as a construct (Scheffler, Brown, & Rice, 2007). The propensity to utilize HCAHPS data for a majority of patient satisfaction research allows a consistent benchmark that is conducted throughout U.S. hospitals, allowing important comparisons; however, concerns remain from an academic perspective about common method variance. In particular, high utilization of HCAHPS scores for patient satisfaction research raises serious questions about predictor and criterion variables being measured at the same point in time, from the same source, and using the same medium, as well as concerns with the possibility of a consistency motif bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

These concerns can certainly be mitigated through the use of a formative scale, in which the items can be consistently and discretely measured by their significance to the overall score, rather than uniformly suggesting that each plays an equal role in patient satisfaction. Thus,

¹ Additional information regarding HCAHPS patient satisfaction surveys can be found at <http://www.hcahponline.org>

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patient satisfaction as measured by HCAHPS much more clearly presents a formative scale and needs to be treated as such (Diamantopoulos & Winklhofer, 2001). Another option would be an item which allows patients to rank the importance of factors which impact their overall satisfaction levels; unfortunately, this is not common practice either. While the data may not always be available from other sources, a single-common-method-factor approach will help researchers to understand what the appropriate satisfaction outcome truly is (Podsakoff et al., 2003). The consideration of a formative patient satisfaction construct also alleviates measurement concerns commonly found with the use of single item indicators (Boyd, Gove, & Hitt, 2005). Understanding what matters most to patients is ultimately the primary goal of patient satisfaction research; finding a broad solution to avoid equal weighting of factors will present a substantial advance to the field.

Patient Centered Care and Patient Satisfaction

There appears to be general consensus in previous literature that the provision of patient-centered care is a critical aspect of a high-quality health care model, although it is not unanimously understood or defined. At times, patient-centered care and patient satisfaction are used interchangeably, despite being distinct constructs (Kupfer & Bond, 2012). Patient satisfaction, while not itself consistently constructed, can be understood as the "...individual's positive evaluations of distinct dimensions of health care" (Linder-Pelz, 1982b, p. 580). Patient satisfaction measurement has been an attitude of interest for decades (Larsen et al., 1979); however, more recently patient satisfaction surveys have been refined to measure aspects of patient centered care, which have been shown to correlate with positive outcomes, including satisfaction with providers, nursing, and wait times (Aragon & Gesell, 2003). Some of the frequently cited benefits of high levels of patient satisfaction include strong correlations to

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improved outcomes (Furukawa & Poon, 2011; Kane et al., 1997) and improved adherence to care plans (Ciechanowski, Katon, Russo, & Walker, 2014). These are important relationships to understand, however, some liberty has been taken with regards to stating that high levels of patient satisfaction are part of these relationships. Frequently, upon a closer read, researchers have used discrete aspects of patient satisfaction such as global rating of hospital, likeliness to recommend, or satisfaction with communication. This can be problematic, as organizations hoping to improve their HCAHPS scores may turn to high impact studies citing the benefits of certain actions upon patient satisfaction, investing time and resources into supporting such actions; unfortunately, an examination of the relationships specifically found may reveal that these actions actually improve physician communication scores, an area in which the organization may already receive top scores.

Patient centered care, on the other hand, has been strongly encouraged by the Institute of Medicine as one of the six key aims of the U.S. health system (Corrigan et al., 2001) and focuses primarily on patient involvement in care and care individualized to the specific patient context. In order to measure patient-centered care, oftentimes certain aspects of the care delivery model, such as wait times, are evaluated from the patient perspective to test for their perceived presence (Robinson, Callister, Berry, & Dearing, 2008). This is a difficult construct to measure, as measuring how something worked for an individual becomes difficult to capture in a generalizable survey (knowing that what worked for one in an individualized setting may not always work for another). Measurement can be further complicated by patients wanting something they perceive they need, such as a particular drug, and yet physicians feel that another treatment or drug is more appropriate for the medical situation (R. M. Epstein & Street, 2011). Nonetheless, researchers and clinicians agree that there lies a sweet spot between evidence based

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medicine and patient centered care (Epstein & Street, 2011). As the two concepts' measurement tools continue to be refined, it is increasingly common for patient-centered practices to also have a positive impact upon patient satisfaction, causing some misunderstandings regarding the discrete concepts (Kupfer & Bond, 2012). Specifically for the present research, patient satisfaction will be studied further in order to solidify understanding of one piece of the patient care puzzle.

Prior Patient Satisfaction Outcomes

Patient satisfaction has long been understood to have a strong correlation with improved clinical outcomes throughout the health care domain (Manary et al., 2013). This underscores the significance of the concept, but also highlights patient satisfaction as an outcome variable that is not measured consistently. Prior literature frequently has found overall rating of hospital and willingness to recommend as single item proxy measures for patient satisfaction (Boulding et al., 2011; Chatterjee et al., 2012; Lyu et al., 2013). The two items frequently have been found to be highly correlated, leading some to select one or the other as the variable of interest (Tsai et al., 2015). Other times, alternate satisfaction outcomes have been used, such as custom satisfaction composite scores focused upon communication (Abdul-Razzak, Sherifali, et al., 2015; Fenton et al., 2012), satisfaction with a specific technology (Cottrell et al., 2015), patients' reported negative experiences (Rozenal et al., 2015), and other composite patient satisfaction constructs (Kullberg et al., 2015). This myriad of outcomes contributes valuable knowledge to the network of antecedents and consequences of patient satisfaction, but also demonstrates the time has arrived to push for a consistent measurement of the outcome to allow proper theoretical development.

Prior Patient Satisfaction Antecedents

Several important antecedents to patient satisfaction have been previously researched, as well as numerous attempts to understand patient satisfaction through the lens of other consumer satisfaction research. For example, many pioneers in consumer satisfaction have lauded the importance of disconfirmation theory, which suggests customers compare their satisfaction to some sort of preconceived notion about how the experience should have been, rather than through direct comparison or their own expectations (Oliver, 1980). Unfortunately for patient satisfaction, after scrutiny it has been suggested that this may not be entirely appropriate in relation to patient satisfaction considering the markedly different end state to utilization of health care (Newsome & Wright, 1999). Previous attempts to build upon consumer research theory have sought to understand the role expectations play in satisfaction research; however, these too have not always proven fruitful when applied to patient satisfaction (Toma, Triner, & McNutt, 2009). Even more distant streams of literature, such as context emergent turnover theory, have attempted to understand patient satisfaction. Context emergent turnover theory is a unit-level turnover model which focuses on the factors that impact organizational performance benchmarks (Nyberg, 2010). One such application applied this theoretical model to patient satisfaction as the organizational outcome of interest, finding several negative and significant relationships with patient satisfaction, including job demands and voluntary turnover rates (Rewelly, Nyberg, Maltarich, & weller, 2014). In each of the above examples, important antecedent linkages have been supported; however, the measurement of patient satisfaction as a dependent variable has differed from study to study. Too often research focuses upon specific factors affecting or resulting from patient satisfaction but does not definitively establish a consistent measurement of the construct. The HCAHPS methodology will remain important for patient satisfaction and

patient centered care reasons, but a definitive and clear definition for patient satisfaction as a construct is long overdue.

Theoretical Background

Prior literature has demonstrated a maze of antecedents and consequences of patient satisfaction drawn from a combination of theory, field research, experiments, and trials, and yet a prominent model or theory of patient satisfaction has yet to emerge. In 2003, a proposed theory of satisfaction emerged but was constrained strictly to the emergency department and has gained little traction or validation outside of that context since (Aragon & Gesell, 2003). This research did however build upon prior distribution of antecedents, using a combination of satisfaction with physician (Fenton et al., 2012), nursing (Kutney-Lee et al., 2009), and wait times (Pather et al., 2010). This approach was effective but ignored other factors known to affect patient satisfaction, such as age or current health status (G. Cohen, 1996; Rahmqvist, 2001), explanation of status and condition (Jackson, Chamberlin, & Kroenke, 2001), health information technologies (Rozenblum et al., 2013), or environmental factors such as ease of parking (Devesa, Laguna, & Palacios, 2010; Pather et al., 2010) or cleanliness (Andaleeb, 2001).

Prior Patient Satisfaction Models

Two prior conceptualizations of patient satisfaction provide some insight as to a starting point for the present research; one a conceptual piece and the other a focused niche model with potential broader application. In 1982, there was a conceptualization of a patient satisfaction model which included social psychological variables affecting that satisfaction: beliefs and valuations regarding care received, perceived occurrence versus prior expectations, and interpersonal comparisons (Linder-Pelz, 1982b). The same research noted the lack of variables from the patient or health care organization perspective as a clear limitation, including, for

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example, characteristics of the health care system, anything to do with the providers of the care, or any socio-demographic variables (Linder-Pelz, 1982b). Thus, the model helped to provide a first step towards a theory but left a large path of further research needed and was a conceptual piece requiring further validation. Leaving out the characteristics of the actual care received left a gaping hole which made it difficult to build upon this model while still providing some theoretical support to the role that expectations and what actually transpired have upon satisfaction.

The aforementioned model was tested by the same author to specifically test the main five hypotheses: expectations, entitlements, values, interpersonal comparisons, and perceived occurrences (Linder-Pelz, 1982a). These social-psychological variables only explained a small amount of patient satisfaction, with only expectations directly impacting satisfaction in any significant way, uprooting much of the previously proposed model. In more contemporary patient satisfaction research, expectations have long been held to play a major role in overall evaluations of patient satisfaction (Macfarlane, Holmes, Macfarlane, & Britten, 1997; Spahr, Flugstad, & Brousseau, 2006). Several studies have actually found support for the claim that that providers may be more inclined to provide a treatment which may not be necessary if they feel it would meet patient expectations (Linder & Singer, 2003; Linder, Singer, & Stafford, 2003). In a direct effort to assess this notion, in a survey of 987 patients who presented during enrollment periods, Toma et al. (2009) could find no relation between expectation fulfillment and satisfaction. Interestingly, they did find strong significant correlations between interpersonal skills of the provider and satisfaction, as well as adequate explanations of waiting time and perception of total time playing a role in the patients' overall assessment of satisfaction (Toma et al., 2009).

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A second noteworthy conceptualization of patient satisfaction can be found by Aragon and Gesell (2003), who approached patient satisfaction through the development of the primary provider theory, which focuses exclusively upon patients' satisfaction with their primary providers, wait times, and provider assistants as the key antecedents to overall satisfaction (Aragon & Gesell, 2003). This model notably excludes the social psychological variables conceptualized decades before, as well as any patient or system characteristics, instead focusing purely on the perceptions of the occurrence, perhaps contributing to its minimal impact to the development of a comprehensive model of patient satisfaction thereafter. Both models, however, provide the theoretical framework which suggests the encounter itself, the patient, and the care (or perception of care) others receive may play a critical role in understanding the nomological network of factors affecting patient satisfaction.

Prior Theoretical Support for Satisfaction Models

Fulfillment theory and discrepancy theory. Health care researchers have historically drawn upon fulfillment theory to help them understand the patient satisfaction attitude (Korsch, Gozzi, & Davis, 1967; Vertinsky, Thompson, & Uyeno, 1974). Fulfillment theory essentially defines satisfaction as the difference between the desired outcome and the outcome received (Lawler, 1971). This is often partnered with discrepancy theory, which also defines satisfaction as the difference between the desired outcome and the outcome received, except in discrepancy theory it is the comparison to the perception of the outcome received that is compared, rather than the actual outcome (Shapiro & Wahba, 1978). Research has shown in many circumstances that discrepancy theory plays the more substantial role in satisfaction than does fulfillment theory, largely due to the fact that patients frequently do not understand fully the care outcomes that have transpired and can only respond based on their perception (Linder-Pelz, 1982a). Thus,

future models of patient satisfaction have often considered expectations in addition to the provider interactions in future health care satisfaction research. With growing evidence that expectations do not play a major role in patient satisfaction (Toma et al., 2009), the current trend appears to be a myriad of antecedent and consequences to satisfaction without a general or consistent model to approach the attitude.

Social comparison theory. Social comparison theory is rooted in the job satisfaction literature and shapes satisfaction as a perception of equity in comparison to those considered peers (Lawler, 1971). In the health care setting, this would imply the satisfaction of patients with perceived similar medical circumstances is directly affected by getting the same patient experience (wait times, outcomes, and provider interactions). The key notion here is that expectations as well as aspirations can be influenced by social comparisons (R. M. Williams, 1975), and with expectations playing such a prominent role in the health care literature, there has been obvious research output in this space. While finding traction in job satisfaction literature, health care has notably had minimal literature validating social comparison theory as a fundamental root of patient satisfaction, leaving room for further exploration on the importance of comparisons regarding patient satisfaction.

Customer satisfaction models. With job satisfaction not completely finding transferrable theory in the patient satisfaction realm, customer satisfaction literature offers additional insight. In particular, the American customer satisfaction index (ASCI) model provides a fairly generalizable customer satisfaction model (Fornell, Johnson, Anderson, Cha, & Bryant, 1996). The ASCI forms customer satisfaction as a latent variable consisting of perceived quality, perceived value, and customer expectations (Fornell et al., 1996) and attempts to measure satisfaction at a macro level rather than at the individual transaction level, despite also

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collecting individual encounter information (Anderson, Fornell, & Lehmann, 1994). Perceived quality is suggested on the basis of meeting the customers' needs as well as being reliable (Fornell et al., 1996). Perceived value is posited on the basis of meeting consumer demand, in that customers can perceive the general value of something when compared to the quality of the product (Fornell et al., 1996; Lancaster, 1971). Finally, expectations of the customers were found to have a predictive role in determining customer satisfaction, with the assumption that customers' expectations were in general rationale and predictive of quality and value assessments (J. A. Howard, 1977). This model continues to be used to the present day, with a plethora of studies citing the ASCI as an important variable of understanding within marketing and customer research (Fornell, Morgeson, & Hult, 2016; Sorescu & Sorescu, 2016).

While the ASCI model has worked well in measuring customer satisfaction, customer satisfaction literature also provides a clue as to why there has been difficulty transferring such models to health care, as it has been posited that infrequent transactions lead to consumers having greater difficulty estimating quality, value, and expectations (J. A. Howard, 1977). Intuitively, even with frequent visits, it is easy to conceptualize that patients' expectations may be skewed (the patients expect there is some way to solve their medical problem), they may not understand the value of the care received (nor do they always know the cost of their care until after it has been received), and they may find it difficult to accurately judge the quality of care received when the providers of this care frequently learn their trade for more than a decade before engaging in their care specialty.

In summary, multiple job and customer satisfaction theories have been applied to the patient satisfaction space with mixed results. Prior theoretical underpinnings suggest consistently that an evaluation of the encounter, the interaction with the provider, and social

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comparisons of some sort play a role in assessing one's own satisfaction with a health care experience. Unfortunately, the results have not been consistent, suggesting a more rigorous look at patient satisfaction is needed if there is to be progress towards a generalizable model.

Research Model

This section describes the research model and hypothesis for this study. Figure 1.1 illustrates the research model. In this model, the patient satisfaction scale is the dependent formative construct, preceded by instruction effectiveness, atmosphere, and care team communication.

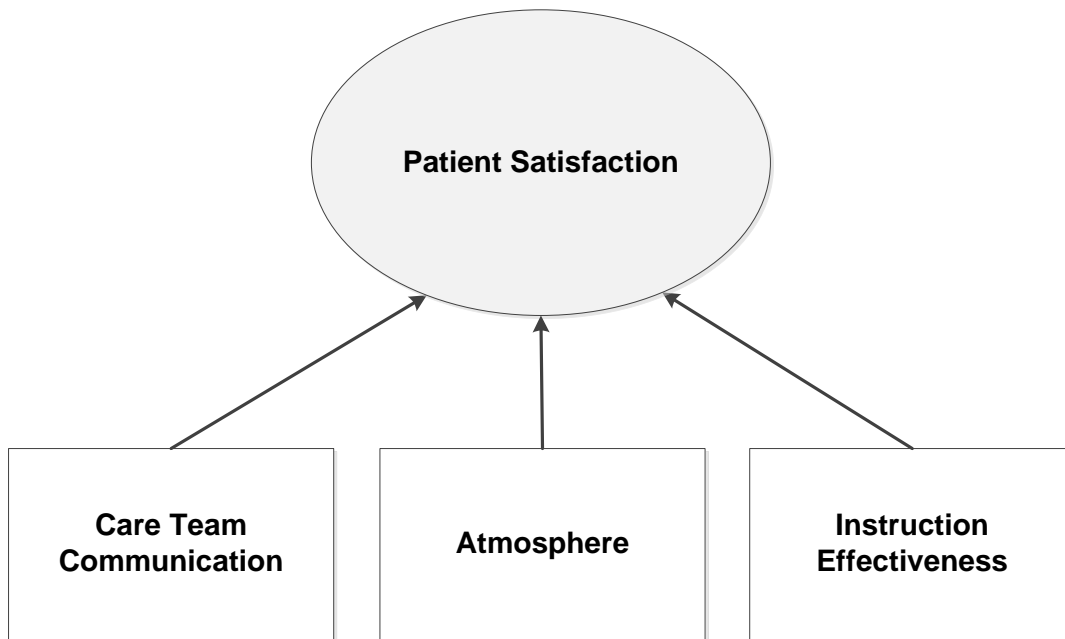


Figure 1.1. Research model of patient satisfaction. The patient satisfaction scale is the dependent formative construct, preceded by instruction effectiveness, atmosphere, and care team communication.

Patient Satisfaction

For the present research model, patient satisfaction has been re-conceptualized, with the intent being to measure patient satisfaction without unduly weighting some of the items as is found with the common HCAHPS ratings. It is necessary to define the proposed alternative to one of the predominantly used patient satisfaction outcome variables, the HCAHPS single item overall satisfaction rating. The benefits to using HCAHPS are numerous, not the least of which is the ability to compare against other organizations nationally as the overall satisfaction rating is one of 32 questions distributed to most U.S. hospitals. The survey allows measurement of 10 measures of care processes, and provides payment incentives under the value based purchasing program for eight of the measures. The eight measures with financial incentives include: communication with doctors, communication with nurses, staff responsiveness, pain management, communication about medicines, discharge information, cleanliness and quietness, and overall rating (Center for Medicaid and Medicare Services, 2016). As discussed previously, the fundamental issue with this methodology is that there are equal weights applied to the different measures in calculating an organization's overall score. While it is important for a variety of reasons from the practitioner and patient perspective to conduct the surveys in such a way, it does not always translate to consistent measurement of patient satisfaction as an outcome variable of interest.

To facilitate consistent outcome variable measurement, this research used a modified version of the existing HCAHPS 32-item survey and let the items load in relation to overall satisfaction and willingness to recommend scores. This allowed the measures to act as formative measures for satisfaction (Diamantopoulos & Winklhofer, 2001) and allowed an academic understanding of the significance of the measure Weights on satisfaction. The specific proposal

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was to use the patient responses to the formative measures to re-conceptualize the dimensions of patient satisfaction, with overall satisfaction and willingness to recommend single item indicators used to control for measurement error (C. B. Jarvis, MacKenzie, & Podsakoff, 2003). This allowed greater understanding of the actual loadings of the measures and enabled the ability to exclude measures not significant to patient satisfaction. The initial data analysis of this study first evaluated these loadings to establish the accurate model for the patient satisfaction index. Once established, testing of the present model proceeded with either the newly supported constructs of patient satisfaction or the legacy outcome measures of satisfaction or willingness to recommend. The present survey added an additional willingness to recommend item in order to allow analysis with at least two reflective measures of patient satisfaction if the proposed constructs were not a superior conceptualization.

Instruction Effectiveness

Instruction effectiveness is conceptualized as a dimension which captures the care team's ability to convey information pertinent to the patient back to the patient, notably including communication about medicines and discharge information. Development of a variable which allows the patient perspective of the care encounter itself to be considered in the overall satisfaction model is rooted in both customer and job satisfaction literature. Indicators that were fairly comparable across disease, acuity, and care facility were used and thus focused on items which can be assessed uniformly: responsiveness, cleanliness, and quietness. Cleanliness and quietness are factors known to be important across most patient demographics (Quintana et al., 2006) but also are reported publicly via HCAHPS as an indicator of quality, and as such these factors were included in the study rather than relying on a patients' perception of quality. Prior research suggesting the importance of health care staff responsiveness on willingness to

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recommend (Abrahamsson, Berg, Jutengren, & Jonsson, 2015), coupled with the understanding that willingness to recommend is highly correlated to overall satisfaction (Tsai et al., 2015) suggests that instruction effectiveness will have a positive impact upon the patient satisfaction scale.

Atmosphere

Atmosphere is defined by this research as the evaluation of the health encounter with respect to the things around the patient, notably cleanliness, quietness, and staff responsiveness. Since I know that expectations and aspirations can be influenced by comparisons (R. M. Williams, 1975), it is posited here that easily comparable information should be evaluated in an effort to provide a reliable proxy for expectations which have not had consistent success predicting patient satisfaction. Lindner-Pelz (1982b) originally proposed including some sort of interpersonal comparisons in the original proposal of a patient satisfaction model, however did not ultimately test for the relationship (Linder-Pelz, 1982a). Given the advent of HCAHPS and the ability to compare data across institutions uniformly, this variable was thus reconsidered. Further, social comparison theory provides compelling support in the job satisfaction literature as an important predictor of satisfaction and was thus posited as an important antecedent to the patient satisfaction scale.

Care Team Communication

This research defines care team communication as any communication between a patient and a member of the care team. In the current academic and practitioner research areas, care team communication has been repeatedly found to influence satisfaction (Adams, Flores, Coltri, Meltzer, & Arora, 2015; Boissy et al., 2016b; Buller & Buller, 1987; Roter & Hall, 2006; S. Williams et al., 1998). In attempting to gather the critical variables affecting satisfaction across

the spectrum, expectations and perceptions dominate the established predictive models (Fornell et al., 1996; Linder-Pelz, 1982a, 1982b). The inconsistent ability of expectations to be found in health care can intuitively be understood as the patient's inability to fully grasp the medical situation enough to accurately establish expectations or perceptions of what has transpired. This is not surprising given the understanding that negative life events cause hopelessness (Abramson, Metalsky, & Alloy, 1989), which perhaps skews both expectations and perceptions in such a way that they become unreliable. That said, provider communication offers an opportunity to predict satisfaction in that provider communication is understood to be an opportunity for providers to help set expectations (Svarstad, 1976). Contemporary research has continued to cite the predictive nature of care team communication upon patient satisfaction (Adams et al., 2015; Ruberton et al., 2016) and as such was posited to have a direct relationship in our model.

Methods

Sampling Design and Procedures

Participants throughout the United States were invited to participate in this electronic survey via Qualtrics, with a goal of 500 survey respondents. Previously, electronic surveys have been noted as suitable for population samples (Berinsky, Huber, & Lenz, 2012). An additional reason this study sought to achieve more than 500 survey respondents is that generally at least 500 samples are recommended for analysis as a population sample (Barratt, Ferris, & Lenton, 2015). Finally, 500 samples allow for adequate structural equation modeling using path analysis via SmartPLS, consistent with prior research (Myers, Ahn, & Jin, 2011). General guidelines for modeling in partial least squares regression (PLS) require the larger of either ten times the formative indicators or ten times the number of the maximum incoming paths to a construct (Chin, 2003). This would suggest that in the present research model, 170 responses would be the

required minimum for obtaining a medium effect size (Goodhue, Lewis, & Thompson, 2012); however, 504 responses were obtained.

Qualtrics provided a financial incentive (the negotiated rate with Qualtrics was just under \$5 per completed survey) for the completion of the survey for this dissertation. Qualtrics allowed users to complete either in one sitting or save their progress and complete in multiple visits. To this end, reminder emails were scheduled for those participants who had not completed surveys within 24 hours of starting the survey; however, the survey attained more than 500 completed survey responses from users who completed the survey in the first attempt. A high participation rate was expected given the use of Qualtrics, specifically due to the incentive model (Berinsky et al., 2012). The only requirements to take the survey were to successfully answer that they were 18 or older and consented to take the survey. The study made clear it was seeking those whom had used an electronic patient portal in the last 12 months, however this was not mandatory. Failing to complete the survey after starting it resulted in exclusion, and users failing to complete the survey were not furnished incentive payment. Survey instructions noted that participation was anonymous and voluntary.

Research Design and Methods of Data Collection

The present research used a survey to collect data for this study for two reasons. First, this survey was focused on the measurement of attitudes, and a survey has been deemed an appropriate way to measure attitudes (Schuman & Presser, 1996). Second, given the theory testing nature of this work rather than theory building, a survey remained appropriate (Yin, 2013). This study sought to build upon previous knowledge rather than build new theory. Given the significant relationship pathways to be observed, SmartPLS modeling software was used to complete the partial least squares modeling for this study.

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This study was designed as a closed cohort, single stage survey consisting of four sections. The first section consisted of screening information, as well as the consent; the second section contained seven questions focused upon the electronic health portal; the third section was comprised of questions related to characteristics of the respondents; the fourth section included items mirroring HCAHPS surveys, followed by demographic information such as age, gender, income, race, and education. All responses were evaluated for reliability checks, described in detail within the analysis section. There were no forced responses, and as such, missing or not applicable responses were calculated using mean score imputation (Allison, 2002). Ultimately, there were 857 data points missing, primarily resulting from withholding demographic information such as income or race (which were not imputed), followed by the selection of not applicable responses. In this survey the median age was from 41 to 45, and the discovered ratio of males to females was 345 women (68.5%) and 159 Men (31.5%).

Item development and expert review. Existing measures greatly assisted in the construction of the survey instrument for this study. New items were established based on literature review, expert review, and desired measurement unique to the questions of this survey. Previous research item development processes greatly aided in this item development (DeVellis, 2016; Netemeyer, Bearden, & Sharma, 2003). Given the techno centric nature of this research, new items were first devised in collaboration with an information technology professor with experience in health care research. Next, an expert review was arranged, to include numerous subject matter experts, including physicians, nurses, health care administrators, and health care researchers. Here, physicians and nurses alike suggested shifting the names of the proposed constructs from evaluation of health care encounters, social comparisons, and care team communication to instruction effectiveness, atmosphere, and care team communication. An

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initial pilot study was conducted with 20 health care staff, including doctors and nurses interested in the outcomes of this research; of those surveyed, nine of the 20 completed a survey. These data were used to adjust and refine the survey instrument; feedback largely consisted of issues with item wording, order, and display. A revised pilot survey was then sent to 65 current and former doctoral students, with 43 responding over a week long collection period. The intent of this additional pilot survey was to use the data to run initial statistics to check for any issues or trends, while working towards finalization of the survey tool. A final expert review was completed prior to moving the study to the current version.

Measures

The research informing the creation of this survey suggested a formative index, as such, measure development was slightly different when compared to reflective constructs (Diamantopoulos & Winklhofer, 2001). Existing HCAHPS scoring methodology evaluates all stated dimensions of care, however weights them evenly. The present study sought to not hold the measures with equal weighting, given the specific goal to discover if the items were loading in a way that would help illuminate the complex nomological network of factors surrounding patient satisfaction. In the current survey, it was necessary to include several inclusive, overall indicators, such as satisfaction with care and willingness to recommend, which can be used as reflective items to the dependent variables, so that the formative dimensions could be validated (Diamantopoulos & Winklhofer, 2001).

Controlling for method bias. Because this study measured all data at the same point in time, from the same survey tool and all via the Qualtrics platform, which made it important to consider ways to avoid common method bias (Podsakoff et al., 2003). This bias is often found when researchers collect all variables in a study using the same time, source, and system (Jarvis

et al., 2003; Podsakoff et al., 2003). Common method bias to falsely influence constructs and beta-Weights, thereby raising concerns of falsely represented results (Jarvis et al., 2003; Podsakoff et al., 2003). To avoid these biases, researchers often separate the collection of independent and dependent variables through multi-round surveys, or by gathering data for different sections of the survey from different respondents (Morrison, 2002). In this study, common method bias was tested by isolating the factor loadings of the dimensions, and then completing single-common-method-factor approach (Podsakoff et al., 2003). These results are discussed in the analysis section and alleviate concerns of common method bias.

Controlling for Other Factors. Demographic information was collected in this survey, using prior studies, and even demographic data collected in HCAHPS surveys as a guide, such as age, gender, income, race, and education level. This data was then used in post-hoc analyses, and helped to alleviate concerns related to statistical bias, while allowing examination of other factors to statistical results.

Analysis and Results

This section of the paper depicts the statistical analysis of the survey data as well as the analysis of the results, measurement model, and structural model. SmartPLS 3.2.6 was used for this analysis. The measurement model evaluated reliability, convergent validity, and discriminant reliability, while the structural model was used to test the hypotheses. First, the measurement model is presented, then the structural model, and finally the supplemental analysis.

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Figure 1.2. Patient Satisfaction Structural model. This model depicts the loadings and significance of the proposed structural model. * $p < .05$, ** $p < .01$, *** $p < .001$

Measurement Model

Prior to evaluating the measurement model, an exploratory factor analysis was conducted, the results of which are depicted in Table 1.1 and Figure 1.3. Using SPSS Statistics software, a principle component analysis revealed two factors with eigenvalues above 1.0 and a third factor at approximately 1.0 (.962) as shown in Table 1.1; however, this explained only 69% of the variance. While a 1.0 eigenvalue is often used as a rule of thumb for establishing factors, it has often been criticized as being a non-precise cutoff lacking theoretical support (Conway & Huffcutt, 2003); hence, the next step was to perform a varimax rotation with Kaiser normalization as depicted in Table 1.2. This revealed three dimensions of satisfaction which began to suggest loadings similar to what the patients and physicians in our expert review were suggesting: communication items loading together (care team communication); facility environmental factors loading together, such as staff responsiveness, cleanliness, and quietness (atmosphere); and the ability of medical staff to explain discharge and medical information to patients (instruction effectiveness). These results helped to advance our model in preparation for PLS modeling and confirmatory factor analysis.

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Table 1.1

Eigenvalue Variance Explained. This table depicts the eigenvalue results from the exploratory factor analysis, without and with rotation.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.283	54.608	54.608	9.283	54.608	54.608	5.240	30.824	30.824
2	1.562	9.190	63.798	1.562	9.190	63.798	4.082	24.013	54.837
3	.962	5.658	69.456	.962	5.658	69.456	2.485	14.619	69.456
4	.735	4.325	73.781						
5	.669	3.937	77.718						
6	.526	3.092	80.810						
7	.458	2.694	83.504						
8	.413	2.428	85.933						
9	.378	2.226	88.159						
10	.338	1.986	90.145						
11	.316	1.858	92.003						
12	.283	1.666	93.668						
13	.263	1.547	95.215						
14	.231	1.360	96.575						
15	.214	1.261	97.836						
16	.203	1.195	99.031						
17	.165	.969	100.000						

Extraction Method: Principal Component Analysis.

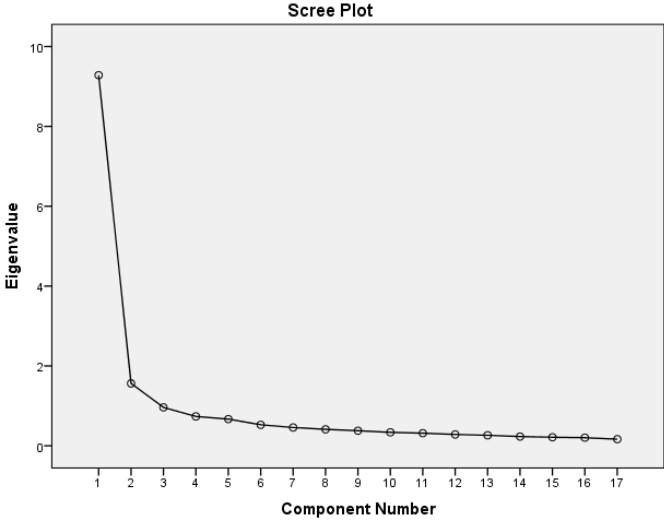


Figure 1.3. Scree plot for patient satisfaction exploratory factor analysis.

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Table 1.2

Rotated Component Matrix

Items	Component		
	1	2	3
<i>DC3</i>	.822		
<i>NC3</i>	.793		
<i>DC1</i>	.787		
<i>DC2</i>	.778		
<i>NC2</i>	.775		
<i>SR1</i>	.747		
<i>NC1</i>	.729		
<i>CM2</i>	.484	.421	.472
<i>SR3</i>		.787	
<i>DI_3</i>		.774	
<i>DI_1</i>	.343	.767	
<i>DI_2</i>		.749	
<i>CM3</i>		.716	
<i>SR2</i>	.375	.494	.454
<i>CM1</i>		.457	.400
<i>CQ2</i>			.848
<i>CQ1</i>	.366		.776

Note. The abbreviations above stand for the associated dimension as follows. DC=doctor communication, NC=nursing communication, SR=staff responsiveness, CM=communication about medicines, DI=discharge information, CQ=cleanliness and quietness

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To establish model, convergent, and discriminant reliability, I followed the guidelines for conducting confirmatory factor analysis in PLS (Gefen & Straub, 2005). Constructs with only single item indicators were excluded from discriminant and convergent reliability evaluations, given the item is presumed to capture the item with an average variance extracted (AVE) of 1.000. Variable reliabilities and item loadings were above the recommended threshold of 0.70 (Nunnally, 1978). Table 1.3 portrays the t values of the outer model loadings of the model. The first criteria focused on ensuring that the t values were equal to or greater than 1.96 to ensure convergent validity (Gefen & Straub, 2005). Consequently, the t values, shown in Table 1.3, were significant ($t > 1.96$), which helps establish one aspect of convergent reliability. I also verified that the (AVE) were greater than or equal to 0.5 (Fornell & Larcker, 1981). Table 1.5 shows an AVE greater than 0.5, which is indicative of convergent validity for the constructs. Despite this, a problem was presented in that communication (0.768) and atmosphere (0.769) had near identical AVE and correlation values, and instruction effectiveness (0.801) actually exceeded atmosphere, suggesting issues with discriminant reliability with the proposed model (Hoyle, 2012).

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Table 1.3

Outer Model Loadings

Construct	Item	Question	<i>t</i> values
Communication about Medicines (CM)	CM1	How often did hospital staff describe possible side effects?	21.199
	CM2	How often did hospital staff tell you what the medicine was for?	26.607
	CM3	I clearly understood the purpose for taking each of my medications?	20.633
Cleanliness and Quietness (CQ)	CQ1	How often were public restrooms found clean?	23.923
	CQ2	How often was the noise level quiet during appointments?	29.007
Doctor Communication (DC)	DC1	Did providers (e.g., doctors) treat you with courtesy and respect?	52.416
	DC2	Did providers (e.g., doctors) listen carefully to you?	51.395
	DC3	Did providers (e.g., doctors) explain things in a way you could understand?	68.947
Discharge Information (DI)	DI_1	Staff took my preferences into account in deciding what my health care needs would be.	53.155
	DI_2	Whenever I left my typical health care facility, I had a good understanding of the things I was responsible for in managing my health.	53.806
	DI_3	I received information in writing summarizing the visits and describing any symptoms or health problems to look out for	28.923
Nurse Communication (NC)	NC1	How often did nurses treat you with courtesy and respect?	51.744
	NC2	How often did nurses listen carefully to you?	57.359
	NC3	How often did nurses explain things in a way you could understand?	35.131
Staff Responsiveness (SR)	SR1	How often did you get help from any staff as soon as you wanted it?	22.981
	SR2	How often did you get an appointment as soon as you needed?	36.77
	SR3	When contacting my typical health care facility with a question, I typically received an answer the same day.	26.16
Willingness to Recommend (WR)	WR1	I am satisfied with my health care facility.	201.569
	WR2	I would recommend this health care facility to my friends and family.	193.899

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Table 1.4

Item-to-Construct Correlations. The bolded sections in each column are the constructs associated with the corresponding items in each row.

Items	Atmosphere	Communication	Instruction Effectiveness	Patient Satisfaction
<i>CM1</i>	0.581	0.521	0.701	0.493
<i>CM2</i>	0.701	0.673	0.754	0.538
<i>CM3</i>	0.502	0.398	0.71	0.515
<i>CQ1</i>	0.768	0.603	0.522	0.502
<i>CQ2</i>	0.776	0.531	0.536	0.533
<i>DC1</i>	0.662	0.868	0.604	0.525
<i>DC2</i>	0.672	0.867	0.621	0.557
<i>DC3</i>	0.651	0.877	0.609	0.506
<i>DI_1</i>	0.672	0.595	0.862	0.678
<i>DI_2</i>	0.713	0.59	0.864	0.718
<i>DI_3</i>	0.564	0.471	0.768	0.56
<i>NC1</i>	0.673	0.857	0.599	0.552
<i>NC2</i>	0.684	0.876	0.614	0.535
<i>NC3</i>	0.639	0.84	0.557	0.468
<i>SR1</i>	0.739	0.753	0.574	0.465
<i>SR2</i>	0.81	0.591	0.669	0.562
<i>SR3</i>	0.751	0.515	0.743	0.642
<i>WR1</i>	0.702	0.582	0.732	0.966
<i>WR2</i>	0.672	0.592	0.733	0.966

Note. The abbreviations above stand for the associated dimension as follows. DC=doctor communication, NC=nursing communication, SR=staff responsiveness, CM=communication about medicines, DI=discharge information, CQ=cleanliness and quietness

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Table 1.5

Measurement Model Validation - Average Variance Extracted.

Dimensions	Atmosphere	Communication	Instruction Effectiveness	Patient Satisfaction
Atmosphere	0.769			
Communication	0.768	0.864		
Instruction Effectiveness	0.801	0.696	0.779	
Patient Satisfaction	0.711	0.608	0.758	0.966

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Upon reflection and in evaluation of the actual items and the proposed latent construct, it would be appropriate to consider these latent variables (atmosphere, instruction effectiveness, and care team communication) as second order formative variables (Hoyle, 2012; C. B. Jarvis et al., 2003). Figure 1.4 depicts the revised structural model, adjusted to reflect the more accurate second order conceptualization. The revised measurement thus resolved our AVE concerns. However, communication remained insignificant, which was inconsistent with prior research that overwhelmingly has supported the importance of physician and nurse communication in explaining patient satisfaction (Abdul-Razzak, Sherifali, et al., 2015; Adams et al., 2015; Ishikawa, Hashimoto, & Kiuchi, 2013).

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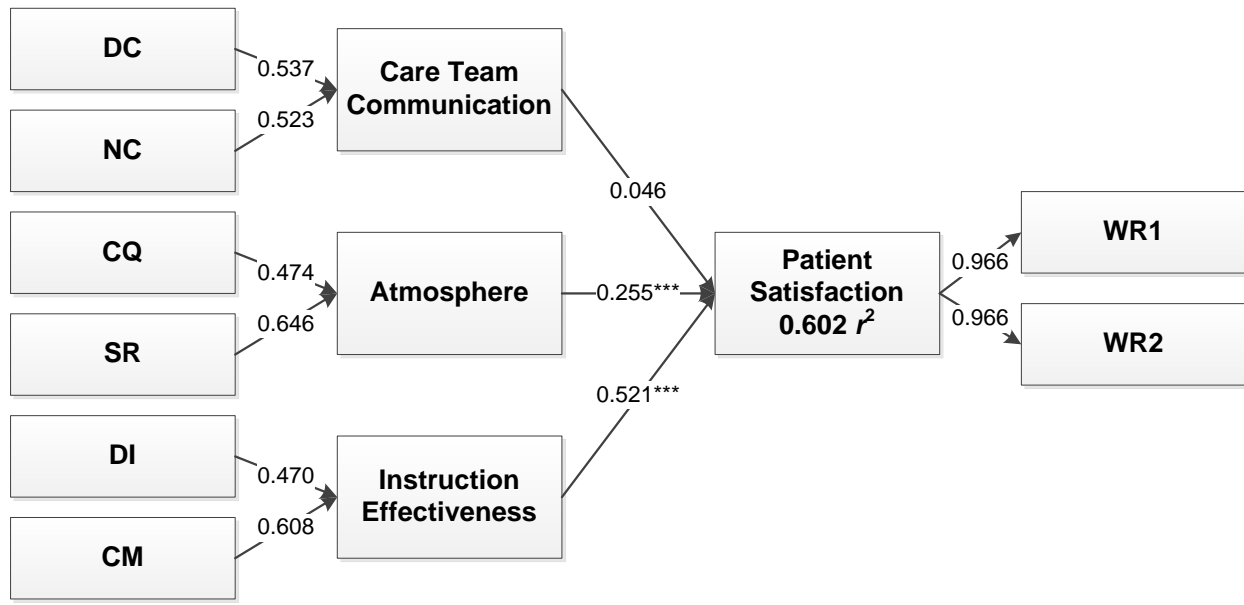


Figure 1.4. Revised structural model for patient satisfaction.

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

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Table 1.6

Revised Measurement Model Validation - Average Variance Extracted.

Dimensions	Atmosphere	Communication	Instruction Effectiveness	Patient Satisfaction
Atmosphere	1			
Communication	0.774	1		
Instruction Effectiveness	0.792	0.696	1	
Patient Satisfaction	0.704	0.607	0.756	1

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An alternative method of PLS modeling suggests loading all items into the dependent variable to enable direct assessments of significance when theoretically supported (Hair, Black, Babin, Anderson, & Tatham, 1998); however, there are limitations to evaluation of the rest of the model when utilizing this method, such as inability to measure the true R^2 . Given the historical precedence supporting the significance of communication, Figure 1.5 was modeled to further evaluate the specific significance of the latent variables. In doing so, it was found that care team communication (beta = 0.456, t value = 39.280), atmosphere (beta = 0.293, t value = 31.967), and instruction effectiveness (beta = 0.346, t value = 26.648) have significant and positive relationships. Here I also found that AVE issues had been resolved.

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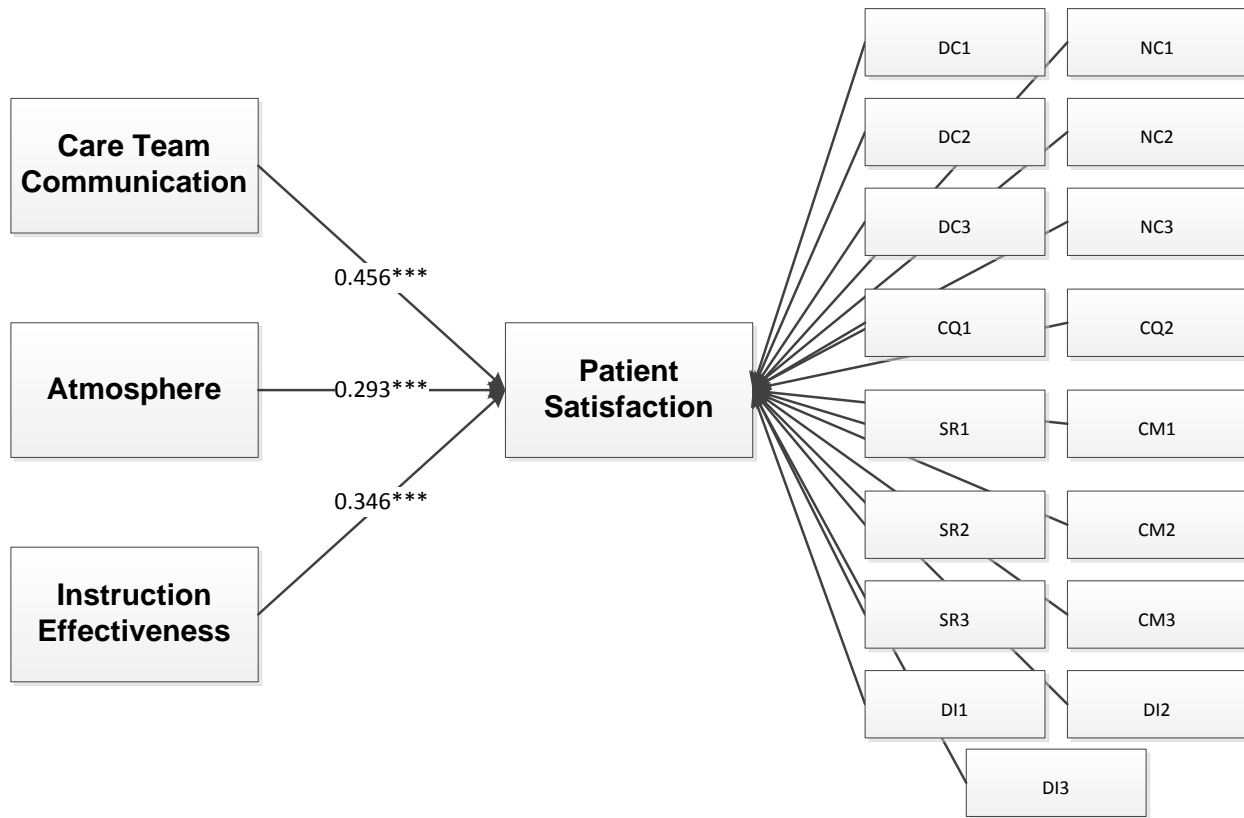


Figure 1.5. Third measurement model – direct assessment of item significance.

Note. The abbreviations above stand for the associated dimension as follows. DC=doctor communication, NC=nursing communication, SR=staff responsiveness, CM=communication about medicines, DI=discharge information, CQ=cleanliness and quietness. * p < .05, ** p < .01, *** p < .001

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Table 1.7

Third Measurement Model Validation - Average Variance Extracted.

Dimensions	Atmosphere	Communication	Instruction Effectiveness	Patient Satisfaction
Atmosphere	1			
Communication	0.774	1		
Instruction Effectiveness	0.792	0.696	1	
Patient Satisfaction	0.92	0.923	0.895	0.739

Structural Model

The evaluated structural models are shown in Figures 1.2, 1.4, and 1.5. To validate the second order constructs, the procedure described by Pavlou and El Sawy (2006) was used. This process required that the items associated with the second order constructs were validated based on convergent and discriminant validity, as explained in the prior section of this paper. This allowed analysis of the path coefficients from the first order constructs to the second order constructs (care team communication, atmosphere, and instruction effectiveness) to check for significance. The corresponding path coefficients were found to be highly significant at $p < 0.001$, as depicted in Figures 1.2, 1.4, and 1.5, with t values shown. This established that the second order constructs of care team communication, atmosphere, and instruction effectiveness were derived from six, five, and six first order constructions, respectively.

As a conceptual piece, there were not specific hypotheses to evaluate in this research model, however there were two specific research questions that the present model sheds light upon: (a) what are the appropriate dimensions of the patient satisfaction outcome construct, and (b) to which dimensions should the current HCAHPS measures be assigned?

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Table 1.8

Importance of Dimensions of Satisfaction

Descriptive Statistics							
Dimensions	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Count 1 Selection	Mean Statistic	SD Statistic
<i>COMDOC</i>	504	6	1	7	284	2.17	1.840
<i>COMNUR</i>	504	6	1	7	33	2.97	1.404
<i>STFRES</i>	504	6	1	7	38	3.61	1.420
<i>COMMED</i>	504	6	1	7	20	4.00	1.314
<i>DISINF</i>	504	6	1	7	22	5.20	1.635
<i>CLNQTN</i>	504	6	1	7	40	4.83	1.777
<i>PAINMG</i>	504	6	1	7	32	5.23	1.874
Valid N (listwise)	504						

Note. The abbreviations above stand for the associated dimension as follows. COMDOC=doctor communication, COMNUR=nursing communication, STFRES=staff responsiveness, COMMED=communication about medicines, DISINF=discharge information, CLNQTN=cleanliness and quietness, PAINMG=pain management.

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The initial research question of this study suggested the current six dimensions of patient satisfaction may have a better alternative. When clustered as conceptualized into three dimensions, it was found that while atmosphere ($\beta = 0.262$, t value = 3.429) and instruction effectiveness ($\beta = 0.514$, t value=6.625) were found to have positive and significant effects upon patient satisfaction, communication as conceptualized (lumping nurse and doctor communication together) was not significant in the first two models ($\beta = 0.049$, t value = 0.726) but was found to be significant in the third model ($\beta = 0.456$, t value = 39.280). The insignificance of the communication dimension in the first two models could be because the two reflective items of communication did not fully capture the complexity of the relationship between communication and patient satisfaction. However, this research explored which dimension the patients evaluated as most important to their overall rating (Table 1.8). Interestingly, communication with doctors was overwhelmingly selected as the number one factor in patients' own assessment of overall satisfaction. This suggests that despite the lack of significance when clustered, communication remains a significant factor to satisfaction scores. I again confirmed this aspect with our third structural model (Figure 1.5). This data helped to shed light on the importance of the existing dimensions of care, while also showing the ability of practitioners and researchers alike to further condense these constructs into three dimensions for parsimony, targeted interventions, and expansion of understanding of the antecedents and consequences of these variables.

In conclusion, based on the results of the three structural models, I consider the second structural model (Figure 1.4) as the best representation of the patient satisfaction dimensions for two reasons. First, from a theoretical standpoint, it closely aligned with the original proposed theoretical framework. Second, from a methodological standpoint, the AVE concerns were addressed while the insignificance of the communication dimension was resolved through further

testing. Therefore, I will utilize the second structural model (Figure 1.4) as the patient satisfaction model for Essays 2 and 3 in this dissertation.

Discussion, Limitations, and Conclusions

Diverging from earlier conceptualizations and contemporary measurement of patient satisfaction, this essay re-conceptualized patient satisfaction and contributes to existing literature in three distinct ways. First, the patient satisfaction model was factored into three dimensions, rather than the eight espoused by the HCAHPS methodology. Second, by adding an additional reflective outcome variable, the study increased validity and understanding of relationships that can be obtained in the measurement models (Diamantopoulos, Riefler, & Roth, 2008) as opposed to the single item indicator outcomes often seen in patient satisfaction research. Finally, this study also allowed patients to rank order which of the patient satisfaction dimensions most affected their overall satisfaction score. Future research can build on the advances made in this model to more fully understand the nomological network of constructs that affect patient satisfaction. I discuss these contributions in detail below.

Patient satisfaction as an outcome variable has often been criticized for numerous reasons: adequacy of the approach (Fitzpatrick & Hopkins, 1983), issues on measurement and perceptions of satisfaction (B. Williams, 1994), whether or not patient satisfaction is a good proxy for quality of care (Tzeng & Yin, 2008), or, most recently, whether patient satisfaction is a valid approach to assess the level of care provided (Berkowitz, 2016). Unfortunately, due to mandatory public reporting requirements and value based purchasing (Ryan, 2013), hospitals find themselves uniquely interested in their HCAHPS scores due to the financial implications of failing to attain positive responses. These scores have been nicknamed patient satisfaction

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scores, despite overall satisfaction being only one of the more than 30 items in the survey.

Because of these and many other critiques, this research sought to explore if existing HCAHPS items could be leveraged to not only conceptualize a better outcome variable for patient satisfaction, but also if more meaningful and actionable constructs could be conceptualized to guide future research.

Collectively, this study makes several important contributions to the extant literature. First, from a theoretical standpoint, this study renders clarity to the construct of patient satisfaction. I defined and established patient satisfaction as a multidimensional construct consisting of three dimensions: care team communication, atmosphere, and instruction effectiveness. By opening the black-box of the patient satisfaction construct, I therefore provided a more meaningful way to understand and model the underlying structure of the patient satisfaction construct. Thus, the theoretical development provides significant contributions to the extant literature, since, as pointed out previously, the patient satisfaction construct has often been defined and captured only using single measures.

Second, patient satisfaction research has often been critiqued due to the issues with measurement error of formative constructs, especially with only one reflective outcome item (Diamantopoulos et al., 2008). To address these concerns, a second reflective item was added to the present research model as recommended by C. B. Jarvis et al. (2003), hence the depiction of two willingness to recommend items as reflective items to the patient satisfaction construct. This addition added to the model validity while also allowing future research to explore the statistically significant findings (Figure 1.2) for the impacts of atmosphere ($p = 0.001$) and instruction effectiveness ($p = 0.001$) on patient satisfaction. Consequently, by validating this dependent variable I can end the decades long pattern of inconsistent measurement of this critical

outcome variable (Boissy et al., 2016; Chang, Tseng, & Woodside, 2013; Chen, Birkmeyer, Saint, & Jha, 2013; Cohen, 1996; Fenton, Jerant, Bertakis, & Franks, 2012; González et al., 2005; Larsen, Attkisson, Hargreaves, & Nguyen, 1979; Raposo, Alves, & Duarte, 2009; Raup, 2008; Ross, Steward, & Sinacore, 1995; Williams, Inman, & Dale, 1998).

Finally, this study also documented how patients perceive the importance of each dimension in the overall patient satisfaction scale. The addition of the opportunity for patients to select which dimension most impacted their overall evaluation of their satisfaction with their care experience (Table 1.8) provided a stark contrast to the insignificant relationship found for the communication construct to patient satisfaction depicted in the initial model ($p = 0.485$, t value = 0.699).² Respondents overwhelmingly selected doctor communication as their number one important item in overall satisfaction assessment (285 selected this as the number one important dimension vs. an average of 30 respondents, ranging from 20 to 40, for all other dimensions). This is in line with prior research (Bertakis, Roter, & Putnam, 1991; Boissy et al., 2016a; Fenton et al., 2012) which has stated that communication plays a significant role in patient satisfaction evaluations. Therefore, in addition to establishing the multidimensionality of patient satisfaction, this study also provides a significant contribution to the literature by providing a more nuanced perspective of the importance of each dimension for patients.

² Post-hoc analysis also revealed that when six dimensions of patient satisfaction were used with the constructs as formative indicators, all six were found to have significant relationships with patient satisfaction and have substantially improved AVE (doctor communication, nurse communication, cleanliness and quietness, staff responsiveness, communication about medicines, discharge information; Hoyle, 2012). Likewise, as noted, the model became significant for communication when performing alternative PLS modeling for formative second order factor variables.

Limitations

This study has several limitations. First, the use of existing HCAHPS survey items rather than derive new was the result of a challenging decision during the survey design process. During the expert review process, experts were asked if they thought HCAHPS surveys did a good job of measuring patient satisfaction. Some of the responses included:

- “Mostly... however, HCAHPS measures other things more intentionally than patient satisfaction. It almost seems like a quality report card, focused on whether or not the hospital is properly taking care of patients...” (nurse).
- “...I am shocked there is only one question that specifically asks about satisfaction when I am scanning these questions... however, I routinely refer to these as our patient satisfaction scores...” (physician).
- “HCAHPS measures how a visit went from the perspective of the patient. This is important, however, [it] is only one measure. Its primary value is that I are all held to the same questions...” (physician).

These responses led the present study to build from existing HCAHPS survey items for two reasons. Not only did hospitals have financial incentives tied to the HCAHPS scores, but the antecedent dimensions have been previously found to have important relationships with patient satisfaction, from communication (Abdul-Razzak, Sherifali, et al., 2015; Buller & Buller, 1987; Ishikawa et al., 2013; S. Williams et al., 1998) to discharge instructions (Lo, Stuenkel, & Rodriguez, 2009) and staff responsiveness (Tea, Ellison, & Feghali, 2008).

Second, this survey requested that patients assess all of their health care visits in the past year versus relating to an individual encounter with a single care provider. The survey also

sought participants who had used electronic health portals which, despite achieving more than 500 participants, may have presented a skewed sample, especially with published research noting the preference of the millennial generation to gather health information online (Stellefson et al., 2011). Third, the data collection method to gather both the independent and dependent variables from the same source, as done with the HCAHPS methodology, presented issues with common method bias, which then had to be controlled throughout the survey design (Podsakoff et al., 2003). Finally, the present research was conceptual in nature and while the survey data partially supported the proposed outcome variable (with two reflective items of the formative patient satisfaction construct), the construct requires additional validation with new and established patient satisfaction antecedents and consequences.

Implications for Research

The present research offers significant insight into the patient satisfaction outcome variable while also establishing a foundational way to measure patient satisfaction. This was done in three primary ways. First, the present research took the opportunity to administer a survey similar to contemporary HCAHPS questionnaires. However, it also added numerous items, one of which addressed the significance of each dimension from the patient's perspective. The overwhelming support for the significance of physician-patient communication and nurse-patient communication not only confirms numerous studies highlighting the role of communication in predicting patient satisfaction (Abdul-Razzak, Sherifali, et al., 2015; Fenton et al., 2012), but also demonstrates that communication plays a more significant role as compared to the other dimensions of patient satisfaction. This provides a fertile avenue for research in health care systems with known deficiencies to further understand how communication-only interventions might drive these outcome variables of patient satisfaction. Notably, the equal

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Weighting of the different dimensions followed by the current HCAHPS methodology has not provided a conducive environment for such studies in the past.

Second, a key criticism of patient satisfaction studies has been the proclivity to use single item indicators to justify the emerging theoretical support of the outcome variable as opposed to using multiple or formative constructs (Boyd, Gove, & Hitt, 2005). With the present study suggesting that not only does a multiple item single outcome variable present the significant relationships found in single item outcome variable studies of patient satisfaction, it also demonstrates that using multiple formative outcome variables of patient satisfaction provide significant relationships. With the complex history of attempting to craft a patient satisfaction theory (Aragon & Gesell, 2003; Linder-Pelz, 1982b; Macfarlane, Holmes, Macfarlane, & Britten, 1997; Spahr, Flugstad, & Brousseau, 2006), this could be a turning point in identification of the key formative constructs that provide significant opportunity to expand knowledge towards a consistent theoretical model and could provide new avenues of study of the dimensions or other aspects of patient satisfaction.

Finally, the conceptualization of instruction effectiveness and its demonstrated significance offer new avenues for researchers to apply pedagogical theory to the health care experience, an under applied concept in patient satisfaction research that has historically focused on physician behaviors (Bartlett et al., 1984; Comstock, Hooper, Goodwin, & Goodwin, 1982), communication skills (Bartlett et al., 1984), or even patient literacy (Katz, Jacobson, Veledar, & Kripalani, 2007). With the substantial research available in pedagogy as well as communication providing a tremendous amount of theoretical building blocks to explore, instruction effectiveness might be one of the greatest opportunities for further study from the present research. Quite simply, if researchers and practitioners can establish best methods for teaching

about medicines and discharge regardless of the patient, this data would suggest a positive and significant impact upon patient satisfaction.

Implications for Practice

This study has important implications for practice, as well. First, patient satisfaction scores are part of the way health care systems recover a portion of their withheld government payments. Therefore, the discovery that patients find physician communication to be one of the most important dimensions of their assessment suggests physician communication could be a primary driver for recovering these funds. Alternative PLS modeling also supported the significance of the communication variable, which highlights the importance of continued practitioner attention to physician and nurse communication issues. Thus, health care systems seeking to maximize their payments would likely benefit financially by exploring ways to first maximize their physician and nurse communication efforts, such as providing additional resources and support.

Second, instruction effectiveness (discharge information and communication about medicines) and atmosphere (staff responsiveness, cleanliness, and quietness) have a direct and positive impact upon patient satisfaction, with instruction effectiveness having a larger impact. This suggests that health care organizations can provide more resources to improving instruction effectiveness. Notably, a clean hospital environment is also needed to achieve patient satisfaction. Thus, hospitals can review their own results, identify areas of concern, and utilize resources which can be targeted to maximize impact on these dimensions.

Conclusion

This research found significant relationships between patient satisfaction and instruction effectiveness, care team communication, and atmosphere. In alternate model testing, it was discovered that the initially explored research model presented an insignificant relationship between communication (when clustering nursing and physician communication together) and patient satisfaction. These discoveries, on the one hand, lead to the important assertion that instruction effectiveness and atmosphere improvements in health care facilities may have direct practitioner benefit while also highlighting a perceived difference in the importance of physician versus nursing communication. These findings suggest that the communication variable may be more complex than the current reflective variables can effectively measure, which highlights an opportunity for further academic refinement of how to capture this critical variable. This was echoed by the patient assessment that physician communication was the primary driver of their overall health assessment.

CHAPTER III – ESSAY 2

What's the Special Sauce? Towards a Patient-Technology Fit Perspective of Patient Satisfaction

Abstract

Increasingly, as hospitals invest in new forms of technology to improve patient satisfaction the fit between patient needs and technological capabilities becomes extremely important. Although technology adoption theories have been applied in the health care literature, the notion of patient-technology fit and its impacts on patient satisfaction have been understudied in the health care literature. This study takes an information processing perspective and builds a research model of patient-technology fit, its antecedents, and its impacts. It is hypothesized that patient-technology fit has a direct impact on patient satisfaction. Initial findings show that patient characteristics and technological capabilities are antecedents of patient-technology fit. This study used a survey of patients in Qualtrics to test the hypotheses. Findings from this study are expected to inform both the health care literature and the practitioner community alike.

Keywords: Patient-technology fit, patient satisfaction, information processing, task-technology fit, computer self-efficacy, digital self-efficacy, provider affinity, technological capabilities, hospital environment

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In response to recent health care regulations, such as the HITECH Act, hospitals are continuing to implement health information technologies (HIT) aimed at improving the accuracy, safety, and access of patient data (Bates & Gawande, 2003; Buntin, Burke, Hoaglin, & Blumenthal, 2011). The central imperative of the HITECH Act and allied health care laws is to improve patient care quality (Blumenthal, 2010) while also paying attention to patient satisfaction as a proxy indicator of that quality (B. Jarvis et al., 2013). Hospitals are routinely ranked on their patient satisfaction scores (HCHAPS surveys; Elliott et al., 2009), and financial incentives, such as Medicare payments, are tied to this satisfaction metric (Elliott et al., 2015; Kutney-Lee et al., 2009). Thus, it becomes imperative for hospitals to not only improve digital access to patient records but also to improve utility of records for patients in a way that improves patient satisfaction.

However, such investments in HIT have produced mixed results for improving patient satisfaction. Some studies have demonstrated significant improvements in patient satisfaction while others have shown apparent failures in this endeavor (Rozenblum et al., 2013). Practitioner reports and anecdotal evidence have suggested that the reason for this apparent discrepancy is due to potential issues in the acceptance and use of HIT by patients (N. P. Gordon & Hornbrook, 2016; Rozenblum, Mweller, Pearson, & Marielli, 2015). In other words, HIT diverges in its enabling-capability, leading to discrepancy in its utilization by patients, pointing to potential issues of fit between patients and technology. Although prior research has applied different theoretical perspectives to examine this phenomenon (Holden & Karsh, 2010), researchers have predominantly used either a patient-centric or techno-centric perspective in their studies. Consequently, the notion of patient-technology fit and its impacts on patient satisfaction have been understudied in the literature.

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In this study, I seek to address this research gap, by focusing on the following research questions:

1. What are the impacts of patient-technology fit on patient satisfaction?
2. Do antecedent conditions such as patient characteristics and technological capabilities have an impact on patient-technology fit?
3. What are the impacts of hospital environmental conditions on the relationship between patient-technology fit and patient satisfaction?

I drew upon information processing theory from individual and organizational perspectives and prior work in the domain of task-technology fit to postulate the dimensions of patient-technology fit and its impacts on patient satisfaction. I also theorized on the antecedent conditions that predict patient-technology fit, specifically building on the individual and technology characteristics previously found to affect person-technology fit (Tomer & Mishra 2014). Likewise, I postulated that hospital environment can impact the relationship between patient-technology fit and patient satisfaction, building from previous contributions in person-environment fit (Kristof-Brown and Guay 2011). I describe the theoretical background, research model and methodology in the subsequent sections.

Literature Review

In order to define patient-technology fit, I must first define the current state of technology fit theories in order to describe how they are being leveraged to support this refined construct. The antecedents and consequences of these current models lend to the present research model, while also helping to define the mechanisms by which technology affects outcomes and antecedents affect fit. I then must understand technology usage and how the use and adoption of

technologies can impact performance in order to properly account for these phenomena in our model. Finally, protection motivation theory must briefly be reviewed to best understand the why behind patient motivations.

Theories on Technology Fit

The theories of technology fit have seen widespread proliferation in contemporary research and center on the notion that an information system should be suited for tasks that must be performed in order to get the usage and performance benefits associated with the technology (Goodhue & Thompson, 1995). After the conceptualization of this concept, task-technology fit has seen increasing application to other settings, such as group settings (Zigurs & Buckland, 1998), as well as increased attempts to clarify how fit and usage might best be measured (Pendharkar, Khosrowpour, & Rodger, 2001). Interestingly, there has been a recent trend of exploring a myriad of technology fit outcomes, such as satisfaction with work environment (Belanger, Collins, & Cheney, 2001), system use (Teo & Men, 2008), and task performance (Karsh et al., 2009) to name a few. The following sections define some of the predominant applications of technology-fit including task-technology fit, person-environment fit, and person-technology fit.

Task-technology fit. Task-technology fit frames the notion that task, technology, and usage need to be considered in relation to one another and has been consistently validated in a variety of settings. While the original models suggested technology and task characteristics were antecedents to task-technology fit and task-technology fit directly impacted technology use and performance (Goodhue & Thompson, 1995), the model has evolved over time. Three broad areas have been conceptually added, including individual level characteristics as an antecedent to task-technology fit (Lee, Cheng, & Cheng, 2007), the addition of other antecedents to technology

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use such as intention to use (D'Ambra & Wilson, 2004a, 2004b; Dishaw & Strong, 1998a, 1998b, 1999, 2003), and the acknowledgement that there are other meaningful outcomes of task-technology fit (Belanger et al., 2001; Karsh et al., 2009; Teo & Men, 2008). Table 2.1 helps to demonstrate these relationships. Recently, Furneaux (2012) conceptualized the current state of technology-fit as seen in Figure 2.1.

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Table 2.1

Evolution of Task-Technology Fit

Constructs	References
Task-Technology Fit	Goodhue, 1995; Goodhue &
Technology Characteristics	Thompson, 1995; Ziguers & Buckland,
Task Characteristics	1998
Technology Use	
Performance Benefits	
Individual Characteristics	Lee et al., 2007
Other Antecedents to Technology Use	D'Ambra and Wilson 2004a; D'Ambra and Wilson 2004b; Dishaw and Strong 1998a; Dishaw and Strong 1998b; Dishaw and Strong 1999; Dishaw and Strong 2003
Other Outcomes	Belanger et al., 2001; Karsh et al., 2009; Teo & Men, 2008

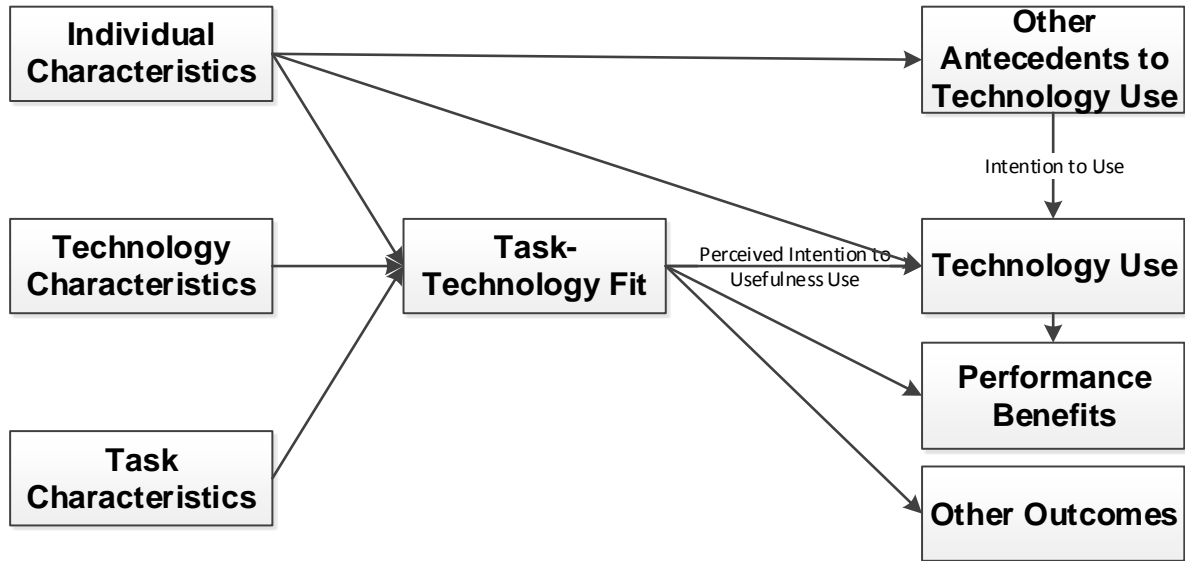


Figure 2.1. Summary framework of task-technology fit research. This figure is derived from Furneaux (2012).

Person-environment fit. Person-environment fit builds off the task-technology fit structure and can be defined as the relationship that occurs when individual and environmental characteristics have a good fit (French, Rodgers, & Cobb, 1974; Kristof-Brown & Guay, 2011). With roots in psychology and organizational behavior, person-environment fit allows researchers to better explore antecedent conditions that persons bring to situations, such as abilities and aspirations (Caplan, 1987), stress (Edwards, 1996), or family relationships (Edwards & Rothbard, 1999). The understanding that persons can have an interactive fit with their environment is critical to the inclusion of environment in the present research model and provides a unique modification to the technology-fit perspective. Table 2.2 summarizes these references.

Table 2.2

Person-Environment Fit

Constructs	References
Person-Environment Fit	French et al., 1974; Kristof-Brown & Guay, 2011
Abilities and Aspirations	Caplan, 1987
Stress	Edwards, 1996
Family Relationships	Edwards & Rothbard, 1999

Person-technology fit. Person-technology fit is rooted in social identity theory (Abrams & Hogg, 1990) and refers to the extent to which the roles one plays and the experiences one has had cause or prevent a fit with technology (Speier & Venkatesh, 2002). In the most basic example, age has been found to help predict a person's fit with technology (Charness & Boot, 2009). Understanding these person-technology relationships helps to understand potential barriers which may exist when considering technology as a source of improved information flow or as a mechanism to increase performance outcomes such as patient satisfaction. Table 2.3 helps to highlight these concepts.

Table 2.3

Person-Technology Fit

Constructs	References
Person-Technology Fit	Speier & Venkatesh, 2002
Social Identity Theory	Abrams & Hogg, 1990
Aging and Technology Usage	Charness & Boot, 2009

Technology Acceptance and Usage

Prior research has studied the circumstances that affect adoption of technologies (Davis et al., 1989). Research in this area is rooted in technology acceptance (Davis, 1989; Venkatesh & Davis, 2000), the theory of planned behavior (Ajzen, 1991), the theory of reasoned action (Fishbein & Ajzen, 1975), and innovation diffusion theory (Moore & Benbasat, 1991; E. M. Rogers, 2010), among others. Given the goal of the present research to further understand how patient-technology fit can have an impact upon the performance proxy of patient satisfaction, it is necessary to briefly review the literature surrounding technology acceptance and usage. Table 2.4 shows many of the important theories related to technology acceptance and usage. The following sections look first at the technology acceptance literature followed by the usage and combination knowledge. Both informed the conceptualization of patient-technology fit for the present study.

Table 2.4

Technology Acceptance Literature

Theory	Concept	References
Theory of Reasoned Action (TRA)	Predicts behaviors	Fishbein & Ajzen, 1975
Technology Acceptance Model (TAM), TAM2	Built off TRA to explain acceptance	Davis, 1989; Venkatesh & Davis, 2000
Unified Theory of Acceptance and Use of Technology (UTAUT), UTAUT 2	Draws TRA, TAM, TAM2, motivation, theory of planned behavior, model of computer utilization, innovation diffusion, and social cognitive theories into a unified model	D. Compeau, Higgins, & Huff, 1999; Davis, 1989; Davis, Bagozzi, & Warshaw, 1992; Fishbein & Ajzen, 1975; Rogers Everett, 1995; S. Taylor & Todd, 1995; Thompson, Higgins, & Howell, 1991; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012

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Technology acceptance models have centered on the search for understanding why individuals are inclined to adopt and utilize technology. To summarize at a high level, research has focused upon understanding the attitudes related to adoption (Fishbein & Ajzen, 1975), usefulness and the perception of usefulness (Davis, 1989), *motivations* to use (Davis et al., 1992), the perception that one has control in choosing that behavior (Ajzen, 1991), as well as the advantages of using the technology (Rogers Everett, 1995; S. Taylor & Todd, 1995; Thompson et al., 1991). These topics provide the general framework for understanding the series of factors related to accepting a technology. In development of an understanding of a patient's fit with technology, the technology acceptance literature provides a necessary roadmap on how this phenomenon has been viewed historically.

The unified theory of acceptance and use of technology (UTAUT) extends prior work on usage and acceptance from the eight different aforementioned theories and combines them into a unified model of technology acceptance (Venkatesh et al., 2003). This unified approach allows the knowledge from all streams of research regarding usage and acceptance to inform future scientific inquiry in this arena. In 2012, this model was expanded to what is commonly referred to as UTAUT 2 (Venkatesh et al., 2012). Within the information technology field, UTAUT is commonly applied to understand adoption and usage scenarios. Specifically in the health information technology setting it has been supported that perceived value of usage (Hassol et al., 2004; C.-T. Lin, Wittevrongel, Moore, Beaty, & Ross, 2005; Turvey et al., 2014), as well as ease of use (Hassol et al., 2004; C.-T. Lin et al., 2005) have significant relationships with usage. In conceptualizing the patient-technology fit construct, UTAUT provides a framework to guide this extension.

Protection Motivation Theory

Protection motivation theory centers on fears and how individuals make decisions to protect themselves (R. W. Rogers, 1975). This theory has been previously used in predicting health care related behaviors (Milne, Sheeran, & Orbell, 2000). More recently, the model has been extended to study patients' intentions to accomplish recommended health behaviors based on perceived threat, offering an interesting look into HIT adoption (Laugesen & Hassanein, 2011). This has allowed interesting person-specific, health related research into usage behaviors, such as tobacco usage (MacDonell et al., 2013), food choices (M.-F. Chen, 2016), or even automobile speed limit adherence (Glendon & Walker, 2013). The cognitive roots of this theory focus upon threat appraisals and coping appraisals (R. W. Rogers, 1975) and encourage the present research to build upon these cognitive roots to further understand patient-specific technology fit.

Summary

In summary, task-technology fit theory as well as the theories supporting technology acceptance and adoption provide an important foundation for conceptualizing patient-technology fit. Both streams of literature have been extensively studied, with significant support for continuing to extend these theories into new contexts. The clinical setting provides a gap in understanding as to what specifically should be considered in the patient context, and current acceptance and fit models provide a unique opportunity to explore this phenomenon.

Theoretical Background

Information processing theory was utilized as the theoretical lens for our study. Information processing theory can be understood from both the individual and the organizational perspectives. From the individual perspective, information processing theory posits that

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information is organized by individuals using information inputs, short-term memory storage, long-term memory storage, and the interplay that occurs between that information prior to formulation of a response (Shiffrin & Schneider, 1977). In simple terms, information is first gathered and as information is processed the individual compares it to past occurrences and then responds to the situation (Simon, 1978). These steps form the information processing cycle in individuals and place bounds on the extent of individual information processing (Simon & March, 1978). The organizational perspective of information processing informs us of the individual's need for information processing: reducing uncertainty and equivocality. Galbraith (1974) proposed that the extent of information processing required is dependent on the uncertainty of the task. Higher information requirements can be understood to be a limiting factor and reducing uncertainty helps to eliminate those limits (Tushman & Nadler, 1978). In addition, equivocality can be understood to be a natural result of resolving uncertainty. That is, as the information available increases, the potential for too much data arises, leading to indistinctiveness and conflicting information (Daft & Lengel, 1986).

In this regard, information technology can play a significant role in reducing the uncertainty and equivocality of information. Prior research on the applications of task-technology fit (Goodhue & Thompson, 1995) and technology adoption (Venkatesh et al., 2003) have informed us of the role of technology in improving outcomes in the health care context. For instance, prior research shows that task-technology fit (Belanger et al., 2001; Karsh et al., 2009; Teo & Men, 2008) and intention to use technology can impact health care outcomes (D'ambra and Wilson, 2004a; Dishaw and Strong, 1999; Karsh et al., 2009). These studies have illustrated the prominent role played by technology in improving health care outcomes.

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While patient-technology fit can be modeled using different perspectives (informational, social, and political), this study models fit through the information processing lens for the following reasons. First, information processing is crucial for evidence-based decision making, and technology can transform the way information is stored, exchanged, and processed in this situation. Evidence-based decision making refers to the practice of making deliberate and conscientious selections of the best evidence available (Sackett, Richardson, Rosenberg, & Haynes, 2000). Recent years have seen a shift away from heuristic-based medical practice to more evidence-based decision making by physicians (Bates et al., 2003; Bates, Saria, Ohno-Machado, Shah, & Escobar, 2014). While medical decision making can be a complex scenario unique to each situation, there are common factors to consider, such as the anticipated effect of a decision, the certainty of those effects, feasibility, or even expense of the decision (Alonso-Coello et al., 2016). Health information technologies can help frame and coordinate information along these lines. As health care organizations leverage more evidence-based decision making with the aid of superior information technology, modeling the informational aspects of technology and patient care becomes relevant.

Second, technology and information processing are inextricably linked in that technology can alter communication and coordination of information and also human processing of information (Hrebiniak, 1974). This relationship was highlighted by Tushman (1979) who found that communication and task requirements are key factors in how technology and information processing affect performance. Finally, technology can enhance the quality of information, which affects the way information is used or processed by the actors (providers, patients etc.). As cognitive information flow processes such as perception, attention, labeling, and meaning (Craik & Lockhart, 1972) need to be managed (Wyer, 2014), the presentation of information

(i.e., quality and design) becomes equally important. Here, technology plays an enabling role on both fronts, providing richness of information to reduce uncertainty and equivocality in health care contexts (Ambrose, Rai, & Ramaprasad, 2006) while ensuring that the information being presented triggers the desired processes in individuals. Therefore, applying the information processing perspective to study patients' technology use becomes relevant. I extended prior work on internet usage for information provisioning and decision making by providers (Ambrose et al., 2006) to focus specifically on the patient perspective of care and how health information technologies support information flow and processing unique to each patient situation. I provide a brief overview of these theories in the following section.

Human Information Processing Theory

Human information processing theory helps to map out how information is processed in humans as a socio-cognitive understanding of the way information is not only stored but processed (Atkinson & Shiffrin, 1968). This theory posits that the information is organized between information inputs, short-term memory storage, long-term memory storage, and the interplay that occurs between that information prior to formulation of a response (Shiffrin & Schneider, 1977). The general principle that describes this information flow primarily focuses on the information processing system, the task environment, and the problem space (Simon, 1978). Essentially, information is presented to the information processing system (presumably a human being) who then must decide to process or ignore the information then move on to selecting a response. To determine a response, the human must decide if the information presented provides enough information to formulate a response, access and compare that information to short- or even long-term memory, then use it to respond (Simon, 1978).

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An example of this might be the child at a lemonade stand labeled “Lemonade: \$1.00.” If someone approaches the stand with a dollar, hands it to the child, takes a glass of lemonade, and walks away, there is a substantial amount of information flow occurring: customer approaches, payment processed, product depleted. The child may come to the conclusion that nothing further is required. If, however, the customer approached in a different order, grabbing the lemonade without paying or not offering the correct funds for the exchange, the child may have to formulate a different response. Here the task environment and problem space adjust but the information processing steps of stimulate, compare with known information, and formulate a response remain consistent. Contemporary research has added to this understanding by informing us that this may not be a neat and stepwise process, rather much more an automatic and immediate process than previously thought (Wyer, 2014). Regardless, the present research narrowed the focus to just the information processing that influences how and why decisions are made.

By narrowing this research to information processing, I focused upon the different steps involved in the information processing cycle. Human information processing consists of four stages: 1) information presentation, 2) information processing, 3) comparison with existing information, and 4) response selection (Atkinson & Shiffrin, 1968). First, I understand that actors are faced with stimuli as a specific and conceivable first step. Therefore, this research explored this information gathering aspect that technology may assist with. Second, cognitive research has told us that the information is compared to the information available, whether present in the new information, short-term memory, or long-term memory (Atkinson & Shiffrin, 1968). By focusing on the technological aspect of information available and coordinated with, and potentially how it might automatically communicate information, I built upon this concept in

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the present study. Third, ultimately the individual must use that information and formulate a response decision (Simon, 1978). Understanding that technology can potentially assist in framing what the responses might be, it was important to include in the framing of this research. Finally, it is necessary for the actor to consider if any further action is required, such as warning of a particular customer service experience (Anderson, 1998).

Information technology can play a key mediating role in these stages by specifically enabling information to be gathered for presentation, effectively processing the information, providing tools to compare the information with relevant information from the past and other sources, and also selecting a response. A patient portal is an interesting example of such technology mediation in human information processing. A patient portal provides a centralized location for the provider and patients to gather information about test results. It enables the patients and providers to communicate with each other, thereby facilitating effective processing of information. It also provides tools to view historic information and advanced tools such as sharing in social media and blogs to compare with peers. Thus, the social sharing aspect of information process and the role technology plays will be considered further. In a clinical context, the concept of this information flow and processing is readily available. Consider the patient with an abnormal heart rhythm. The clinical symptoms associated with abnormal heart rhythms can vary greatly and range from quite serious to completely innocent. Information technology can effectively intervene in this process as it can ensure the accuracy and quality of the information recall the patient can provide to the physician. The patient is no longer required to remember when they felt different; instead the patient can bring home a monitor which will capture accurate information from which the care team can make decisions (Banchs & Scher, 2015).

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Finally, technology can also enhance the quality of information, which affects the way information is used or processed by the actors (providers, patients etc.). The human memory has been suggested to have different levels of processing which occur based on the information provided (perception, attention, labeling, and meaning; Craik & Lockhart, 1972). In looking at the information that can face actors, a problem with equivocality arises when there is too much or conflicting information, which can be remedied in part through rich information sources (Daft & Lengel, 1986). As such, there must be an understanding that cognitive information flow processes involve receiving information, considering stored or known information and environmental factors, accessing short- and long-term memory, and automatically formulating a response (Wyer, 2014); then the quality and design of that information is of the utmost importance. Here, technology plays an enabling role on two fronts: to provide richness of information to avoid equivocality (Ambrose et al., 2006) but also to ensure the information being processed through technologies triggers the desired processes. For instance, electronic health records (EHR) systems not only provide direct technological and quality advantages over paper-based systems but also indirectly improve patient safety and quality of care by triggering specific clinical practices (Middleton et al., 2013). Therefore, the role of technology in affecting the quality of information cannot be understated.

Consequently, understanding how patients' process information becomes an important consideration in patient-technology fit since technology can transform the way information is provided and exchanged in evidence-based practice. From preventing adverse drug events (Truitt, Thompson, Blazey-Martin, NiSai, & Salem, 2016) to reducing transcription (Atique, Lee, Shabbir, Hsu, & Rau, 2016) and dictation errors (C. David, Chand, & Sankaranarayanan, 2014), information technology can have a profound impact on the cognitive processes of information

processing in humans. Thus, the focus on the cognitive processes involved in information flow between patients, technology, and providers are of critical importance to study further if I are to fully understand a patient's perception of satisfaction, especially as related to the use of a technology. To address this further, the following section will harness organizational information processing theory, which provides two major contributions to the present study in the form of uncertainty reduction and equivocality (Daft & Lengel, 1986; Tushman & Nadler, 1978), helping to explain why certain decisions are made.

Organizational Perspective of Information Processing

The organizational perspective of information processing directs the present research towards two key considerations in order to better understand the information processing phenomena: uncertainty reduction and equivocality reduction. First, Galbraith (1974) proposed that the more uncertain a task, the more information is required to perform that task. Therefore, higher information requirements can be understood to be a limiting factor, and reduced uncertainty helps to eliminate those limits (Tushman & Nadler, 1978). Second, the concept of equivocality arises as a natural result of resolving uncertainty. That is, as organizations increase the information available to reduce uncertainty, the potential for too much data arises, leading to indistinctness and conflicting information (Daft & Lengel, 1986). With conflicting information leading to multiple potential solutions, the very limits hoped to be eliminated by reducing uncertainty through increased information create equivocality about which information and solution to pursue. To address equivocality, it has been suggested that data richness be pursued so that more clarity can be obtained regarding which information to process (Daft et al., 1987).

Uncertainty. Uncertainty can be defined as a situation in which there is unknown or imperfect information, making it difficult to make decisions, especially related to one's health.

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Understanding this definition helps to portray how technology can assist in providing more information to reduce uncertainty and assist in decision making. In the patient setting, the importance of uncertainty is intensified given the myriad of issues a patient may face while not having the information, training, or tools to effectively understand or make decisions related to that information. A clinical example helps to portray this more effectively. Consider the patient who experiences a syncopal event—or the temporary loss of consciousness—followed by a spontaneous recovery. While most syncope events are benign (O'Connor, Oriscello, & Levine, 1999), this would no doubt cause a great deal of uncertainty for the patient and limit the patient's ability to accomplish other tasks until that uncertainty were reduced. This leads us to the clinical example of equivocality.

Information processing theory tells us that as uncertainty is reduced, effectiveness will increase (Leifer & Mwells, 1996). However, it is useful from a patient perspective to understand why patients specifically might seek to resolve this uncertainty. Here, the protection motivation perspective posits that certain behaviors occur in response to fearful events such as threatening health information (R. W. Rogers, 1975). In short, faced with threatening health information, patients will strive to determine the seriousness of their situation and develop coping mechanisms (Laugesen & Hassanein, 2011; Milne et al., 2000). Striving to determine the seriousness of their situation may include such tasks as gathering information online, coordinating an appointment with their providers or seeking out others with similar conditions to truly assess what they are facing. Coping mechanisms, on the other hand, might include alienation, hostility, or denial (Derogatis, Abeloff, & Melisaratos, 1979; Schüssler, 1992).

Equivocality. Equivocality is a similar problem, yet distinctly different in that it is defined as having too much or conflicting information, hindering the ability to process that

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information effectively. Consider the syncope patient who, worried about spontaneously passing out, begins to conduct internet searches for all sorts of symptoms, yielding all manner of information in return; there is no doubt there will be conflicting or inaccurate information. Uncertainty in these situations is not reduced despite having more information, and the patient must then seek an alternate route to gather information, such as visiting a care provider to get more rich or accurate information. In turn, the care provider may perform diagnostic tests or run the patient through established medical protocols to better understand what is occurring, using rich data to reduce equivocality (Daft et al., 1987). Once equivocality and uncertainty are reduced, the limits on tasks brought on by both are eliminated, and the patient can resume normal tasks.

In looking at the organizational perspective of information processing, it becomes clear that information gathering, coordination, communication, and sharing all play an important role in reducing uncertainty and equivocality. In a clinical context, the introduction of technology into these information processes directly impacts the nature of the communication and coordination between patients and physicians (Adams et al., 2015; S. Williams et al., 1998). With the advent of the internet, and especially electronic health records, information gathering can be an overwhelming process in relation to health care, almost assuring equivocality. Information coordination and communication are likewise directly influenced by technology. For instance, automatically generated messages and notes ensure certain key information are shared but potentially removes the two-way communication that exists in face-to-face encounters (Charles, Gafni, & Whelan, 1999; Roter & Hall, 2006). While some technologies have indeed been found to improve physician-patient communication (C. R. Gordon et al., 2015), contemporary research is still seeking to define which technologies best assist in physician

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communication (Nguyen, McElroy, Abecassis, Holl, & Ladner, 2015). Technology also has a distinct ability to alter the information process by allowing greater information quality and timing, which allows enhanced patient care and reduced equivocality. The volume and quality of information that technology provides must be considered to ensure that the technology does not allow information to have ambiguous, conflicting, or misunderstood meaning (Daft & Lengel, 1986; K. H. Lim & Benbasat, 2000).

Summary

In summary, human and organizational information processing theories provide a framework for understanding how information is gathered, coordinated, communicated, and shared. Human information processing informs the discussion through understanding the basic process that occurs after information is presented: the input is received, the information is considered as a standalone source, it is compared to short- and long-term information, and then a response is formulated, followed by any follow-up decisions (Atkinson & Shiffrin, 1968; Shiffrin & Schneider, 1977; Simon, 1978). Organizational information processing helps us to understand this more clearly through consideration of equivocality and uncertainty reduction (Galbraith, 1974). Overlaying technology with all of these factors provides a rich understanding of how technology can influence the ability to gather, coordinate, communicate, and share information and provides the theoretical basis from which to construct our research model.

Research Model and Hypotheses Development

This section describes the research model and hypotheses for this study. Figure 2.2 depicts the research model, with the antecedents and consequences of patient-technology fit. In this study, patient satisfaction was adopted as the dependent variable and patient-technology fit was conceptualized as consisting of four dimensions, namely information gathering,

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coordination, communication, and social sharing. Patient-technology fit was postulated to have a direct impact on patient satisfaction. Patient characteristics (such as affinity toward provider and digital self-efficacy) and technological capabilities were theorized as antecedents of patient-technology fit. Finally, the impact of patient-technology fit on patient satisfaction was theorized to be moderated by hospital environmental conditions.

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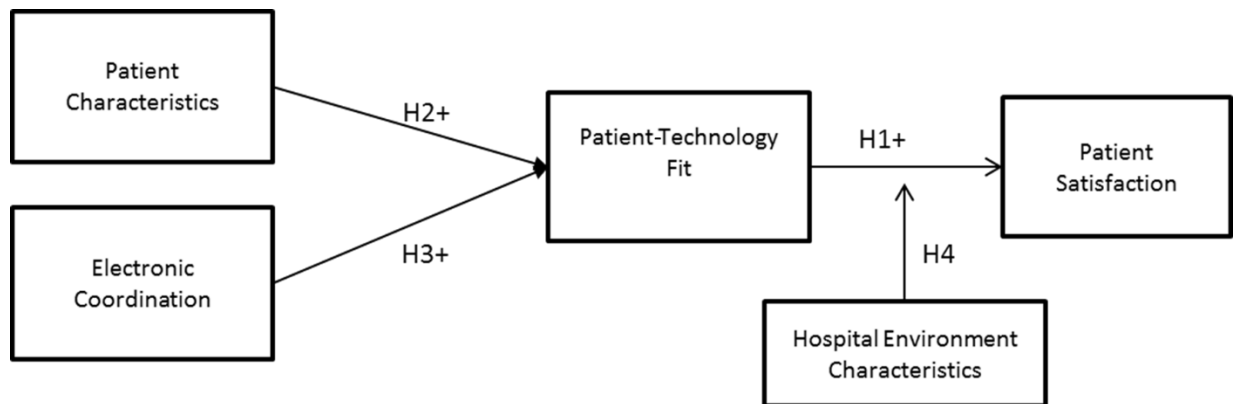


Figure 2.2. Research model of patient-technology fit.

Note. H1 abbreviates the proposed relationship of hypothesis 1. H2 abbreviates the proposed relationship of hypothesis 2. H3 abbreviates the proposed relationship of hypothesis 3. H4 abbreviates the proposed relationship of hypothesis 4.

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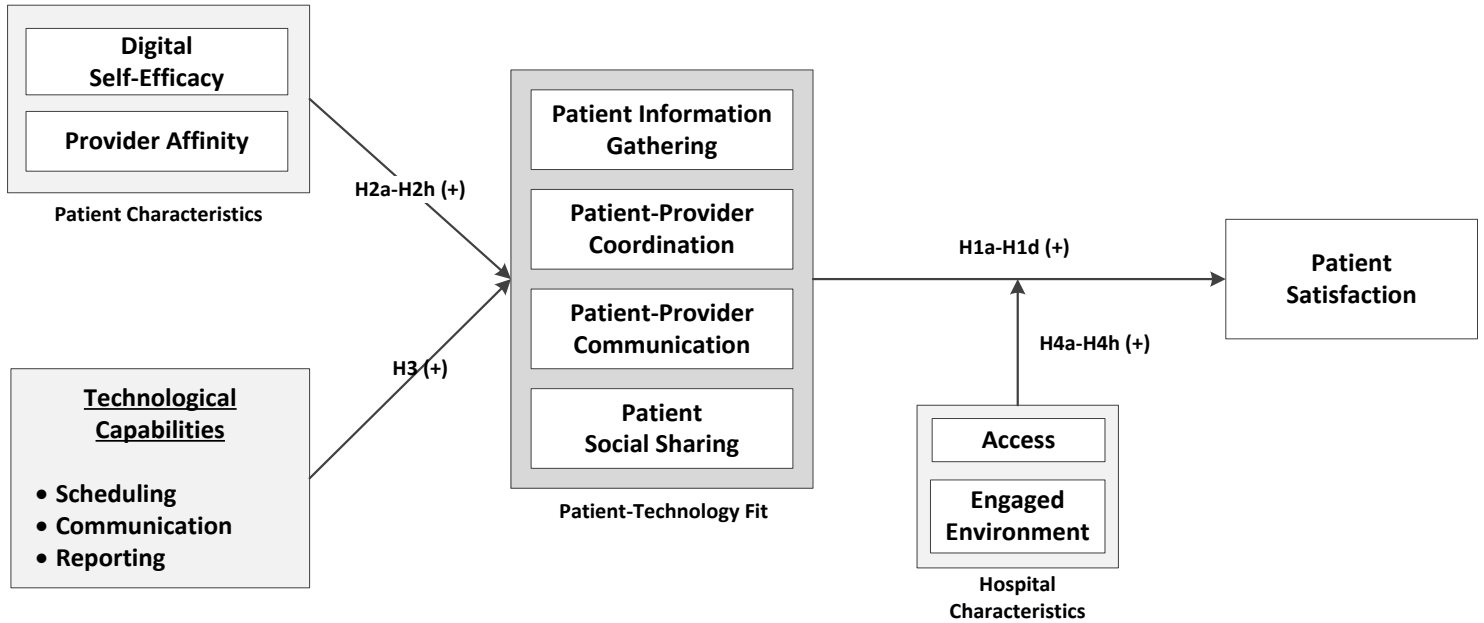


Figure 2.3. Research model: Antecedents and consequences of patient-technology fit.

Note. H1 abbreviates the proposed relationship of hypothesis 1. H2 abbreviates the proposed relationship of hypothesis 2. H3 abbreviates the proposed relationship of hypothesis 3. H4 abbreviates the proposed relationship of hypothesis 4. The alphanumeric associated with the hypothesis represent any sub-hypothesis.

Patient Satisfaction

Patient satisfaction is defined as an individual's positive assessment of distinctive aspects of a health care experience (Linder-Pelz, 1982b), and prior research has validated this. For example, high levels of patient satisfaction have strong correlations to improved outcomes (Furukawa & Poon, 2011; Kane et al., 1997) and improved adherence to care plans (Ciechanowski et al., 2014). In other words, as patients are more satisfied and engaged, they are more likely to practice healthy behaviors (Hibbard & Greene, 2013). This can have a significant impact on improving overall health care goals for the government, health care providers, and insurance companies. Therefore, from the standpoint of individual patients, their overall satisfaction becomes an important outcome measure to study. Consistent with prior studies in the health care setting (Boissy et al., 2016b; Dang, Istbrook, Rodriguez-Barradas, & Giordano, 2012; Larsen et al., 1979), this research adopted patient satisfaction (as conceptualized in essay 1 of this dissertation) as the dependent variable in our study to provide a well-accepted individual-level outcome measure in health care settings. As illustrated in Essay 1, patient satisfaction surveys have become mandatory across the United States for any organization receiving federal funds. While patient satisfaction surveys are not without flaws or critics (Avis, Bond, & Arthur, 1995; Godil et al., 2013; Lyu et al., 2013), they are increasingly interesting to practitioners and academics alike due to recent changes in hospital value based purchasing regulatory norms. According to these regulatory changes, as of 2017 up to 2% of Medicare funding can be withheld from health care organizations, which amounts to approximately \$2 billion nationally. Healthcare organizations are able to receive these withheld funds in part only through high patient experience scores on the standardized HCAHPS survey (Ryan, 2013). With the financial implications associated with value based purchasing regulation, patient satisfaction is no longer

merely a peripheral metric to measure (since it is unrelated to surgical skill or quality of care) but is rather a core financial performance outcome of significant interest (Tsai et al., 2015).

Consequently, patient satisfaction is a necessary outcome variable in health care settings and hence was adopted as the dependent variable in this study.

Patient-Technology Fit

Patient-technology fit is defined in this dissertation as the ability of the information technology utilized by patients and providers to enable the patients to accomplish their tasks related to health care. Adapting the information processing theories from human processing and organizational perspectives (Atkinson & Shiffrin, 1968; Daft et al., 1987; Galbraith, 1974; Simon, 1978) to the health care context and building on prior work in this domain, I defined patient-technology fit as consisting of the following dimensions: a) patient's information gathering, b) provider-patient coordination, c) provider-patient communication, and d) patient's social sharing. The definitions and references for each of the dimensions are shown in Table 2.5.

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Table 2.5

Patient-Technology Fit References

Construct	Definition	Reference(s)
Patient-Technology Fit	The ability of the technology to enable a patient to accomplish tasks related to health care.	
Information Gathering	The extent to which a technology enables gathering of information related to health care.	Dutta-Bergman, 2004; Feng & Xie, 2015; Laugesen & Hassanein, 2011; Milne et al., 2000; Neter & Brainin, 2012
Provider-Patient Coordination	The extent to which a technology helps patients schedule, coordinate, receive, or arrange health care.	Gupta & Denton 2008; Keller, 1994; Milne et al., 2000; Newell & Simon, 1972
Provider-Patient Communication	The extent to which a technology helps a patient communicate with providers and other health care providers.	Abdul-Razzak et al., 2015; Anthony et al., 2015; Fenton et al., 2012; Hargreaves, 2010; Newell & Simon, 1972; Pope, 2006
Patient Social Sharing	The extent to which a technology enables sharing and discussing health-related information with others.	Baldwin & Moses 1996; Bornkessel et al., 2014; Dutta-Bergman, 2004; Feng & Xie, 2015; Kallinikos & Tempini, 2014; Levkoff & An, 2014; McGowan et al., 2012; Peek et al., 2015

Patient's information gathering. Information gathering is defined by this study as the ability of the information technology to allow patients to gather information about their own health. Consumer health information seeking behaviors are increasingly studied, with numerous understood antecedents and consequences (Dutta-Bergman, 2004). When combined with the protection motivation theory model (R. W. Rogers & Prentice-Dunn, 1997), information gathering is important to allow individuals to not only assess the seriousness of the medical situation and establish a coping mechanism (Laugesen & Hassanein, 2011; Milne et al., 2000) but also to reduce uncertainty (Tushman & Nadler, 1978). Recent studies have focused on understanding antecedents (e.g., demographic characteristics) of health information seeking behavior (Feng & Xie, 2015; Neter & Brainin, 2012). In addition, notable consequences to health information seeking have been found to include better health literacy (Ivanitskaya, Boyle, & Casey, 2006), better informed patients (Nicholas, Huntington, Williams, & Blackburn, 2001; Silberg, Lundberg, & Musacchio, 1997), and better health outcomes (Nicholas et al., 2001). Thus, information gathering by patients becomes an important dimension to study given that the outcome of interest for this research is a decision that will require information previously gathered.

It is postulated that information gathering by the patient, as a dimension of patient-technology fit, can have a positive impact on patient satisfaction. Information processing theory states that as uncertainty in information is reduced, it leads to higher levels of individual and organizational effectiveness (Tiedens & Linton, 2001). The degree to which uncertainty is reduced is dependent on the types of mechanisms used by the organization and the individual (Galbraith, 1977; O'Newell, Beauvais, & Scholl, 2001). It is contended that mechanisms which provide the patient an opportunity to gather information from multiple sources can be effectively

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used to reduce uncertainty. That is, information gathering by patients can lead to higher levels of patient satisfaction through a reduction of uncertainty.

Research has shown that when organizations offer more opportunities for users to gather information, such as reviews and peer referrals (Eastin, 2010), there are higher levels of user satisfaction. Information processing theory informs us that to reduce uncertainty, information must be processed by the individual or organization, while comparing to information already possessed by the individual or organization (Tushman & Nadler, 1978). By allowing users to have access to more than just the company statements about the product or service (which may not be always accurate), users can reduce their perceived uncertainty in information. In other words, as users are able to listen to and potentially interact with someone who has personally used the product, rather than only with the potentially biased company, more clarity (i.e., less uncertainty) is achieved, leading to a more satisfying experience.

In health care settings, as patients increasingly seek their own health information through various means (Dutta-Bergman, 2004; Feng & Xie, 2015), they gather a wide array of information about their own health, from a variety of sources. For example, patients can gather information about details on test results and what the results mean, information on treatment modalities, their own clinical schedule, as well as additional information depending on their interests. Such information affords patients the opportunity to understand more about their own health and diseases or conditions, which leads to decreased uncertainty for patients. From the provider perspective, this has been conceptualized by Ambrose et al. (2006) as internet usage for information provisioning (IUIP), which encompasses the process through which decision makers use information available through the internet to assist them in decision making. Also, there continues to be rising popularity of physician review websites allowing information on care

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providers to be shared publicly, with some studies having found correlations between physician ratings and quality (Gao, McCullough, Agarwal, & Jha, 2012). By knowing that one's doctor is highly rated, a patient is able to reduce uncertainty as to whether care is being received from the right provider. This can lead to the patient appreciating and being satisfied with the services provided by the provider and the facility. Therefore, as technology provides opportunities for patients to gather information, the degree of uncertainty in information will be reduced, consequently leading to higher levels of patient satisfaction. Hence, I postulated that:

H_{1a}: Information gathering by patients will have a positive impact on patient satisfaction.

Provider-patient coordination. Provider-patient coordination is conceptualized as the ability of the information technology to allow the patient to coordinate with the provider (physician, nurse) through any information channel (e.g., email, text messaging, and mobile applications).

Information processing theory informs us that once individuals gathers information, they must then process the information and determine their response (Newell & Simon, 1972). These cognitive responses could be tasks as innocuous as scheduling appointments or as complex as arranging end of life care. I contended that the patient's ability to coordinate the acquired information is a key component of the processing stage (Atkinson & Shiffrin, 1968) and information technology can play a vital role in this activity.

Organizations utilize coordination mechanisms to process information (Daft & Lengel, 1986; Galbraith, 1977; Tushman & Nadler, 1978). Galbraith (1994) and colleagues (Daft & Lengel, 1986; Daft et al., 1987; Tushman & Nadler, 1978) have stated that both formal and informal coordination mechanisms (such as structural overlays and human resources policies) improve information processing capabilities and consequently reduce information uncertainty and equivocality. More recently, Galbraith (2012) contended that these organizational

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coordination mechanisms are being augmented by technology, such as video conferencing, leading to automation and improved processing of various activities, which further reduces uncertainty and equivocality. In other words, technology-enabled coordination is increasingly being practiced as a way to facilitate information processing in organizations.

I posited that in the health care context, as patients process varied bits of information, technology-enabled coordination can play a vital role in reducing uncertainty and equivocality. Prior research has explored the impact technology has on facilitating key portions of the information coordination processes, such as volume of information and data richness (Keller, 1994). Such technology-enabled coordination can include information coordination between patients and their providers or hospitals, who may provide clarifying information on the patients' medical diagnoses, illustrate complex information through charts, and provide simplified reports to patients. For instance, consider the electronic delivery of a diagnostic test by a patient. This information, which is a raw number, reveals very little to the average patient. However, merely including the range of normal values along with the raw score allows the patient to not only understand the severity of the information (Laugesen & Hassanein, 2011; Milne et al., 2000), but also allows the coordination of next steps. In addition, the provider can enhance such reports through personal notes to the patient. This data richness makes the numbers more meaningful to patients, thereby reducing information equivocality.

Technological capabilities, such as the ability to electronically schedule appointments, have been shown to significantly improve timely care (Gupta & Denton, 2008), a demonstrable example of coordinating information via patient technology. That is, the ability to use the information gathered from a patient technology can in fact facilitate timely and efficient care, thus enhancing patient satisfaction. Providers can decide when to schedule appointments

depending on the severity levels exhibited by the information. Some systems also provide alerts to remind the providers of potential life-threatening conditions and to schedule immediate visits. For instance, consider a patient with a potential life-threatening ailment, such as an abnormal heart rhythm. As technology-enabled coordination provides better efficiencies (Dong, Xu, & Zhu, 2009), I postulated that the ability to quickly and efficiently process the information through technology-enabled coordination with the care provider can reduce uncertainty, given the predominant desire to start treatment as soon as possible (Landercaasper et al., 2010). In this case, the questions of when, where, and whether care will be received from the provider can potentially be eliminated, and the patient is better prepared to cope with the situation, improving overall satisfaction levels. Thus, by decreasing both information uncertainty and equivocality, such technology-enabled provider-patient coordination will have a positive effect upon patient satisfaction, as the following hypothesis outlines:

H_{1b}: Provider-patient coordination through information technology will have a significant and positive effect on patient satisfaction.

Provider-patient communication. Provider-patient communication is defined in this study as the ability of the technology to enable interactive communication between the providers and patients, through any information channel (e.g., email, short message service, mobile applications, etc.). Newell and Simon (1972) noted that communication can be viewed as the cognitive response to information being gathered. Communication may also become an important next step to facilitate gathering more information or sharing that information with others. Therefore, from an information processing perspective, the extent to which health information technology allows a patient to communicate with providers regarding health issues becomes vital.

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From the patient perspective, this relationship is enhanced when patients (or a technology) have information related to their health to participate in the health communication process and self-management of their care (Pope, 2006). Studies have shown that one of the significant factors consistently found to impact patient satisfaction is communication with providers (Abdul-Razzak, Sherifali, et al., 2015; Fenton et al., 2012). Some of the established ways in which a health information technology can facilitate communication include enhanced communication with providers (Hargreaves, 2010), the ability to monitor blood pressures or other vitals (Anthony et al., 2015), or even communicate test results (Pwellemer et al., 2016). These different communication methods provide more rich data, which reduces information uncertainty and equivocality.

It has been previously suggested that rich information can assist in circumstances where large amounts of information may conflict (Daft et al., 1987) and the clinical diagnostics context has been previously noted to be a context in which reducing equivocality is of the utmost importance (Ambrose et al., 2006). Therefore, from the provider perspective, the ability to receive accurate and specific information from the patient helps to differentiate and isolate the patient symptoms to the correct medical problem. This, in turn, helps providers to more expeditiously sort through all of the possible issues and begin treatment as soon as possible for the right condition and potentially receive a more positive experience rating from the patient regarding meeting patient needs. For example, rather than waiting on the next appointment with a provider to change medications, a patient might wear a medical device that monitors certain conditions such as heart rate; when certain triggers are met, the device might communicate directly with a physician who could adjust medications or care plans rather than delaying that care to the next scheduled visit. This reduces the uncertainty of what is happening (Galbraith,

1977) and also helps provides data to the care provider as to how to accurately manage the condition (Daft et al., 1987), both of which contribute directly to the patient's overall satisfaction with the care experience. Thus, this study posits that the technologies' ability to facilitate this patient-provider information exchange will have a positive and direct impact upon patient satisfaction through reduction in information uncertainty and equivocality.

H_{1c}: Provider-patient communication through information technology will have a significant and positive effect on patient satisfaction.

Patient's social sharing. Finally, this research postulated that the ability to propagate information gathered via health information technologies is an important aspect of the patient-technology fit construct. A patient's social sharing is defined as the ability of the technology to enable interactive sharing of health-related information to others through any information channel. Social information gathering research posits that humans use one another as information sources (Baldwin & Moses, 1996). While there has been an increasing awareness of and study into consumer health information seeking behaviors (Dutta-Bergman, 2004; Feng & Xie, 2015; Neter & Brainin, 2012), social networks are increasingly understood to be an opportunity to improve the way care is delivered (Bornkessel, Furberg, & Lefebvre, 2014). An important component of these networks is not only the referencing to legitimate sites hosted by medical professionals but also the fact that consumers are increasingly searching for this type of medical information on social networks, or even from their peers such as links to medical blogs (Peek et al., 2015). While some have explored the possibility of designing discrete social media sites devoted strictly to self-reported medical information to help address this perceived need (Kallinikos & Tempini, 2014), more commonly medical information is being shared by both patients and providers via existing social media platforms (McGowan et al., 2012). For example,

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in their survey of 485 physicians, McGowan et al. (2012) found that 61% of respondents scanned social media weekly for medical information, 46% contributed, and 60% found that social media enhanced the quality of care they delivered. Thus, this social sharing not only benefits the patients who are seeking information, but enables the clinicians providing care to share information and receive information themselves. This information exchange helps to not only reduce uncertainty regarding what might happen or what is the current state of the field but also reduce equivocality by narrowing the data so that specific information can be processed.

From an organizational perspective, sharing of medical information is urged for patient safety reasons. The key to this argument derives from the notion that important information exists that is not available to the treating provider (Teich, 1998) and technology can help us close this gap. More recently, studies involving patients and clinicians have supported the computerized sharing of clinical information (Perera, Holbrook, Thabane, Foster, & Willison, 2011). Organizational information processing helps us understand this need to socialize the information as it helps to provide accurate information at the outset of care, reducing conflicting information and helping to provide certainty as to the right course of action needed for care. From the patient perspective, the individual social sharing of medical information has been studied in the clinical context. For example, Wicks et al. (2010) found numerous positive patient benefits to social sharing of medical information, including learning about symptoms and side effects, finding other like patients, as well as making decisions to start a medication. More recently, emotional support, esteem, emotional expression, and enhanced psychological well-being have all been found to be correlated to social media usage for health reasons (Smailhodzic, Hooijsma, Boonstra, & Langley, 2016).

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In summary, the ability of a patient technology to enable socialization of medical information between patients will have a direct impact on patient satisfaction in three ways. First, socialization of medical information helps patients decrease uncertainty by sharing with one another the patient impact of a condition from diagnosis to treatment options. Second, social sharing facilitates emotional support by providing a connection to others with similar issues; patients are able to not only look out for, but also remember to pay attention to and ask about pertinent factors that may have been overlooked, thereby decreasing equivocality in their care management, allowing both patient and provider to rule out erroneous cues. Finally, narrowing the focus of patients' interests to the pertinent factors also allows patients to share with one another the key points in their own disease processes, allowing them to filter the important information at a higher level instead of being overwhelmed and missing details (Driver, 2001). The increase in consumer seeking medical information (Dutta-Bergman, 2004; Feng & Xie, 2015; Neter & Brainin, 2012) and the discovered link between consumers getting the information they seek and their satisfaction (Kauer, Mangan, & Sancu, 2014) reinforce the importance of patient technologies enabling the socialization and sharing of information. Thus, social sharing of information by patients will have a direct impact upon patient satisfaction through enhanced information flow and processing between physicians and patients.

H_{1d}: Social sharing of information by the patient will have a significant and positive effect on patient satisfaction.

Patient Characteristics

A key tenet of human information processing theory is the notion that humans have information stored that is accessed when presented with new information (Tushman & Nadler, 1978). This helps them to determine their next action based on the new information; the most

basic example might be the stored information that fire is hot and shouldn't be touched.

Regarding this stored information, existing information technology research suggests that an individual's already established notions of technology play an important role in the adoption of technology in organizational and consumer settings; in particular, the notions about perceived usefulness (Venkatesh & Davis, 2000), ease of use (Venkatesh & Davis, 2000) and even prior habits (Venkatesh et al., 2012) all play a role in technology adoption. Exploring this in a health care context revealed that prior attitudes of satisfaction with health care play an important role in predicting patient satisfaction (John, 1992; Taylor, 1994). Similarly, other factors have been found to affect perceptions of a health care experience, including the patients' perceptions that they received an adequate explanation of status and condition (Boulding et al., 2011), their current health status (Manary et al., 2013), or choices available for service providers (Chang et al., 2013). Each of these factors tell us that the patients are coming not only with unique feelings and stored information related to these experiences, but also that their level of attention to these factors may vary due to selective attention based on their prior experiences, highlighting (or not) the importance of certain factors. These experiences conversely lead to the development of abilities or affinities, which provide the theoretical support for the patient characteristic construct.

In this study, I subscribed to the findings from prior research not only regarding information processing (Galbraith, 1977; Tushman & Nadler, 1978) but also prior patient characteristics that might shape the patient stored information (Boulding et al., 2011; Chang et al., 2013; Manary et al., 2013) and model patient characteristics into abilities and affinities. To accomplish this, I specifically focused on digital self-efficacy ability as well as affinity towards provider. I describe these dimensions and their impacts in the following sections.

Abilities: Digital self-efficacy. In examination of antecedent abilities that would impact patient-technology fit, computer self-efficacy is a primary construct of interest. Computer self-efficacy is generally defined as a measure of one's ability to use a computer (D. R. Compeau & Higgins, 1995). This is rooted in the more general definition of self-efficacy (Bandura, 1977), as well as the theory of reasoned action, which posits that people will use something (e.g., method, artifact, device, system) if they can perceive a benefit (Fishbein & Ajzen, 1975). Thus, one can reason that individuals who perceive advantages to computers tend to use them and as such have increased computer self-efficacy. While computer self-efficacy was conceptualized in the context of computers, the main focus was not on past demonstrated abilities with the computer but rather on one's ability to essentially figure out how to do an assigned task like create a spreadsheet (D. R. Compeau & Higgins, 1995). However, recent advances in the digital domain, which includes extensive use of applications, tablets, mobile phones and other electronic devices to access medical records, warrants an adaptation of the computer self-efficacy construct to the digital use. Therefore, in our study, I adapted the theoretical tenets of computer self-efficacy to model digital self-efficacy that encompasses not only computer usage but also applications, tablets, mobile phones, or other electronic devices.

By adapting the definitions of computer self-efficacy (D. R. Compeau & Higgins, 1995) and internet self-efficacy (Eastin & LaRose, 2000), I defined digital self-efficacy as one's ability to use electronic devices, such as tablets, mobile phones, and so forth, and to access the internet to accomplish desired tasks. I posited that digital self-efficacy will have a positive influence on each of the patient-technology fit dimensions. Previously, computer self-efficacy has been noted to affect usage (Igarria & Iivari, 1995) and also satisfaction (C. K. Lim, 2001). Users with higher levels of computer self-efficacy are likely to use technology (Igarria & Iivari, 1995) and

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view an increasing amount of information available online. Similarly, I posited that patients with higher levels of digital self-efficacy are more likely to engage in information seeking behavior, reducing uncertainty levels, resulting in higher levels of patient-technology fit. Higher skills utilizing technology devices will allow patients to fully utilize technology functions (T.-C. Lin & Huang, 2008), such as those designed to improve coordination: digital messaging, remote reporting, or electronic scheduling functions. Provider-patient communication will be higher, as both parties will have improved competency in sending and receiving messages via web based information systems, such as patient portal systems (Mun & Hwang, 2003). Finally, patients with high self-efficacy skills are considered highly likely to engage in social sharing related to their medical issues as their digital savviness allows them to fully access information available via social media across all platforms (Hsu, Ju, Yen, & Chang, 2007).

Therefore, I postulated that:

H_{2a}: Digital self-efficacy will have a significant and positive effect on information gathering.

H_{2b}: Digital self-efficacy will have a significant and positive effect on provider-patient information coordination.

H_{2c}: Digital self-efficacy will have a significant and positive effect on provider-patient communication.

H_{2d}: Digital self-efficacy will have a significant and positive effect on patient social sharing.

Affinities: Affinity towards provider. Affinity towards provider is defined as the extent to which a patient feels positively towards a provider or organization. This construct is derived

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from previous research highlighting the importance of the ability of patients to choose their provider, health care location, or care provider (Bravo Gil, Fraj Andres, & Martinez Salinas, 2007; Hausman, 2004). Consider the following example. The spontaneous automobile accident may result in an unexpected visit to an unknown health care facility which removes all choice of service location. This spontaneous care provided by a new care provider unknown to the patient is also likely to encourage information seeking behaviors; those with a high affinity for their current providers are postulated to have more concern than those without a high level of affinity for their current providers. On this topic, comments from the expert panel while discussing narrowing the research model included, “It can’t get any worse than my normal provider” and “I am concerned because I am not at my normal provider who is one of the best.”

Choice of provider has been shown to affect patient satisfaction directly and provides a compelling framework for affecting patient-technology fit (Bravo Gil et al., 2007). The following section demonstrates that affinity towards provider will have a direct impact on the measures of patient-technology fit.

Attribution theory (Burger, 1981; Desai, 2015; Ford, 1985) proposes that an understanding of causality of prior events is formed, regardless of whether or not the perceived causes are to blame for the events at hand (Kelley, 1967). This is an incredibly important concept in patient satisfaction research in which patients are asked to rate their feelings about previous events of which they may or may not know all the details. Returning to the spontaneous automobile accident example, attribution theory suggests that the patient might deflect blame to the absence of care at their usual hospital. For instance, one comment from the expert panel while discussing narrowing the research model was, “This would never have

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happened, if I would have been at my usual hospital.” Thus, attribution theory helps to frame the importance of affinity towards provider and its impact upon patient-technology fit.

Affinity towards provider is predicted to have an impact upon patient-technology fit for four reasons. First, organizational information processing theory suggests that when patients find themselves at an unfamiliar location, especially those who have high affinity towards their existing providers, they are more likely to engage in information seeking behavior in an effort to find information which would reduce the uncertainty of this new care environment (Tushman & Nadler, 1978). Those with a high affinity towards the provider are anticipated to have better coordination with their providers, not only because their stored information tells them their health can be managed by this provider or facility but also because they know the various mechanisms with which to coordinate care and feel certainty in that coordination relationship. For the patient, the information flow processes that occur in familiar health care locations are well understood and thus more likely to be properly utilized. Likewise, those with high affinity towards the provider of their care are argued to have better provider-patient communication as their prior experiences are more likely to demonstrate that their providers can help them to reduce uncertainty with health concerns and begin to work towards the determination of coping mechanisms (Milne et al., 2000). Finally, just as customer reviews are found to influence decisions (Eastin, 2010), information that can be gathered by patients, such as hospital and quality rankings, have long been shown to influence patient decisions and outcomes (J. Chen, Radford, Wang, Marciniak, & Krumholz, 1999). With the understanding that social sharing of health information provides emotional support amongst other advantages (Smailhodzic et al., 2016), those with high affinity towards provider were postulated to share that affinity in an effort to be helpful to others. Here, attribution theory and organizational information processing theory

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suggest patients with high affinity towards their providers are most likely not only to seek information, but coordinate with, communicate about, and socially share this information so that others can benefit from the providers they feel an affinity towards.

H_{2e}: Affinity towards provider will have a significant and positive effect on information gathering.

H_{2f}: Affinity towards provider will have a significant and positive effect on provider-patient information coordination.

H_{2g}: Affinity towards provider will have a significant and positive effect on provider-patient communication.

H_{2h}: Affinity towards provider will have a significant and positive effect on patient social sharing.

In summary, patient abilities and affinities are posited to have a direct and positive impact upon patient-technology fit. Here, attribution theory and organizational information processing theory provide theoretical support for this conceptualization. Attribution theory suggests the patient's existing stored information is likely to cause a patient to attribute reasons as to why certain interactions are (or are not) occurring (Burger, 1981). Organizational information theory suggests that those patients with high affinity towards provider will be concerned about reducing uncertainty in their care (Jay R Galbraith, 1974). In combination, both frameworks suggest an increased likelihood of information seeking, information coordination, information communication, and social sharing and are thus suggested to have a significant impact upon patient-technology fit.

Technology Capabilities

The characteristics of technologies play an integral role in whether they directly impact patient-technology fit. While a myriad and near unlimited number of characteristics might present themselves during this discussion, limiting the focus to those as guided by human information processing theory provides meaningful boundaries to the present study. Particularly informing to the present research has been prior work studying the impact of patients' information preference style (Sawka et al., 2015), preferred media (Lifford et al., 2015), satisfaction with electronic messaging (Cottrell et al., 2015), satisfaction with care delivered digitally (Rozenal et al., 2015), perceptions of computerized assistance (Salloum, Crawford, Lewin, & Storch, 2015), and digital electronic health record access patterns (Shah et al., 2015). These data suggest a focused approach to understanding technology factors from three angles will facilitate the inclusion of a technology capabilities construct to the present research model.

This study defined technological capabilities as the ability of a technology to assist in scheduling, communication, or access to critical information. Technological capabilities as defined were necessary to consider in the present research model for the three reasons. First, the ability of a technology to assist with scheduling an appointment both reduces uncertainty and decreases equivocality, which organizational information processing theory tells us will decrease the amount of information required to provide care (Daft & Lengel, 1986; Galbraith, 1974). Second, a technology's ability to facilitate communication provides access to rich and even historical data, again decreasing sources of conflicting or missing information, which helps care providers make meaningful and accurate decisions (Ambrose et al., 2006). Finally, consideration of technologies' ability to electronically access reports further reduces uncertainty for patients about what is occurring and helps providers sort through numerous patient symptoms. In

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summary, the technology capabilities construct provides a measurement proxy to a technology's ability to reduce both uncertainty and equivocality. Technology capabilities will thus directly increase the ability of a patient or provider to have accurate information gathered, coordinated, communicated, and shared and as such is suggested to have a direct impact on patient-technology fit.

Consideration of the information exchanges that occur in the patient care process elaborate the importance of this construct further, from making the appointment, receiving the care, and ultimately coming to some sort of conclusion of that care. Technology provides a critical role in each of these stages. First, a patient must set up an appointment, pre-operative visit, or surgery prior to any actual care being received so that a care provider can become involved in the care. Current technology capabilities can help facilitate and communicate timely appointments as well as meet patient preference (Gupta & Denton, 2008). Given the rising popularity of electronic scheduling (Feldman, Liu, Topaloglu, & Ziya, 2014), it is prudent to consider it as one of the technology factors herein that may inform a patient's opinion of the visit, both regarding convenience as well as preference for provider, time, and location. Technologies that assist in electronic communication help to facilitate refills, referrals, and scheduling which frees up time for the providers (Kittler et al., 2004) and allows timely medical care for the patient (Gupta & Denton, 2008). Finally, consider reports delivered electronically as opposed to more classical methods of receiving medical test results such as via mail, fax, or a phone call. The key benefit to getting a copy of results is that patients finally have access to the data involved in their care, rather than being told in a nonspecific way that their results are normal or inconclusive. These legacy reporting formats rely on trust between the doctor and patient and actually facilitate a lack of communication as providers may rightly assume that the

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numbers don't mean anything to the patients. Understanding that patients are increasingly using electronic portals to access their health information and many providers are supportive and comfortable with direct electronic test results encourages inclusion of the ability to obtain test results in this construct (Callen et al., 2015).

In summary, technology capabilities are predicted to have a direct impact on patient-technology fit. The ability of technology to facilitate and provide rich data will directly encourage the information gathering process, a cornerstone of the patient-technology fit model. The coordination and communication of potential benefits associated with technology capabilities are unmistakable (Callen et al., 2015; Gupta & Denton, 2008; Kittler et al., 2004) and thus necessary to this construct. Finally, the ability of technology to facilitate direct patient access to testing information (Kwan & Cram, 2015), which empowers patients (Woods et al., 2013), forces us to consider such access in our current model. The combined effect of technology capabilities results in increased information gathering, communication, coordination, and social sharing of information, and as such are predicted to have a direct impact upon patient-technology fit.

H_{3a}: Technology capabilities will have a significant and positive effect on information gathering.

H_{3b}: Technology capabilities will have a significant and positive effect on provider-patient information coordination.

H_{3c}: Technology capabilities will have a significant and positive effect on provider-patient communication.

H_{3d}: Technology capabilities will have a significant and positive effect on patient social sharing.

Perceptions of Hospital Environment

The hospital environment can be understood as all factors that involve the overall environment of the facility in which the care is received, excluding the clinical aspects of patient care. This concept has roots in the tourism and commercial satisfaction literature; for example, in consumer marketing literature, various environmental factors have been found to impact perceptions of satisfaction, including the atmosphere of the venue (Anselmsson, 2006), or even such innocuous items as restroom availability and access to the venue (Lambrecht, Kaefer, & Ramenofsky, 2009). Often, this experience has been discussed within the realm of condition of stay, and frequently the concept is considered to be significant to overall satisfaction (Devesa et al., 2010).

Refined to the health care setting, interesting results have been found regarding nonclinical aspects of care that should be considered in the present research model. For example, items such as wait times and parking were found not to affect overall satisfaction in one recent study (Dang et al., 2012), which contrasts with numerous studies suggesting the importance of wait times (Bleustein et al., 2014; Michael, Schaffer, Egan, Little, & Pritchard, 2013; Pather et al., 2010) and parking (Pather et al., 2010). Some of these same studies agreed on the importance of access (Dang et al., 2012; Pather et al., 2010), as was previously suggested by marketing literature (Lambrecht et al., 2009). The complicated and sometimes inconsistent results demonstrate the importance of this area. For these reasons the present research considered access (both physical and scheduling) and an engaged environment in order to help narrow the context in which environmental factors influence satisfaction attitudes.

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Specifically, in the context of patient-technology fit, I postulated that environmental factors play an important moderating role to the relationship between patient-technology fit and patient satisfaction. Hospital environment, which is characterized as consisting of access and an engaged environment, can enhance or mitigate the effects of patient-technology fit on patient satisfaction. Patient-technology fit affects patient satisfaction through enhanced information flow and processing between physicians and patients. As the hospital access and engagement improve or degrade, I contended that the nature of the information flow and processing between physicians and patients is affected.

Access. Hospital access is typically defined as the distance to and infrastructure supporting navigating to the hospital (Messina, Shortridge, Groop, Varnakovida, & Finn, 2006). In looking specifically at individual hospitals, this can be understood as the ability of patients to find and gain access to their health care destination in a manner that lets them be seen when scheduled. Beginning with wait times, it has been found that if patients experience unusually long wait times, even if receiving world-class care, they are more likely to have a low patient satisfaction score and less likely to return to the provider (Camacho et al., 2006). The care environment, including time waiting for the provider, continues to be found as an important piece of information considered by patients in evaluation of their perceptions of care (Soremekun, Takayesu, & Bohan, 2011). Wait times have also been shown to correlate with decreased confidence in care, as well as perceived quality from the patient perspective (Bleustein et al., 2014). Worse, extended wait times disrupt the information gathering and coordination which occurs during a provider visit as both the patient and provider are pressed to move through the visits quickly, potentially leaving important information unconsidered. This environmental effect, coupled with the disruption of the information flow dimensions of patient-technology fit

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cause real concern that excessive wait times can considerably affect otherwise positive patient satisfaction scores.

Consumer satisfaction literature has stated that access is an important consideration in enhancing customer satisfaction, in particular access to the desired location (Lambrecht et al., 2009). Findings from environmental psychology also informs this discussion through consideration of the term *servicescape*, related to the various aspects of a service experience, including floor plan layouts or even signage guiding the consumers to their desired locations (Bitner, 1992).

In the health care setting, I expected to find access as a moderating relationship between patient-technology fit and patient satisfaction. Some clinical examples helped to highlight these relationships. For example, consider an electronic patient portal which links the tech savvy young millennial to an easy to use and intuitive self-scheduling system. All potential benefits to perceived satisfaction with the encounter could be eliminated the moment the patient realizes access is denied due to issues with the login, requiring the patient to change the password in person. Similarly, consider the example of the frustrated patient who is running late and cannot find the burn clinic because it is housed within the surgery clinic; while the appropriate providers work within this clinic, this is not always intuitive to patients who themselves may have had no surgery. Therefore, in the health care setting, I postulated that these access problems can impact the relationship between patient-technology fit and patient satisfaction through the disruption of information flow. Just as information processing theory informs us that patients will take the information given to them and consider their next actions (Newell & Simon, 1972), they would also access the memories of the lack of access when attempting to evaluate their perception of their satisfaction with the visit in an attempt to provide increased certainty to what to expect.

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Therefore, contemporary knowledge tells us the impact of patient-technology fit on patient satisfaction will be diminished when access for patients is limited. Given its prominence in the literature, access was included as a critical aspect to consider in the patient-technology fit and satisfaction relationship.

H^{4a}: Access moderates the relationship between information gathering and patient satisfaction, such that positively perceived access will enhance the relationship and negatively perceived access will mitigate the relationship.

H_{4b}: Access moderates the relationship between provider-patient coordination and patient satisfaction, such that positively perceived access will enhance the relationship and negatively perceived access will mitigate the relationship.

H_{4c}: Access moderates the relationship between provider-patient communication and patient satisfaction, such that positively perceived access will enhance the relationship and negatively perceived access will mitigate the relationship.

H_{4d}: Access moderates the relationship between patient social sharing and patient satisfaction, such that positively perceived access will enhance the relationship and negatively perceived access will mitigate the relationship.

Engaged environment. Finally, an engaged environment is imperative to consider when measuring the impact of patient-technology fit upon patient satisfaction. An engaged environment has been defined as an environment in which employees are committed to their workplace, enjoy their work, and willingly provide additional effort to achieve organizational goals (LoI, 2012). While workforce engagement literature is plentiful, it has been typically conducted from the staff perception perspective (Harter, Schmidt, & Hayes, 2002). Marketing

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literature has found a strong relationship between employee engagement and customer satisfaction (Bowden, 2009), encouraging the present consideration in this research. Further, psychological research has found support between work engagement and high levels of customer loyalty (Salanova, Agut, & Peiró, 2005), which has been shown to highly correlate to satisfaction (Tsai et al., 2015).

Given the importance of information flow to patient-technology fit's ability to positively impact patient satisfaction through reduction of uncertainty, any disruptions in this information flow can be problematic. Consider again the millennial patient portal example with incorrect login information; an engaged environment might drastically enhance or decrease satisfaction in this encounter. In this example, when the patient calls to complain about being locked out of the system, the patient has a high level of uncertainty as to whether or not an appointment will be obtained and will want to verify that the only way the password can be changed is to come in person. While the answer might be yes, an engaged employee might answer as such then offer to make the appointment for the patient and put a note in the chart to have this updated at the visit, enhancing the positive effect the technology had rather than leaving the negative perception in play. This removes the uncertainty and in turn increases satisfaction despite having to deliver bad news to the patient (that the only way to correct being locked out of the system is to come in person). Therefore, I postulated that hospital environment can enhance or mitigate the effects of patient-technology fit on patient satisfaction when considering wait times, access, and an engaged environment.

H_{4e}: An engaged hospital environment moderates the relationship between information gathering and patient satisfaction, such that a positively engaged workforce will enhance the relationship and a negatively engaged workforce will mitigate the relationship.

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H_{4f}: An engaged hospital environment moderates the relationship between information gathering and patient satisfaction, such that a positively engaged workforce will enhance the relationship and a negatively engaged workforce will mitigate the relationship.

H_{4g}: An engaged hospital environment moderates the relationship between information gathering and patient satisfaction, such that a positively engaged workforce will enhance the relationship and a negatively engaged workforce will mitigate the relationship.

H_{4h}: An engaged hospital environment moderates the relationship between information gathering and patient satisfaction, such that a positively engaged workforce will enhance the relationship and a negatively engaged workforce will mitigate the relationship.

In addition to the aforementioned hypotheses, I also postulated that patient-technology fit will be a partial mediator of the relationship between patient characteristics and patient satisfaction and electronic coordination and patient satisfaction. That is, patient characteristics and electronic coordination will also have a direct impact on patient satisfaction, in addition to the indirect effect through patient-technology fit. I modeled patient-technology fit as a partial mediator for the following reasons. Prior research has shown that many aspects of patient characteristics and electronic coordination considered in this research independently impact patient satisfaction. For example, just as computer self-efficacy has been found to influence nurse's satisfaction (Mawellet, Mathieu, & Sicotte, 2015), it is posited that digital self-efficacy will have the same direct relationship for patients. Current health status is understood to affect patient satisfaction (Manary et al., 2013), as well as choice of provider (Bravo Gil et al., 2007) or prior satisfaction (Bolton, 1998). Similarly, electronic scheduling (Abanes & Adams, 2014; Feldman et al., 2014) and electronic access (Woods et al., 2013) are increasingly demanded and anticipated by patients and are expected to have a direct relationship with satisfaction.

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Therefore, I contended that patient characteristics and electronic coordination could impact patient satisfaction through an alternate pathway, in addition to the pathway through patient-technology fit.

Methods

Sampling Design and Procedures

Patients from across the United States were invited to participate in this online survey via Qualtrics, with a goal of 1,000 surveys distributed. Previously, electronic survey tools have been confirmed as a suitable collection technique for population samples (Berinsky et al., 2012) and given the nationwide impact of electronic patient portals and universal interest in health care, a population sample was deemed appropriate. The goal of this research was to achieve more than 500 survey respondents given the desire to analyze as a population sample (Barratt et al., 2015). Additionally, 500 samples as a minimum were sought to allow for proper use of structural equation modeling using path analysis via SmartPLS, consistent with prior research (Myers et al., 2011). Conservative estimates for modeling in PLS requires the larger of either 10 times the formative indicators or 10 times the number of the maximum incoming paths to a construct (Chin, 2003). Based upon this and the present research model, N = 170 responses were the required minimum for obtaining a medium effect size (Goodhue et al., 2012); however, 504 responses were obtained.

To assist with non-response bias, Qualtrics was used to provide a small financial incentive (the initial negotiated rate with Qualtrics was \$5 per completed survey) for the brief survey that users could complete either in one or more sittings after saving the form. Reminder emails were planned to be sent to all participants who had not completed surveys within 24 hours of starting the survey, however the survey received more than 500 qualified responses without

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needing to send any reminder emails. Due to the incentive model used to find participants, a high participation rate was expected (Berinsky et al., 2012). To qualify, patients had to successfully answer that they were 18 or older and consented to taking the survey. The study was specifically seeking those whom had used an electronic patient portal in the last 12 months. Participants were excluded for failure to complete the survey after starting it and those users were not provided an incentive payment. Those who were unable to meet these inclusion criteria were excluded from analysis. The instructions on the survey clarified that participation was completely anonymous and voluntary.

Research Design and Methods of Data Collection

A positivist survey was deemed appropriate for this study for two reasons. First, in this study, I sought attitudes of individuals that had experienced care, and a survey provides an adequate way to measure attitudes (Schuman & Presser, 1996). Second, this research was engaged in theory testing rather than theory building (Yin, 2013). Here I sought to build upon previous contributions in this space rather than utilizing a grounded theory approach to build new theory. For statistical analysis of the survey data, PLS structural equation modeling was used.

Data for this research was collected in a one-stage, closed-cohort, cross-sectional web survey with a seven calendar day data collection period. The survey consisted of four sections. Section one included screening information which disqualified some participants as well as the consent; section two of the survey consisted of seven questions focused upon the electronic health portal; section three consisted of questions related to the respondents' own characteristics; section four consisted of items consistent with existing HCAHPS patient satisfaction surveys, modified to fit the context of this survey by removing any items that required an inpatient stay since our focus was electronic portals, followed by demographic information such as age,

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gender, income, race and education. All responses were assessed for reliability checks, explained in further detail in the analysis section by measure. Any data that was in direct conflict with previous answers caused the participants to be excluded. An example of conflicting answers would include: “I have not used an electronic patient portal in the past 18 months” and “I have used an electronic portal to schedule an appointment within the past 18 months.” This occurred in one of 505 responses. With no forced responses, any missing or *not applicable* responses were imputed with a mean score imputation (Allison, 2002); in total there were 857 missing data points, with nearly 80% of these as a result of not answering demographic information such as income or race (these were not imputed), with most of the remaining missing items being participants who selected *not applicable* as a response.

Item development and expert review. Instruments for this study were developed using existing measures first. New constructs were developed based upon literature review and consultation with professional and academic experts. This was consistent with prior research item development processes (DeVellis, 2016; Netemeyer et al., 2003). First, new items were developed in consultation with an information technology professor with experience in health care research. Then, an expert review was conducted with at least one academic representative, followed by multiple subject matter experts related to the topic at hand, including physicians, nurses, health care administrators, and health care researchers. Here, physicians and nurses alike suggested shifting the names of the proposed constructs from evaluation of health care encounters, social comparisons, and care team communication to instruction effectiveness, atmosphere, and care team communication. After the expert review, a pilot study was conducted with a closed cohort pool of 20 health care staff, including doctors and nurses interested in assisting the outcomes of this research; nine of the 20 responded with a completed survey. These

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results were used to modify and finalize the survey instruments; primarily, issues with question wording, question locations, and display issues were found. Then a pilot survey was sent to 65 current and former doctoral students who have used a patient portal in the last 12 months, with 43 responding in a seven day collection window. This pilot survey allowed us to run basic statistics to check for trends which allowed us to finalize the survey items and circulate for expert review a final time, moving the study to the present version.

Measures

Dependent variable: Overall patient satisfaction. Overall patient satisfaction was measured as a composite score as defined in Essay 1 of this dissertation. These items were adapted from prior research, based upon expert review of three physicians and one nurse executive. To facilitate consistent outcome variable measurement, Essay 1 proposed using the existing HCAHPS 32-item survey and letting the items load in relation to overall satisfaction and willingness to recommend scores; based on the results of this analysis, that satisfaction composite scoring methodology was used in the present study. This allowed the measures to act as formative measures for satisfaction (Diamantopoulos & Winklhofer, 2001) and allowed an academic understanding of the significance of the measure Weights on satisfaction. This study directly replicated HCAHPS questions in order to facilitate benchmarking and generalizability and as such used a 10-point Likert scale ranging from *strongly agree* (10) to *strongly disagree* (1), consistent with hospital consumer assessment of health care provider and systems ratings. A sample item is “Degree to which the doctor took your problem seriously.” No reverse coding was used for this measure.

Independent variable: Patient-technology fit. Patient-technology fit is posited as consisting of the following dimensions: a) patient’s information gathering, b) provider-patient

coordination, c) provider-patient communication, and d) patient's social sharing. As patient-technology fit seeks to operationalize the ability of the information technology to enable the patients to accomplish their tasks related to health care, this variable was measured by asking specific questions aimed at capturing how well a technology enabled patients to gather information, enable coordination, facilitate communication, and share that information.

Information gathering. For information gathering, there are a myriad of established scales focused on different aspects of information gathering, however, for the purposes of the present research, scales related to health information seeking provided the most relevant scales to adapt (Tennant et al., 2015). The most applicable set of questions which are frequently updated with changing health technologies is the HINTS (Health Informational National Trends) survey (Huerta, Walker, Johnson, & Ford, 2016). Six items were used regarding information gathering from the HINTS database, slightly adapted to fit this study. An example item used is, "In the past 12 months, how often did you use the Internet to look for health or medical information for yourself (or) someone else?" with answers consisting of once a week, once a month, every few months, less often, refused, or don't know. A full listing of all survey questions can be found in Appendix A.

Provider-patient coordination. Provider-patient coordination seeks to measure the ability of a technology to allow the patient to coordinate with the provider. To clarify the term coordination for measurement, I specifically sought to utilize questions focused at drawing out some of the task interdependencies involved in health care, including shared goals, frequency and timing of communications, and mutual respect (Gittel et al., 2000). The HINTS database provides a similar set of items to draw upon for measurement; five items were ultimately adapted for use for our survey. A sample of an adapted item is, "The electronic patient portal enables me

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to manage my health care needs with my provider,” rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of all survey questions can be found in Appendix A.

Provider-patient communication. Provider-patient communication is operationalized specifically to measure how well a technology enabled interactive communication between the providers and patients through any information channel. Given the frequently supported significance of provider-patient communication upon patient satisfaction from academic (Adams et al., 2015) and practitioner studies (Fenton et al., 2012), I specifically sought to survey patients on how well technology can facilitate this communication, as well as if the patient was utilizing such technology. Four items from the HINTS database examining provider-patient communication were adapted for use in this survey. An example item is, “In the last 12 months of using the electronic patient portal, I have effectively communicated my needs to my provider/providers’ office,” with answers consisting of a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of all survey questions can be found in Appendix A.

Patient’s social sharing. The social sharing construct aims to measure the ability of the technology to enable interactive sharing of health-related information to others through any information channel. While it is well established that humans use each other as sources of information (Baldwin & Moses, 1996), the benefits of such social sharing have moved well into the digital space, with documented benefits shown as a result of medical blogs, online support groups, and even disease specific social media sites (Kallinikos & Tempini, 2014; Peek et al., 2015). This phenomenon is not limited to the patient perspective and includes providers using such sites to interact with patients or interact with other providers of such patient populations

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(McGowan et al., 2012). As such, I measured social media usage for medical information in our survey. Four items from the HINTS database were adapted for use in this survey. An example item is, ‘In the last 12 months of using the electronic patient portal, I have often visited a social networking site, such as Facebook or LinkedIn to read and share about medical topic,’ with answers consisting of a seven-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of all survey questions can be found in Appendix A.

Independent variable: Patient characteristics. In this study, I were focused upon the cognitive human decision making of patient satisfaction self-evaluations and as such built from information processing theory (Galbraith, 1977; Tushman & Nadler, 1978) as well as prior patient characteristics that might shape the patient stored information (Boulding et al., 2011; Chang et al., 2013; Manary et al., 2013) and have defined our model of patient characteristics as abilities and affinities. Cognitive research encouraged us to strongly consider digital self-efficacy as a key ability to measure, as well as affinity towards provider as a key affinity measurement. Seven items in total were used to create this measure, combining items from the HINTS database as well as prior research (Bravo Gil et al., 2007; Hausman, 2004; John, 1992). Four items gathered information regarding affinity towards provider and three items measured digital self-efficacy. A sample adapted item regarding affinity towards provider is, ‘I have a positive impression of the hospital/health care provider where I typically receive my health care services,’ with answers consisting of a seven-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7). An example of a digital self-efficacy measurement item is, “I am confident about my ability to check information (e.g., test results) on the patient portal,” with responses consisting of a seven-point Likert scale ranging from *Strongly Negative Impression* (1)

to *Strongly Positive Impression* (7). A full listing of all survey questions can be found in Appendix A.

Independent variable: Technological capabilities. This study defined technological capabilities as the ability of a technology to assist in scheduling, communication, or access to critical information. While an endless number of technology characteristics might have presented themselves during this discussion, I limited our characteristics to those as guided by human information processing theory since I were focused on the cognitive decision-making pattern of humans, evaluating their patient satisfaction. Building from prior work studying the impact of patients' information preference style (Sawka et al., 2015), preferred media (Lifford et al., 2015), satisfaction with electronic messaging (Cottrell et al., 2015), satisfaction with care delivered digitally (Rozenal et al., 2015), perceptions of computerized assistance (Salloum et al., 2015), and digital electronic health record access patterns (Shah et al., 2015), I conceptualized our variable. I leveraged five survey items for this measure in combination from prior studies as well as from the national HINTS database; a sample adapted question is, "To what extent does the patient portal you use can accomplish the following: schedule appointments," with answers consisting of a Likert Scale ranging from *Not at All* (1) to *High Degree* (7). A full listing of all survey questions can be found in Appendix A.

Independent variable: Hospital characteristics. Finally, hospital characteristics play an important role in understanding a patient's cognitive evaluation of a care experience. This research identified hospital environment as all factors that involve the overall environment of the facility in which the care is received, excluding the clinical aspects of patient care. Prior research supported the importance of such items as patient access (Camacho et al., 2006; Messina et al., 2006) and the engagement of staff (Bowden, 2009). Thus, four items were used

to create this measure. An example item is, “It is easy to find the location of any services (e.g., X-ray, ultrasound) at the hospital,” on a seven-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of all survey questions can be found in Appendix A.

Controlling for common method bias. This study had predictor and criterion variables being measured at the same point in time, from the same source, and using the same medium, as well as concerns with common method bias (Podsakoff et al., 2003). Common method bias is defined as gathering all variables in a study using the same system, time, and source (C. B. Jarvis et al., 2003; Podsakoff et al., 2003). Common method bias can artificially inflate the scores of constructs and beta-Weights (C. B. Jarvis et al., 2003), thereby contributing to inflated results (C. B. Jarvis et al., 2003; Podsakoff et al., 2003). These biases can be avoided by separating measurement of independent and dependent variables through utilization of a multi-round survey or from multiple respondents (Morrison, 2002).

Common method bias was statistically tested by identifying the factor loadings of the actual dimensions, allowing a single-common-method-factor approach (Podsakoff et al., 2003). Also, the proposed patient satisfaction index also alleviated measurement concerns frequently raised regarding single-item indicators (Boyd et al., 2005).

Control variables. Basic demographic information, similar to what is found on HCAHPS surveys such as age, gender, insurance method (government, commercial, etc.), and health care setting (inpatient, outpatient, surgical, etc.), was collected. This data assisted in post-hoc analyses, allowing further statistical bias control.

Analysis and Results

This chapter discusses the present research data, as well as the measurement and structural models used for analysis. SmartPLS 3.2.6 was used for this analysis. First, the measurement model will be discussed to evaluate reliability and convergent and discriminant validity. Then, I will assess the structural model to evaluate the specific hypotheses, followed by supplemental analysis.

Measurement Model

This analysis begins with a confirmatory factor analysis to establish model, convergent, and discriminant reliability using published guidelines (Gefen & Straub, 2005). The confirmatory factor analysis was conducted to establish variable reliabilities based on the model presented in Figure 2.3. Several issues arose, requiring modification of the final research model. First, prior to the exploratory factor analysis stage it was discovered that the hospital environment moderating variable dimensions (access and engaged environment) were too similar to the HCAHPS staff responsiveness and communication items. In looking at the item questions specifically, questions regarding staff and clinician responsiveness as well as cleanliness and quietness found in the HCAHPS survey (which comprised the outcome variable) were highly similar to items from the proposed dimensions of access and engaged environment. During the expert review, all but one reviewer commented on this problem and suggested picking one or the other and understood it would be problematic to remove the dependent variable associated items. As envisioned, these questions were designed with the intent of measuring distinct variables, however, due to measuring all samples from the same source (single survey), having items derived from overly similar survey items proved problematic for measuring results. Because of this, the hospital environment condition was removed from the measurement model so as not to

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provide falsely significant results. The specific items were compared, revealing many of the survey items were near identical, focused on questions of how quickly staff responded, how quickly appointments were made after calling, and courtesy and respect. Because of this, the moderating condition was removed. The second adjustment to the model came from evaluation of the patient-provider coordination and patient-provider communication constructs. There was significant cross-loading in the exploratory factor analysis between these constructs. Confirmatory factor analysis also revealed similar issues. However, both communication and coordination are important aspects of patient-technology fit. Therefore, rather than remove the variables, all eight items were combined to make a single patient-provider coordination construct, which in the initial analysis loaded with a Cronbach's alpha of 0.895.

Finally, the patient affinity construct cross-loaded with the reflective items of the dependent variable. Although the provider affinity construct had strong outer loadings for all four items (0.928, 0.924, 0.904, 0.939), CFA results revealed cross-loadings. This was likely because the type of questions used to measure provider affinity (how loyal patients were to a certain provider, how highly they thought of the provider, willingness to recommend the provider) were too similar to the willingness to recommend reflective variables for patient satisfaction, which were asking near identical questions. For these reasons, the construct was excluded from further analysis.

The final measurement model is depicted in Figure 2.4, with the second order constructs minimized for readability (i.e., DocCom and NurCom are formative first order constructs of care team communication, cleanliness and quietness, and staff responsiveness to atmosphere, and communication about medicines, and discharge instructions to instruction effectiveness). Item reliabilities were then verified to evaluate the model and all were above 0.70, which is the

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recommended acceptable threshold (Nunnally, 1978). Table 2.6 depicts the t -values of the outer model loadings of the research model. The first requirement in establishing convergent validity is recognized when the t -values are greater than 1.96 (Gefen & Straub, 2005), and as such all items were greater than 1.96 as illustrated in Table 2.6. In addition, verification of AVE values of greater than 0.5 were recommended (Fornell & Larcker, 1981) and achieved as depicted in Table 2.7.

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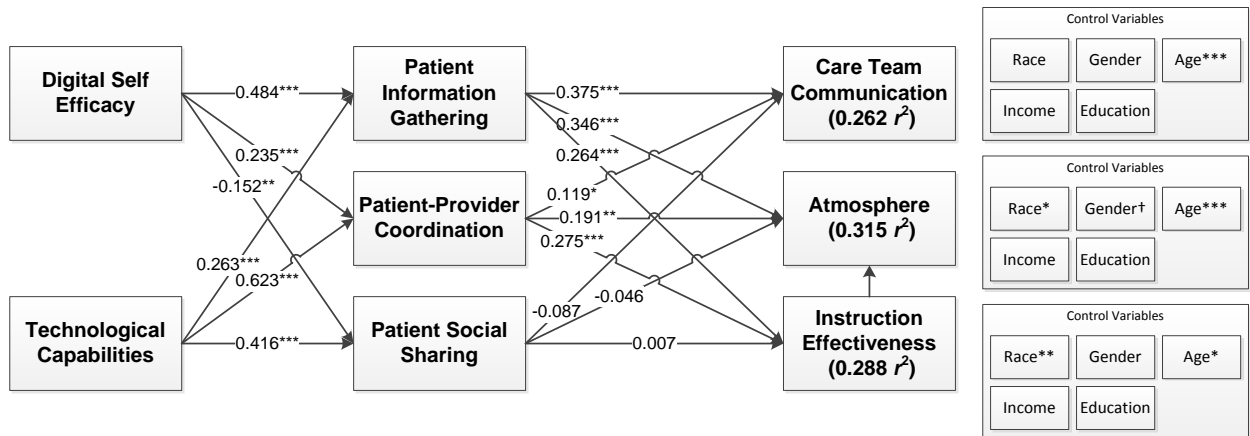


Figure 2.4. Structural three dependent variable model for patient technology fit.

Note: * p < .05, ** p < .01, *** p < .001

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Table 2.6

Outer Model Loadings

Construct	Item	Question	<i>t</i> Statistics
Digital Self-Efficacy (DSE)	DSE1	I believe I have the ability to effectively use the electronic patient portal.	84.726
	DSE2	I am confident about my ability to check information (e.g., test results) on the electronic patient portal.	98.632
	DSE3	I am confident about my ability to find specific information (e.g., messages from my provider) on the electronic patient portal.	81.59
	DSE4	I am able to effectively use digital devices such as computers or mobile phones to accomplish tasks.	30.441
Information Gathering (IG)	IG1	The electronic patient portal allows me to gather information related to my health.	92.671
	IG2	I trust information I receive about my health from the electronic patient portal.	96.155
	IG3	I pay attention to information about my health from the electronic patient portal.	63.084
Patient-Provider Coordination (PPCom)	PPCom1	Using the electronic patient portal, I can communicate easily with my provider/providers' office.	74.818
	PPCom2	Using the electronic patient portal, I can effectively communicate my needs to my provider/providers' office.	69.904
	PPCom3	Using the electronic patient portal, my provider/providers' office has interacted effectively with me.	71.818
	PPCoord1	The electronic patient portal enables me to keep track of personal health information (e.g., care received, test results, upcoming medical appointments).	32.316
	PPCoord2	The electronic patient portal enables me to exchange diagnostic information (e.g., medical illness or diseases) with my provider.	41.796
Patient-Social Sharing (PSS)	PSS1	The electronic patient portal enables me to manage my health care needs with my provider.	59.045
	PSS2	The electronic patient portal enables me to coordinate with my provider conveniently.	93.235
	PSS3	After using the electronic patient portal, I have often visited a social networking site (e.g., Facebook, LinkedIn) to share information about health or medical topics.	26.465
	PSS4	After using the electronic patient portal, I found the information useful when participating in an online support group for people with a similar health or medical issue.	88.117
	PSS5	After using the electronic patient portal, I was better able to update my online diary or blog.	39.582
Technical Capabilities (TC)	TC1	After using the electronic patient portal, I have often felt more informed when sharing information regarding my health with friends or family members.	29.598
	TC2	Using the electronic patient portal helps me to schedule appointments.	54.382
	TC3	Using the electronic patient portal helps me to securely email my provider.	60.472
	TC4	Using the electronic patient portal helps me to obtain test results.	30.501
		Using the electronic patient portal helps me to receive appointment reminders.	46.133

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Two criteria were used to establish discriminant validity; item-to-construct correlations have to be greatest for the intended construct (Gefen & Straub, 2005) and the square root of the AVE of the construct must be greater than the correlations with the other constructs (Fornell & Larcker, 1981). Table 2.7 allows comparisons of each row of the loadings; bolded items depict the loadings for the intended constructs. It can be seen that the highest loading for each item is on the bolded area, meeting the first requirement for discriminant validity. Table 2.8 allows an examination of the square root of AVE construct to ensure it was higher than the correlations with all other constructs. Looking at the diagonal elements in Table 2.8 reveals this requirement was achieved and all diagonal values were in fact more than the off-diagonal elements. This meets the second requirement for discriminant validity for these constructs.

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Table 2.7

Item-to-Construct Correlations. The bolded sections in each column are the constructs associated with the corresponding items in each row.

Items	DSE	IG	PPCoord	PSS	Tech.Cap
DSE1	0.915	0.594	0.569	0.121	0.596
DSE2	0.93	0.595	0.555	0.051	0.556
DSE3	0.912	0.601	0.622	0.135	0.603
DSE4	0.83	0.527	0.469	0.061	0.449
IG1	0.602	0.916	0.606	0.155	0.528
IG2	0.604	0.918	0.581	0.072	0.521
IG3	0.552	0.888	0.627	0.201	0.48
PPCom1	0.53	0.515	0.886	0.324	0.705
PPCom2	0.505	0.489	0.883	0.355	0.695
PPCom3	0.544	0.541	0.887	0.337	0.746
PPCoord1	0.651	0.704	0.776	0.132	0.595
PPCoord2	0.43	0.528	0.823	0.381	0.601
PPCoord4	0.524	0.647	0.889	0.341	0.616
PPCoord5	0.545	0.585	0.906	0.334	0.682
PSS1	-0.058	-0.007	0.175	0.818	0.13
PSS2	0.088	0.139	0.343	0.911	0.292
PSS3	0.014	0.047	0.25	0.882	0.224
PSS4	0.225	0.263	0.402	0.842	0.383
TC1	0.438	0.397	0.662	0.358	0.865
TC2	0.501	0.439	0.72	0.309	0.88
TC3	0.683	0.618	0.613	0.162	0.8
TC4	0.48	0.46	0.62	0.268	0.863

Note: The abbreviations above are defined as: Digital Self-Efficacy (DSE), Information Gathering (IG), Patient-Provider Coordination (PPCoord), Patient-Provider Communication (PPCom), Patient-Social Sharing (PSS), Technical Capabilities (TC).

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Table 2.8

Measurement Model Validations – Average Variance Extracted

Variables	Age	Atmosphere	CTC	DSE	Education Level	Gender	IG	Income	InstEff	PPCoord	PSS	Race	Tech.Cap
Age	1												
Atmosphere	0.227	1											
CTC	0.224	0.776	1										
DSE	0.009	0.475	0.406	0.897									
Education Level	-0.007	-0.012	0	0.052	1								
Gender	-0.024	0.081	0.088	0.081	-0.122	1							
IG	0.048	0.487	0.453	0.647	-0.002	0.04	0.908						
Income	-0.082	0.059	0.002	0.088	0.429	-0.216	0.083	1					
InstEff	0.116	0.787	0.696	0.482	0.017	0.071	0.466	0.091	1				
PPCoord	-0.018	0.413	0.334	0.62	-0.062	-0.005	0.665	0.093	0.462	0.865			
PSS	-0.307	0.011	-0.053	0.105	-0.112	-0.136	0.154	0.11	0.105	0.361	0.864		
Race	0.212	0.18	0.111	0.079	0.039	0.053	0.064	0.076	0.162	0.068	-0.064	1	
Tech.Cap	-0.068	0.364	0.288	0.618	-0.034	-0.019	0.562	0.086	0.363	0.768	0.322	0.011	0.853

Note: The abbreviations above are defined as: Digital Self-Efficacy (DSE) Information Gathering (IG) Patient-Provider Coordination (PPCoord) Patient-Social Sharing (PSS) Technical Capabilities (Tech.Cap), Care Team Communication (CTC), Instruction Effectiveness (InstEff). Race, income, gender, age, and education level are control variables.

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The data in this research was also used to explore a single dependent variable model as depicted in Figure 2.5. While parsimony would suggest this model be used in further analysis, especially given the similar significance of path coefficients seen in Figure 2.5 and acceptable AVE, this was a problematic model for two reasons. First, the three dependent variable model allows practitioners to utilize this research to specifically focus upon areas of known weakness or avoid over investment into areas of strength. Second, the single dependent variable model had an R^2 of 0.166 while each item in the three dependent variable model attained a higher R^2 , which was not unexpected given they are more specific constructs (care team communication had an R^2 equaling 0.262, atmosphere had an R^2 equaling 0.315, and instruction effectiveness had an R^2 equaling 0.288). For these reasons, the three dependent variable model was used throughout this analysis for increased practitioner and academic application.

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Table 2.9

Alternate Measurement Model Validation - Average Variance Extracted.

Variables	DSE	IG	Race	Gender	Age	Income	Education	PPCoord	PSS	Patient Satisfaction	Tech. Cap
DSE	0.897										
IG	0.639	0.853									
Race	0.009	0.026	1								
Gender	0.081	0.027	-0.024	1							
Age	0.052	-0.018	-0.007	-0.122	1						
Income	0.088	0.086	-0.082	-0.216	0.429	1					
Education	0.079	0.053	0.212	0.053	0.039	0.076	1				
PPCoord	0.615	0.681	-0.039	-0.012	-0.061	0.099	0.063	0.84			
PSS	0.108	0.203	-0.306	-0.136	-0.112	0.109	-0.064	0.395	0.863		
Patient Satisfaction	0.338	0.338	0.134	0.086	0.003	0.092	0.124	0.319	0.052	0.966	
Tech. Cap	0.617	0.561	-0.069	-0.019	-0.034	0.085	0.011	0.776	0.325	0.309	0.853

Note: The abbreviations above are defined as: Digital Self-Efficacy (DSE) Information Gathering (IG) Patient-Provider Coordination (PPCoord) Patient-Social Sharing (PSS) Technical Capabilities (Tech.Cap), Care Team Communication (CTC), Instruction Effectiveness (InstEff). Race, income, gender, age, and education level are control variables.

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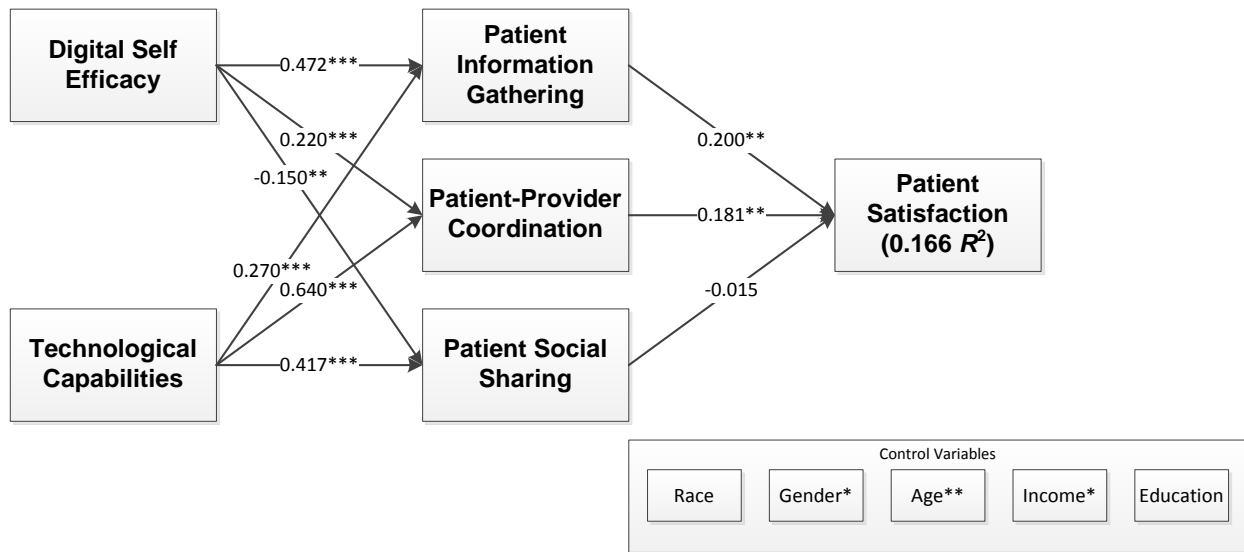


Figure 2.5. Revised structural model of patient-technology fit.

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Structural Model

The model tested in the present analysis is presented in Figure 2.4. Care team communication, instruction effectiveness, and atmosphere were second order factors and as such were modeled and validated following the procedure described in Pavlou and El Sawy (2006). As described previously, the items associated with the second order construct were first checked for convergent and discriminant validity. Next, the path coefficients from the first order constructs to the second order constructs were checked for significance.

The corresponding path coefficients were found to be significant at $p < 0.001$: doctor communication to care team communication ($\beta = 0.537$, t -value = 68.766), nurse communication to care team communication ($\beta = 0.523$, t -value = 71.927), cleanliness and quietness to atmosphere ($\beta = 0.488$, t -value = 33.784), staff responsiveness to atmosphere ($\beta = 0.633$, t -value = 41.286), discharge instructions to instruction effectiveness ($\beta = 0.597$, t -value = 40.969), and communication about medicines to instruction effectiveness ($\beta = 0.482$, t -value = 38.355). This established that the second order constructs of formal and informal governance are each composed of two first order constructs. This does, however, present a problem with AVE given the three dependent variables listed, a limitation of the statistical model. By capturing the latent variables of the second order constructs derived from all first order constructs, these latent variables could be inserted into the model rather than the first order variables, allowing SmartPLS to overcome its limitations while still producing accurate statistical analysis. The results of all significant hypothesis tests are shown with asterisks in Figure 2.4.

Hypothesis 1a stated that information gathering by patients will have a positive impact on patient satisfaction. Results from the structural equation modeling depicted in Figure 2.4 provide support for this hypothesis, as information gathering was positively related to care team

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communication ($\beta = 0.375$, t -value = 6.756), atmosphere ($\beta = 0.346$, t -value = 5.704), and instruction effectiveness ($\beta = 0.264$, t -value = 4.284).

Hypothesis 1b stated that provider-patient coordination through information technology will have a significant and positive impact on patient satisfaction. Results from the structural equation modeling depicted in Figure 2.4 provided support for this hypothesis, as provider-patient coordination was positively related to care team communication ($\beta = 0.119$, t -value = 2.071), atmosphere ($\beta = 0.191$, t -value = 3.244), and instruction effectiveness ($\beta = 0.275$, t -value = 4.116).

Hypothesis 1c, which stated that provider-patient communication through information technology will have a significant and positive effect on patient satisfaction, was not tested as its items were combined with patient-provider coordination, the results of which are depicted in Figure 2.4.

Hypothesis 1d stated that social sharing of information by the patient will have a significant and positive effect on patient satisfaction. Results from the structural model depicted in Figure 2.4 suggested this relationship was not supported. Specifically, social sharing of information was not significantly related to care team communication ($\beta = -0.087$, t -value = 1.895), atmosphere ($\beta = -0.046$, t -value = 1.083), or instruction effectiveness ($\beta = 0.007$, t -value = 0.164). These findings suggest that how likely a patient is to share medical information socially has little to do with patient satisfaction.

Hypotheses 2a and 2b stated that digital self-efficacy will have a significant and positive effect on information gathering and provider information-coordination. Results from the structural equation modeling depicted in Figure 2.4 provided support for these hypotheses in that

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digital self-efficacy was positively related to patient information gathering (H_{2a} : $\beta = 0.484$, t -value = 8.702) and patient-provider coordination (H_{2b} : $\beta = 0.235$, t -value = 3.967).

Hypothesis 2c, which stated that digital self-efficacy will have a significant and positive effect on provider-patient communication, was not tested as patient-provider communication items were combined with the patient-provider coordination items. The relationship with patient-provider coordination items was significant and is depicted in Figure 2.4.

Hypothesis 2d stated that digital self-efficacy will have a significant and positive effect on patient social sharing. Results from the structural equation modeling depicted in Figure 2.4 provided no support for this proposed relationship. In fact, digital self-efficacy and patient social sharing had a negative and significant relationship ($\beta = -0.152$, t -value = 2.728), suggesting those with increased ability to manage digital media were in fact the least likely to share health related information on social networks.

Hypotheses 2e through 2h, which focused on the relationships associated with affinity towards provider, were not tested. While the concept remains supported in the literature, the items used to measure the dimension had significant issues cross-loading with the outcome variables and were removed from the structural analysis. Future research will benefit from recasting these questions in a way carefully designed so as not to cross-load with willingness to recommend items or perhaps seeking an observed variable to measure this construct differently.

Hypothesis 3a stated that technology capabilities will have a significant and positive effect on information gathering. Results from the structural equation modeling depicted in Figure 2.4 provided support for this hypothesis as technology capabilities were positively related to patient information gathering ($\beta = 0.263$, t -value = 4.363).

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Hypothesis 3b stated that technology capabilities will have a significant and positive effect on patient-provider coordination. Results from the structural equation modeling depicted in Figure 2.4 provided support for this hypothesis as technology capabilities were positively related to patient-provider coordination ($\beta = 0.623$, t -value = 10.647).

Hypothesis 3c, which stated that technology capabilities will have a significant and positive effect on provider-patient communication, was not tested as patient-provider communication items were combined with patient-provider coordination items. Results of the structural equation analysis upon patient-provider coordination can be seen in Figure 2.4.

Hypothesis 3d stated that technology capabilities will have a significant and positive effect on patient-social sharing. Results from the structural equation modeling depicted in Figure 2.4 provided support for this hypothesis as technology capabilities were positively related to patient-social sharing ($\beta = 0.416$, t -value = 7.382).

Hypotheses 4a through 4h, which focused on the relationships associated with hospital environmental conditions of access and engagement, were not tested. While employee and staff engagement remain supported in the literature, the items used to measure the dimension had significant issues cross-loading with the outcome variables and were removed from the structural analysis. Given the common practice to measure engagement in health care environments (White, Butterworth, & wells, 2017), this variable would likely be best analyzed using a multi-method study which gathered this information separately from the patient satisfaction survey items.

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Table 2.10

Supported Hypotheses

Hypothesis	Supported	Path
H_{1A}	Supported	IG --> Patient Satisfaction
H_{1B}	Supported	PPCoord --> Patient Satisfaction
H_{1C}	N/A	PPComm --> Patient Satisfaction
H_{1D}	Not Supported	PSS --> Patient Satisfaction
H_{2A}	Supported	DSE --> Information Gathering
H_{2B}	Supported	DSE --> PPCoord
H_{2C}	N/A	DSE --> PPComm
H_{2D}	Not Supported	DSE --> Patient Social Sharing
H_{2E}	N/A	Affinity towards Provider --> IG
H_{2F}	N/A	Affinity towards Provider --> PPCoord
H_{2G}	N/A	Affinity towards Provider --> PPComm
H_{2H}	N/A	Affinity towards Provider --> Patient Social Sharing
H_{3A}	Supported	Tech Cap --> IG
H_{3B}	Supported	Tech Cap --> PPCoord
H_{3C}	N/A	Tech Cap --> PPComm
H_{3D}	Supported	Tech Cap --> PSS
H_{4A}	N/A	Access x IG --> Patient Satisfaction
H_{4B}	N/A	Access x PPCoord --> Patient Satisfaction
H_{4C}	N/A	Access x PPComm --> Patient Satisfaction
H_{4D}	N/A	Access x PSS --> Patient Satisfaction
H_{4E}	N/A	Engagement x IG --> Patient Satisfaction
H_{4F}	N/A	Engagement x PPCoord --> Patient Satisfaction
H_{4G}	N/A	Engagement x PPComm --> Patient Satisfaction
H_{4H}	N/A	Engagement x PSS --> Patient Satisfaction

Note: The abbreviations above are defined as: Digital Self-Efficacy (DSE) Information Gathering (IG) Patient-Provider Coordination (PPCoord) Patient-Social Sharing (PSS) Technical Capabilities (Tech.Cap), Care Team Communication (CTC), Instruction Effectiveness (InstEff). Race, income, gender, age, and education level are control variables

x indicates moderating effect between variables

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Of the control variables, only age had a significant relationship for all three dependent variables, specifically, atmosphere ($\beta = 0.185$, t -value = 4.762), care team communication ($\beta = 0.175$, t -value = 4.402), and instruction effectiveness ($\beta = 0.096$, t -value = 2.317). Education was insignificantly related to atmosphere ($\beta = -0.020$, t -value = 0.502), care team communication ($\beta = 0.010$, t -value = 0.257), and instruction effectiveness ($\beta = 0.019$, t -value = 0.477). Gender was insignificantly related to atmosphere ($\beta = 0.069$, t -value = 1.798), care team communication ($\beta = 0.063$, t -value = 1.464), and instruction effectiveness ($\beta = 0.073$, t -value = 1.690). Income was insignificantly related to atmosphere ($\beta = 0.049$, t -value = 1.150), care team communication ($\beta = -0.009$, t -value = 0.203), and instruction effectiveness ($\beta = 0.052$, t -value = 1.067). Finally, race was significantly related to atmosphere ($\beta = 0.096$, t -value=2.682) and instruction effectiveness ($\beta = 0.097$, t -value = 3.033) but insignificantly related to care team communication ($\beta = 0.033$, t -value = 0.841). The R^2 values for the dependent variables were as follows: care team communication ($R^2 = 0.262$), atmosphere ($R^2 = 0.315$), and instruction effectiveness ($R^2 = 0.288$).

Common Method Bias Analysis

It was necessary to complete a Harmon's single factor test in this study due to the raised concerns with common method bias; this was done via completion of an exploratory factor analysis (Podsakoff & Organ, 1986). These results showed all items loading on more than one factor, which is indicative that method bias concerns are alleviated. This was further evaluated within SmartPLS, by modeling the primary factors (care team communication, atmosphere, and instruction effectiveness) as second order constructs. Finally, the constructs were also evaluated through evaluation of Pearson's correlations to check that none exceeded 0.90 (Pavlou, Liang &

Xue, 2007). These issues did not present, indicating low probability of common method bias in this study.

Chapter Summary

The measurement model examined in this study demonstrated satisfactory construct validity and reliability. The structural model was tested using SmartPLS 3.2.6. These results supported hypotheses H_{1A} , H_{1B} , H_{2A} , H_{2B} , H_{3A} , H_{3B} , and H_{3D} . Additional analysis also occurred to test a similar model with a single dependent variable with similar results. There were no issues with common method bias tests.

Discussion, Limitations, and Conclusions

This essay conceptualized patient-technology fit and its relationship with patient satisfaction in a manner distinct from contemporary measurement to contribute to existing knowledge in three ways. First, patient-technology fit was conceptualized and validated in this research as consisting of information gathering, patient-provider coordination, and patient social sharing. While social sharing lacked a significant relationship with patient satisfaction, there was an unintentional discovery of its significant and negative relationship with digital self-efficacy. Second, this research proposed digital self-efficacy as a construct, building upon computer self-efficacy terms which have been historically supported (C. K. Lim, 2001), allowing the concept to expand beyond computers. Finally, task-technology fit literature has supported exploring the impact of personal or technology characteristics upon known task-technology fit literature (Furneaux, 2012). In this research, I further expanded our understanding of the technical capabilities of electronic patient portals and how they make significant impacts to the patient-technology fit relationships along with the other important antecedents mentioned above.

Discussion

This section discusses the findings from each specific hypothesis test conducted, as well as the interpretation of the results. It is organized into three parts, first discussing the patient-technology fit constructs' impacts upon the patient satisfaction variables, followed by discussing digital self-efficacy and its impacts upon patient-technology fit, and finally exploring how technological capabilities of the health information systems impact patient-technology fit.

Patient-technology fit. This study proposed the concept of patient-technology fit, building off the long history of task-technology fit literature well summarized by Furneaux (2012). Additionally, both organizational and human information processing theories supported the conceptualization of information gathering, coordination, communication, and finally, sharing (Shiffrin & Schneider, 1977). The findings showed that two of the three proposed dimensions of patient-technology fit (information gathering and patient-provider coordination) had a significant impact upon patient satisfaction (either as a standalone single dependent variable or conceptualized as three dependent variables of care team communication, atmosphere, and instruction effectiveness) and that patient social sharing was not supported. In the following section, I discuss the findings in more detail.

Information gathering. Information gathering was conceptualized in this research in large part building from the work on human information processing theory, which suggests humans must receive information to be able to process it (Atkinson & Shiffrin, 1968). Thus, it was proposed and confirmed for this research model that information gathering would play a key role in patients' understanding of a technology and its fit to their own medical conditions. This study successfully validated that information gathering has a significant impact upon care team communication, atmosphere, and instruction effectiveness. This discovery is important, building

on the more recent phenomenon of pushing for increased transparency and information sharing for patients (Asante-Korang & Jacobs, 2016; Mullen, 2004); not only were transparency and information sharing suggested as important but these factors could actually have a positive impact upon patient satisfaction assessments.

Patient-provider coordination. Patient-provider coordination was also built upon human and organizational information processing theories. Galbraith (1994) and colleagues (Daft & Lengel, 1986; Daft et al., 1987; Tushman & Nadler, 1978) have stated that both formal and informal coordination mechanisms (such as structural overlays and human resources policies) improve information processing capabilities and consequently reduce information uncertainty and equivocality. This knowledge, combined with the consistently demonstrated importance of communication and its impact upon satisfaction (Adams et al., 2015; Boissy et al., 2016a) contributed to the conceptualization of patient-provider coordination as a critical dimension of patient-technology fit. Quite simply, it was essential that the model could track the ability of the technology to allow the patients to do something with information once it was obtained. The findings from this study confirmed that a second and important dimension of patient-technology fit is patient-provider coordination. Thus, mechanisms which facilitate this communication and coordination between patients and their health care providers should continue to be explored by practitioners and academics alike.

Patient social sharing. This research proposed the construct of patient social sharing on the basis that humans use one another as information sources (Baldwin & Moses, 1996). While research has confirmed an increasing awareness of and study into consumer health information seeking behaviors (Dutta-Bergman, 2004; Feng & Xie, 2015; Neter & Brainin, 2012), patient social sharing was not found to have a positive and significant relationship with patient

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satisfaction, whether observing patient satisfaction as a single outcome variable or as three dependent variables of care team communication, atmosphere, or instruction effectiveness. Despite the noted awareness and growth of social media, it does not appear that patients are actively seeking to share their health information, nor does it seem that electronic patient portals are facilitating that sharing (in hindsight, not entirely unexpected given Health Insurance Portability and Accountability Act of 1996 privacy requirements; Rothstein, 2016). That said, patient social sharing did reveal some significant relationships: digital self-efficacy has a direct relationship with patient social sharing ($\beta = -0.152$, t -value = 2.728) and technical capabilities has a direct impact upon patient social sharing ($\beta = 0.416$, t -value = 7.382). These findings suggest that while patient social sharing did not play a significant role in our validation of the patient-technology fit construct, there are important relationships to explore further with this variable. Post hoc data analysis suggests these results may have more to do with the overall low utilization of social media to share health related information, with an average score for all for survey items in the construct of 3.72, suggesting respondents tend to disagree with statements that they share this type of information.

Digital self-efficacy. Digital self-efficacy was conceptualized from computer self-efficacy (D. R. Compeau & Higgins, 1995) and internet self-efficacy (Eastin & LaRose, 2000). In particular, this research posited that the main benefits already understood from both of these constructs would expand into the digital generation, including tablets, mobile phones, and so forth to accomplish desired tasks. Regarding this specific study, it was hypothesized that those with greater digital self-efficacy would have better ability to gather information, be better able to use patient-provider coordination tools such as electronic scheduling, and be more skilled in their abilities to share information via social media, blogs, or other electronic methods. Digital self-

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efficacy had a significant positive effect upon information gathering (H_{2a}) and patient provider coordination (H_{2b}). Digital self-efficacy had a negative and significant effect upon patient social sharing (H_{2d}) and thus was not supported. Post-hoc analysis suggested this is partly to do with the overall phenomenon that the majority of respondents in this survey disagreed that they shared health related information socially and that those with increased technical savvy place increased importance upon privacy, supporting current research (K. Martin, 2018). This provides fertile ground for future research to build upon this understanding to future knowledge, exploring where research on tech savvy and digital self-efficacy are complementary. This nicely showcases two important points: first, that understood benefits from computer self-efficacy have transitioned into the digital era, and second, that individual characteristics do have significant relationships with the patient-technology fit construct, which builds upon the contemporary understanding of the field (Furneaux, 2012).

Technological capabilities. Technological capabilities proved to be one of the critical variables to capture in this study. This was due not only to the significance of the variable to information gathering (H_{3a}), patient-provider coordination (H_{3b}) and patient social sharing (H_{3d}) but also to the significant questions received during the expert review process, as well as the additional comments received at the end of the survey. The following comments capture the highlights, concerns, and problems from the patient perspective of these tools and provide fertile guidance for future research.

- “Electronic patient portals would be beneficial if there was a way to message doctors with questions.”

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- “I think [electronic portals] are very convenient, and actually make me more likely to schedule and attend health care appointments instead of delaying them or not going in for something.”
- “Portal is very convenient especially when I'm away from home, I can access my information if needed.”
- “My health provider's patient portal does not make it easy to schedule appointments.”
- “I love electronic patient portals. I find that getting an appointment to see a doctor quicker and easier that way.”
- “[Patient portals] work well, however I like to speak with someone.”

Limitations

While this study made several substantial contributions for academics and practitioners alike surrounding patient-technology fit, patient satisfaction, and digital self-efficacy, there were inherent limitations related to survey design, measures, and sampling methods. An important limitation of this study centers on the fact that the measurement model will require testing across numerous methodologies and health information technologies; despite having 504 survey respondents, several of these constructs are new and will require additional targeted research to continue to strengthen and hone the conceptualizations. Validating these proposed relationships has been a fundamental cornerstone to expanding understanding of patient satisfaction, and has opened many important doors for future research. Additionally, measurement via a single survey presented some concerns of common method bias due to the independent and dependent variables being collected from the same individual from the same survey. While common method bias was not found to be a concern during the measurement and structural validation,

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concerns remain, including social desirability bias, with respondents selecting what they think the surveyors wanted or answering how they think their electronic portals work; however, it is very possible respondents may not fully understand the systems capabilities. Additionally, the survey respondents were paid to participate in a Qualtrics survey; it is conceivable that this sample of respondents may be more technologically inclined than the true population, potentially skewing the results or suggesting significant relationships. Finally, this study into patient-technology fit was much focused on the health care space, leaving many of the significant items such as digital self-efficacy and technical capabilities supported in a narrow field, which may benefit by additional application outside of this arena or even more importantly out of the U.S. health care system.

Implications for Research

This study contributes to our understanding of the nomological network of factors affecting patient satisfaction in four ways. First, information technology research provides a roadmap through which to better understand the role of technology and fit (P.-S. Chen et al., 2015; Crean, 2010; Dishaw & Strong, 1999; Fuller & Dennis, 2009; Furneaux, 2012; Furukawa & Poon, 2011; Goodhue & Thompson, 1995; T.-C. Lin & Huang, 2008; Zigurs & Buckland, 1998). Building off this research, the major academic contribution of this study is the definition of patient-technology fit, consisting of information gathering and patient-provider coordination dimensions. Future academic work will benefit from exploring other dimensions of patient-technology fit, as well as any variables which might have interaction or mediation effects upon the complex patient satisfaction outcome variable.

Second, the creation of this variable allowed the second major contribution of this work, which is a validation of the proposed patient satisfaction outcome from Essay 1. This

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conceptualization allowed both a single dependent variable model as well as a three dependent variable model to be constructed, measured, tested, and validated, all discussed within previous sections of this essay. Third, the development of digital self-efficacy as a measure updates both computer self-efficacy (D. R. Compeau & Higgins, 1995) and internet self-efficacy (Eastin & LaRose, 2000) to apply to the modern technological landscape. Therefore, future research can examine distinctive patient and technology related antecedent conditions of patient-technology fit to further expand the nomological network.

The unexpected negative and significant relationship with patient-social sharing piques great academic interest into how digital self-efficacy affects the behaviors of users. As the millennial and younger generations are generally more adept to utilizing technology, social sharing of information may become a crucial issue in the future. Therefore, future research can explore the discrepant findings regarding social sharing in our research. For instance, under what circumstances would social sharing of information be beneficial for patients? What types of patients are more likely to share information on social platforms? These are some interesting questions that future research can address.

Finally, understanding the antecedents to patient-technology fit allow academic and practitioner insight in the patient and technology characteristics which influence this fit to optimize the care continuum and allow these relationships to be further explored. This study has made clear the significance of digital self-efficacy and technological capabilities, providing a solid framework to explore additional relationships as theoretically supported. These contributions combine to provide a substantially greater understanding of the network of factors impacting patient satisfaction, providing rigorous support for the development of a theory of patient satisfaction.

Implications for Practice

Practitioners can benefit from the findings of this study in three ways. First, using the results from the single dependent variable model constructed in this survey allows those hospitals which need to impact their overall ratings across all areas to approach the problem with an understanding of what might make a statistical difference for their program. Here, constructs such as patient-technology fit, digital self-efficacy, and technological capabilities played an important role in driving patient satisfaction scores. Practitioners can use this information to consider carefully the capacities of their electronic portal systems while also taking steps to ensure there is a good patient-technology fit. Further, the significance of digital self-efficacy is important for practitioners hoping to achieve superior results on patient satisfaction; while training for their own staff is critical, these data suggest education initiatives to increase digital self-efficacy for patients may have significant impact upon patient satisfaction scores. Second, using the results from the three dependent variable model (care team communication, atmosphere, and instruction effectiveness) allows health systems to realistically target the issues they perceive in their systems and focus their interventions accordingly. Systems that have strong communication scores, for example, would be able to focus specifically on instruction effectiveness and what antecedents most drive those results rather than trying to tackle all of patient satisfaction at one time. Being able to more effectively target their own gaps allows organizations to approach those opportunities with interventions specifically designed to yield a result in one of the three dimensions, as guided by this research. Third, despite the results of the statistical analysis, it is important for practitioners to take note of the qualitative patient comments shown in this survey, as well as noting the significance patients overwhelmingly place upon communication as the dimension of patient satisfaction most significant in their selection of

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overall patient satisfaction. This suggests practitioners would highly benefit from evaluating and reacting to their own patients' comments which come in during their patient satisfaction surveys. One thing seems paramount: communication plays a critical role in the mind of patients in terms of their evaluations of their satisfaction with a health care experience. Therefore, resources should be devoted to this area with careful attention paid as to the effectiveness of these efforts.

Conclusion

Recent health care regulations such as the HITECH Act continue to encourage hospitals to implement HIT aimed at improving the accuracy, safety, and access of patient data (Bates & Gawande, 2003; Buntin, Burke, Hoaglin, & Blumenthal, 2011). The central imperative of the HITECH Act and allied health care laws is to improve patient care quality (Blumenthal, 2010) while also paying attention to patient satisfaction as a proxy indicator of that quality (B. Jarvis et al., 2013). This research has provided a framework to understand how patients and technologies synergize, as well as highlighting several of the key relationships in the complex nomological network of patient satisfaction. Two new concepts in particular were supported in this study: digital self-efficacy and patient-technology fit. Digital self-efficacy has modernized the computer self-efficacy construct and provides a robust research stream to ensure all known relationships with this established and important variable persist into the digital era. Patient-technology fit likewise offers a unique contribution to both the information technology and the health care research domains. The significance of the dimensions of patient-technology fit (information gathering, patient-provider coordination, and patient social sharing) offer a focused view on the nomological network of factors affecting patient satisfaction, providing the launch point for progress in both the academic and practitioner realms, even for the unsupported relationships associated with patient social sharing. Quality improvement, knowledge

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expansion, and systems improvement are all highly possible building from the results of this study.

CHAPTER IV – ESSAY 3

Effects of Electronic Patient Portal Use on Patient Satisfaction

Abstract

This research used a techno-centric view to examine the effect of electronic patient portal usage upon patient satisfaction. In particular, social cognitive theory (Bandura, 2011) and adaptive structuration theory helped us understand that using technologies can increase satisfaction in individuals (DeSanctis & Poole, 1994). Data was collected using a survey of patients regarding their experiences with patient portals, measuring portal usage, perceptions and attitudes towards usage, and patient satisfaction. Data was analyzed using structural equation modeling (SEM). Key findings include that portal usage directly impacts overall patient satisfaction and that system use alters both attitude towards using as well as behavioral intentions to use. This research adds to the understanding of patient satisfaction antecedents, contributing towards a theory of patient satisfaction and increased understanding of electronic health portals.

Keywords: Patient satisfaction, UTAUT, TAM, patient portal, affordance-actualization, adaptive structuration theory

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As utilization of health information technologies (HIT), such as electronic health records, patient portals, and computerized physician order entry continue to expand in response to the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, the ability to monitor the impact of these systems upon care delivery and patient satisfaction is critical. The HITECH Act commits nearly \$27 billion to incentivize providers to adopt electronic health records over the course of 10 years (Blumenthal & Tavenner, 2010). In 2010, the Patient Protection and Affordable Care Act, through the value based purchasing program, confirmed a regulatory focus upon patient satisfaction, withholding 2% of all Medicare payments which can be restored in part by achieving high levels of Hospital Consumer Assessment of Healthcare Providers (HCAHPS) patient satisfaction scores (A. M. Epstein, 2012). The focus on patient satisfaction is in large part due to previous health care research finding that increased levels of patient satisfaction have been significantly related to improved clinical outcomes (Kane et al., 1997) and improvement in overall clinical care (Furukawa & Poon, 2011). Hence, the effective monitoring of implementation of HIT systems' impact upon patient satisfaction is important in ideally improving clinical outcomes, which at times can be subjective and difficult to measure.

Despite strong academic interest in patient satisfaction as a performance metric, up to 45% of current studies into the effect of HIT upon patient satisfaction have shown no effect or were inconclusive (Rozenblum et al., 2013). While patient satisfaction has been found to have a relationship with better patient retention (Garman et al., 2004), increased patient care compliance (Ciechanowski et al., 2014), reduction of medication errors (Radley et al., 2013), and improvement in communication (Hesse, Ahern, & Woods, 2011), very few of these relationships have cited any link with HIT. This shows that while health care delivery systems are

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increasingly implementing electronic health records and patient portals (Blumenthal, 2011), there is an incomplete understanding of their impact upon patient satisfaction. Previous research in information technology adoption provides a conceptual understanding of technology adoption, which has yet to be extended to understand impact upon patient satisfaction after portal usage (Venkatesh et al., 2003).

This study sought to apply social cognitive theory and adaptive structuration theory to explore the impacts of post adoptive use of technology in health care settings. I drew upon prior research in the information technology adoption literature, namely technology acceptance model and unified theory of acceptance and use of technology (UTAUT), to inform the understanding of how implementation of electronic patient portals affects patient satisfaction (Davis et al., 1989; Venkatesh et al., 2003), which in turn built upon previous conceptualizations of patient satisfaction as a model (Aragon & Gesell, 2003; Linder-Pelz, 1982b). By reviewing post adoptive use of technology and how it leads to satisfaction, I provide a unique contribution to the extant literature. Finally, this study also built on affordance-actualization literature (Strong et al. 2014) and explored the psychological effects that occur after using a technology, which lead to discrete outcomes such as satisfaction, previously unexplored in academic research. Therefore, the two research questions this study sought to address are as follows:

- What impact does implementation of an electronic patient portal have on patient satisfaction?
- What effect does usage of electronic patient portals have on user attitudes towards using the system?

This research begins with a review of the conceptual understanding of patient satisfaction and electronic health portals, followed by a discussion of the theoretical model and hypotheses.

Next, the study design will be presented, followed by a discussion of the survey results, and finally the resultant implications to future research and practice.

Literature Review

Patient Satisfaction

Research on patient satisfaction has been explored extensively in health care research but has largely been limited to a collection of antecedents and consequences. Patient satisfaction has been reinforced as an important variable to understand due to the potential to lose up to 2% of government payments as a result of poor patient satisfaction scores through the value based purchasing program (A. M. Epstein, 2012). Patient satisfaction has historically been considered a multi-dimensional construct that captures various aspects such as patients' satisfaction with their providers, nurse communication, cleanliness, waiting time, or their overall satisfaction with all facets of a visit (Aragon & Gesell, 2003; Larsen et al., 1979; Pascoe, 1983). This research adapted the construct of patient satisfaction proposed in Essay 1 of this dissertation as an opportunity to extend the model but also followed suit with contemporary researchers and specifically gathered data from all aspects of contemporary HCAHPS scoring questions (Elliott et al., 2015; Tsai et al., 2015). These understood relationships were leveraged to compile an overall patient satisfaction composite score for this research that is directly related to satisfaction with aspects of care that may be affected by electronic patient portals.

The numerous variables of patient satisfaction have important relationships found throughout the health care literature. For example, it has been found that higher nurse to patient ratios result in increased perception of patient satisfaction and clinical outcomes (Aiken et al., 2012). Similarly, decreased waiting times and increases in communication were found to be correlated with an increase in overall patient satisfaction (Komashie, Mousavi, Clarkson, &

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Young, 2015). Satisfaction with provider has also been shown to increase when wait times are low (Michael et al., 2013) and communication is high (Adams et al., 2015) and also results in increased compliance with physician care instructions and thus improved clinical outcomes (Coleman et al., 2013; Phwellips, Leventhal, & Leventhal, 2012). Given the established relationship of each of these items to both patient care and overall patient satisfaction, the proposed patient satisfaction scale in Essay 1 was used as a framework to test established relationships to further validate the scale. More importantly, I posited that electronic patient portal usage may directly influence these established relationships and increase understanding of patient satisfaction (including provider and nurse interaction, time to access information, and wait times).

Health Information Technology and Patient Satisfaction

A review of prior research focused on HIT and the impact upon patient satisfaction revealed inconsistent relationships. Studies have primarily focused on three main areas as compared to patient satisfaction: advanced technology and application infrastructure, outcomes and management issues, and information systems and knowledge resources (Rozenblum et al., 2013). Given the broad reach of HIT, the present research was narrowed to focus upon information system and knowledge resources, which include electronic health records and patient-provider interaction models such as the electronic patient portal and clinical communication tools. This area has been richly studied from multiple angles, providing a robust platform from which to build towards an understanding of the electronic portal's impact upon satisfaction. Some specific examples of study in this area offer several consistent measures important to consider in the present research, including patient empowerment (Tuil, Verhaak, Braat, de Vries Robbé, & Kremer, 2007), anxiety (Tuil et al., 2007), perceived value of usage

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(Turvey et al., 2014), communication satisfaction (Kuijpers et al., 2015), ease of use (Hassol et al., 2004), technology acceptance (Keplinger et al., 2013; Klein, 2007; North et al., 2011), patient outcomes (Goldzlig et al., 2013), and accuracy of information (Cathala et al., 2003; Hassol et al., 2004).

There remains a lack of consistency with regards to supporting consistent relationships between electronic patient portals and patient satisfaction. For example, while some studies have found improved patient satisfaction when electronic patient access to medical information was utilized (Cathala et al., 2003; C.-T. Lin et al., 2005), others have found mixed results (Goldzlig et al., 2013; Hassol et al., 2004), and still others have found patient satisfaction data unchanged (S. E. Ross, Moore, Earnest, Wittevrongel, & Lin, 2004). This inconsistency suggests that understanding the implementation alone is not sufficient. Rather, understanding the context in which the positive patient satisfaction effect occurred would make the greatest contribution to the literature.

In an attempt to understand this contextual effect better, health care researchers have looked at implementation frameworks and guides (Wakefield et al., 2010) as well as factors that affect levels of usage of the patient portals (Turvey et al., 2014). While specific features within electronic portals, such as electronic scheduling or provider communication, have been studied (Turvey et al., 2014), research has yet to consistently extend understanding of these features to the resultant impact upon patient satisfaction (instead halting measurement at usage). Some of the common items to consider for portal implementation planning have been suggested to include the strategic fit of the portal, especially with regards to its integration and design, privacy issues, marketing and enrollment, and on-going performance management (Wakefield et al., 2010). Regarding usage, research has shown patients were found to be slightly more satisfied

with care when they had a high volume of portal usage; however, this finding was listed as a minimal impact, and the study did not track different features used (C.-T. Lin et al., 2005). To date, it seems a comprehensive definition of high versus low usage to include volume as well as depth of usage has not been explored in relation to overall patient satisfaction.

Technology Acceptance, Adoption, and Usage

Considerable prior research has focused upon the circumstances that affect adoption of new technologies (Davis et al., 1989). Given the inquiry at hand is related to understanding the effect of electronic patient portals, it seemed appropriate to turn to technology acceptance and adoption research for guidance. Research in this area is rooted in technology acceptance (Davis, 1989; Venkatesh & Davis, 2000), the theory of planned behavior (Ajzen, 1991), the theory of reasoned action (Fishbein & Ajzen, 1975), and innovation diffusion theory (Moore & Benbasat, 1991; E. M. Rogers, 2010). The unified theory of acceptance and use of technology (UTAUT) takes this research one step further, compiling many of the components of each of these theoretical roots into a unified model of technology acceptance (Venkatesh et al., 2003). Through this unified approach, the strength of multiple theories helps explain phenomenon associated with technology use and acceptance.

Technology acceptance research offers an interesting lens to study the implementation of electronic health portals. Research into health portals has found perceived value of usage to be an important measure (Hassol et al., 2004; C.-T. Lin et al., 2005; Turvey et al., 2014), as well as ease of use (Hassol et al., 2004; C.-T. Lin et al., 2005). In the technology acceptance model (TAM), these perceptions are encompassed by the perceived usefulness and perceived ease of use constructs (Davis et al., 1989). Essentially, TAM finds that users' attitudes towards using a technology are directly affected by the perception of the technology's ease of use and usefulness;

in turn, this affects the behavioral intention to use and finally leads to actual system use (Davis et al., 1989). Electronic patient portals offer the ability to access data, scheduling, and reports at any time (perceived usefulness), as well as allowing certain functionalities without any of the previous barriers (perceived usefulness), such as scheduling an appointment without waiting on a call back.

While TAM appears to provide an excellent framework to examine the phenomena, a significant gap in this research is on the impacts of the system after use. For instance, system usage may have an impact upon other important outcome measures. System usage may also have a direct effect upon both the attitude towards using the technology as well as the behavioral intention to use the technology. These aspects are explored and discussed in more detail in the subsequent sections.

Post Technology Adoption Behaviors

Historical studies that have focused upon decision-making and technology have suggested that the structure provided by technology can help understand human decision-making (Rice, 1984). Similarly techno-centric research has posited that once a technology is adopted, there is the distinct possibility that there may be an effect of technology usage (Papert, 1987). Thus, the techno-centric view offers an approach to study phenomena related to technology in which the effects of using the technology are studied (Orlikowski, 2007). The study of cause and effect related to technology has been well studied in the research; the fundamental gap yet to be adequately explored is whether technology use itself or the behaviors that led to that use impact outcomes. Here, adaptive structuration theory offers valuable insight, suggesting that a certain duality may exist (Giddens, 1984); certain attitudes may influence technology use and using the technology may impact attitudes. Social cognitive theory also supports this notion of attitudinal

changes in terms of cognition, emotion, and behavior as a result of use of a particular intervention (CITE), in this case the patient portal. Given that technology usage and adoption has been well defined in the literature (Davis, 1989; Davis et al., 1989; Venkatesh et al., 2003; Venkatesh, Sykes, & Zhang, 2011; Venkatesh et al., 2012), it seems prudent to extend future research to explore post usage outcomes.

By espousing the adaptive structuration theory approach, the present research expected to find that technology usage has a positive and significant impact upon satisfaction (DeSanctis & Poole, 1994). The suggestion that usage can impact attitudes is both obvious and necessary to conceptualize and may extend existing research to better understand antecedents to patient satisfaction. The affordance-actualization concept likewise suggests that actors and their goals present potential for goal-oriented behaviors to achieve immediate outcomes (Strong et al., 2014). This provides theoretical support via grounded theory to the notion that post technology usage feedback occurs to actors, creating the potential to impact the usage in a way intended to increase satisfaction with the health care experience.

Social Cognitive Theory

Social cognitive theory can be understood as the notion that an individual's knowledge and the gaining of that knowledge is related to media influence, experience, and social exchanges (Bandura, 2011). Specifically, knowledge gain is not suggested to be reserved to individual experiences; rather, one can gain knowledge through the context of another's experience (Bandura, 1986). Just as observed in social cognitive theory research that exposure to certain behaviors and functionalities can be absorbed into one's own knowledge base, this research builds upon this notion suggesting that after users are exposed to the electronic patient portal functionalities, there will be cognitive changes in the users' future actions and attitudes.

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Additionally, it is important to note the reciprocal notion of social cognitive theory. While behaviors impact things such as technology usage, social cognitive theory posits that continued use also shapes behaviors (Bandura, 1986, 2011). This reciprocal relationship is central to the core notion of this research: that technology usage affects attitudes of patient satisfaction.

Summary

In summary, the health care and information technology literature seem to agree that patient satisfaction and HIT have many important intertwined relationships to explore. While patient portals have been explored as to their impact upon different aspects of the care continuum, there remains an inconsistent understanding as to the relationship with portal usage and patient satisfaction (Rozenblum et al., 2013). Discrete aspects of electronic portals have been explored, such as volume of portal usage (C.-T. Lin et al., 2005) or volume of messages received via the portal interface (Keplinger et al., 2013), without regard to the impact upon patient satisfaction. The TAM model offers insight into important antecedents to explore, namely behavioral intentions and attitudes towards technology (Davis et al., 1989), providing a solid model to extend understanding of patient satisfaction. The model extension is however required after technology usage; first inquiring into how attitudes change after usage, recording how that might inform future usage and ultimately impact patient satisfaction. Here, social cognitive theory offers insight as to how this might occur (Bandura, 1986, 2011). With an understanding that the relationship between HIT and patient satisfaction is inconsistently supported (Rozenblum et al., 2013), it is necessary to explore post usage attitudes as well as the psychological effects of that usage upon outcome variables such as patient satisfaction to fully appreciate the contexts in which the relationship is significant.

Theoretical Background and Hypothesis Development

A theoretical model of patient portal usage and patient satisfaction, informed by adaptive structuration theory, social cognitive theory, and prior patient satisfaction research, is presented in Figure 6. Both TAM and UTAUT offer a helpful lens through which to understand patient portal usage. According to TAM, users' attitudes towards using a technology is influenced by ease of use and usefulness and both directly affect users' attitudes towards using the technology; perceived usefulness also directly affects behavioral intention to use (Davis et al., 1989).

Adaptive structuration theory offers a conceptualization that once the system is used, attitudes may remain and may or may not have been altered (DeSanctis & Poole, 1994). Social cognitive theory posits that understanding and knowledge are gathered via a variety of sources including one's own experience, interactions with others, or exposure to cognitive experience through other media (Bandura, 2011). Affordance-actualization research suggests a feedback from actions, such as usage impacts users, thus providing an opportunity to impact future attitudes (Strong et al., 2014). The attitudes that remain are precisely the attitudes which will impact overall patient satisfaction assessments (decreased anxiety, gratification, and cognitive efficiency) and as such the theoretical framework shown in Figure 3.1 is conceptualized.

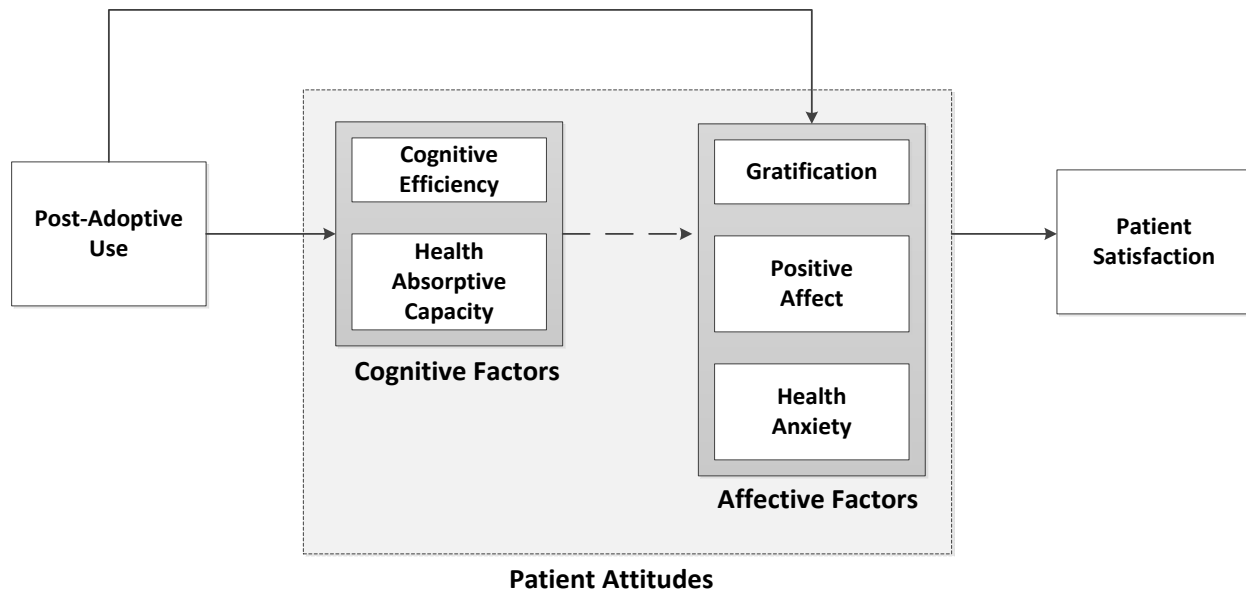


Figure 3.1. Research model of the impacts of post adoptive use of electronic portals on patient attitudes and satisfaction.

Attitudes and Satisfaction

Research on internet use and gratification has suggested that users desire computer mediated rather than interpersonal or telephonic interactions, suggesting patient portals which allow computer mediated interaction with health care providers is a common behavior that patients may seek (Cho, De Zuniga, Rojas, & Shah, 2003). Based on adaptive structuration theory, I posited that consumers seeking computer mediated interaction would result in changes in attitudes, and I specifically explored those attitudes related to satisfaction, including gratification, anxiety, and cognitive efficiency. Specifically, it has been suggested that through usage of electronic portals, already understood through TAM, a cyclical relationship be considered, due to the fact that usage may influence attitudes and behaviors (Strong et al., 2014) and as such affect usage and ultimately lead to increased patient satisfaction. To achieve the objectives of the current research, hypotheses were drawn from the model between portal usage and patient satisfaction (Figure 3.1).

Electronic Portal Usage: Post Adoptive Usage

Behavioral intention to use a technology is known to be impacted not only by the attitude of a user towards using a technology but also the perceived usefulness of the technology (Davis et al., 1989). Electronic portal functionalities which might impact these antecedent conditions have been studied in numerous ways to fully understand portal usage, including the ability to: view medical history, integrate with electronic health record, communicate directly with physicians and nurses, schedule and view appointments, receive results, and refill prescriptions (Hassol et al., 2004). These capabilities are not considered exhaustive. However, they demonstrate that a variety of functionalities are understood to influence perceptions of usefulness as well as the resultant attitudes towards using an electronic patient portal. Here, prior research

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regarding outcome and performance expectations has offered the logic that electronic patient portals would be perceived as having high levels of usefulness in that using these technologies has been shown to increase effectiveness of communication with physicians, allow patients to spend less time doing tasks, and increase the chances of getting in direct contact with providers (D. Compeau et al., 1999; Venkatesh et al., 2003).

Notably, patients may be unfamiliar with the various functionalities of an electronic patient portal prior and as such, perceptions of usefulness, attitudes towards the portal, and behavioral intentions to use the portal would conceivably change after using the technology. Only through understanding the capabilities within the portal can a patient fully appreciate how the technology might impact scheduling, communication, data gathering, and other medical needs. As such, it was posited that actual system usage will have a direct effect upon attitudes toward using as well as behavioral intention to use more features of the electronic portals. Adaptive structuration theory offers insight into the duality of usage and the attitudes that impact usage (DeSanctis & Poole, 1994). Quite simply put, attitudes exist before usage, after usage, and even while using the technology. Acknowledging the non-linear nature guides the present research to consider that while attitudes no doubt impact usage (Davis et al., 1989), it is necessary to examine attitudes after system usage to appreciate which outcomes might be impacted.

Existing health care research has found that electronic portal usage has improved overall satisfaction (C.-T. Lin et al., 2005), satisfaction with response times (Liederman & Morefield, 2003), physician-patient communication (Kuijpers et al., 2015; Liederman & Morefield, 2003), and care coordination (Bodenheimer, 2008). Research into attitudes provided us with the understanding that there are different mechanisms of attitudes, including affective, behavioral,

and cognitive attitudes (Fabrigar, MacDonald, & Igener, 2005; R. Martin, Watson, & Wan, 2000). Affective components of attitudes are those that can be described as a feeling such as love or hate (H.-d. Yang & Yoo, 2004). Behavioral components of attitudes are those that make one desire to take an action towards something, and cognitive factors of an attitude are one's beliefs or thoughts upon something (Ostrom, 1969). All three components may play out together or separately, such as an individual stating a love a smartphone (affective) because it is brand x which is the best (cognitive) and then kissing the screen to demonstrate the individual's attitude towards it (behavioral).

Because all users must have used an electronic portal to measure post electronic portal use, behavioral components of attitudes are not explored in the present study, similar to previous IS research (H.-d. Yang & Yoo, 2004); however, items were added to the survey to gather qualitative information related to behavior changes after system use. Therefore, it is posited that electronic portal usage will impact affective and cognitive factors towards attitudes based upon prior research of three distinct attitudes related to system usage.

First, system usage has long been understood to decrease anxiety (Hackbarth, Grover, & Mun, 2003; Salanova & Schaufeli, 2000) and increase feelings of ease of use as a result. Coupled with the social cognitive theory (Bandura, 2011) and adaptive structuration logic that these feelings will simultaneously influence usage (DeSanctis & Poole, 1994), it is suggested that electronic patient portal usage will decrease anxiety as patients will feel more comfortable using the technology, consequently accessing components of their care such as reports, scheduling, and messaging. This definition can more easily be understood as health absorptive capacity, adapted to the health care context from absorptive capacity literature (Flatten, Engelen, Zahra, & Brettel, 2011). Thus, decreased anxiety and increased ease of use is suggested to

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directly impact affective components of satisfaction, in that users will have positive feelings towards the technology that helped them achieve their health-related tasks. Likewise, when the technology is able to help them achieve their health-related tasks, a simultaneous positive affect upon cognitive factors of satisfaction is expected as users will come to believe that electronic portal usage is an optimal pathway to achieving health related tasks.

Second, prior research has demonstrated that consumers seek computer mediated interaction and that it yields gratification (Cho et al., 2003). Primarily, this gratification effect is due to the near instant ability of the technology to provide the very information, contact with provider, or scheduling needs that a patient is seeking (Acquisti, 2004). Because of the increased gratification expected from electronic portal usage, it was posited that a direct impact upon affective factors of satisfaction would be found as the user feels satisfaction related to achieving health-related tasks. From a cognitive perspective, users will also learn that electronic portal usage may in fact provide an improved experience over legacy methods to accomplishing health related tasks and find increased impact upon cognitive factors of satisfaction.

Finally, the principal of cognitive efficiency suggests that individuals seek to expend the least amount of effort to achieve a desired outcome (Carlston, 2013); technology usage teaches patients that electronic portal activities take substantially less effort than legacy methods. Similarly, the principal of knowledge accessibility suggests that users only have a limited amount of knowledge to draw upon in decision making (Carlston, 2013). As such, using the knowledge freshly provided from the electronic patient portal provides a ready example of how this technology will be efficient, especially after the users have experience with the system (Hackbarth et al., 2003). Their affective factors will be positively impacted as they get the feeling of how easy it is to accomplish these tasks while their cognitive factors will continue to

be positively impacted as they become more aware of how much less effort electronic portal usage requires.

In summary, post adoptive electronic portal usage will impact both cognitive and affective patient attitudes. Research in the IS realm reveals a rich history of inquiry into all three components of attitudes related to technologies (R. Martin et al., 2000; H.-d. Yang & Yoo, 2004); the present research sought to build upon this knowledge. As this research was focused on patients' attitudes towards their own satisfaction with a health care experience after usage behaviors, I focused specifically upon these cognitive and affective attitude consequences of post adoptive usage. The cognitive factors supported by research for further exploration included cognitive efficiency and health absorptive capacity, while the affective factors included gratification, positive affect, and health anxiety. Therefore, I posited that post adoptive technology usage would positively impact both cognitive and affective factors of users' satisfaction attitudes.

Cognitive Factors

In this research, I focused on cognitive factors defined as those factors which influence one's belief about something, and the beliefs adjust based on the inputs provided (Fabrigar et al., 2005). A most basic example of a cognitive factor is developing the belief that boiling pots will be hot and should not be touched, after the experience (factor) of having touched a boiling pot. Here, the experience (factor) provides cognitive inputs to the person about the nature of the boiling pot, which leads to the adjusted belief about boiling pots not being touched. In the following section I specifically examine both how systems usage provides cognitive input into cognitive efficiency, as well as health absorptive capacity.

Cognitive efficiency. Cognitive efficiency is basically defined as the belief that a certain action allows an individual to accomplish a task while expending the least amount of effort (Carlston, 2013). This body of knowledge is largely paralleled by the concept of ease of use (Davis et al., 1989). The fundamental difference is that ease of use involves how easy a person thinks a system is to use, while cognitive efficiency is the belief that using a system expends the least amount of effort.

It is posited that post adoptive use would have a positive impact upon cognitive efficiency. After using a system, users will inevitably accumulate knowledge of the electronic portal process such as scheduling appointments, viewing medical reports, and so forth (Cobb, 1997). More importantly, users will realize that the effort required to accomplish such tasks are reduced, as compared to previous efforts to perform such tasks (Salkind & Wright, 1977). By accumulating this knowledge, users will come to their own belief that electronic portal usage requires the least effort to accomplish their tasks (Charness, 2000). This suggests that post adoptive use will have a positive impact on the cognitive efficiency of patients.

This study posits that cognitive efficiency would have a positive impact on patient satisfaction. Prior research has stated that user participation in the information technology system can empower the user, leading to higher levels of satisfaction with the information technology system (Barki & Hartwick, 1994; DeLone & McLean, 1992; Petter, DeLone, & McLean, 2013). This suggests that as patients accumulate knowledge about portal use, they may feel increasingly empowered by the use of technology to interact with the providers (Earnest, Ross, Wittevrongel, Moore, & Lin, 2004; van der Vaart et al., 2014). Such patients are likely to understand and appreciate the information provided by their providers better, as they can correlate with the information provided by the system. Consequently, such patients will also

likely feel higher levels of patient satisfaction as an increased cognitive ability to use the system to accomplish tasks suggests that patients can begin to appreciate the providers and the hospital even more. Taken together, this means that cognitive efficiency will act as a mediator of the relationship between post adoptive use and patient satisfaction. Hence, I posited that:

H₁: Cognitive efficiency mediates the positive impact of post adoptive use on patient satisfaction.

H_{1a}: Post adoptive use will have a positive impact on cognitive efficiency.

H_{1b}: Cognitive efficiency will have a positive impact on patient satisfaction.

Health absorptive capacity. In this study, health absorptive capacity is defined as the extent of knowledge and skillsets of patients in relation to their own health. Prior research at the organizational level defines absorptive capacity as the ability to take in information, assimilate that information, and apply it in a defined setting (W. M. Cohen & Levinthal, 1990). A number of studies in management and IS literature have pointed to the utility of the absorptive capacity concept in organizations and individuals. For instance, research has shown that competitive advantage can be gained when information technology solutions bridge the gap between potential and realized capacities (Zahra & George, 2002). Specifically, information technologies are seen as providing a competitive edge towards firm performance, however, absorptive capacity is seen as a mediating factor (Liu, Ke, Li, & Hua, 2013). The consistent relationship is that technology usage and its effects upon outcomes are mediated by absorptive capacity.

Information systems research at the individual level has shown that system usage has a positive impact on efficiency of users through the development of technical knowledge (Hackbarth et al., 2003). This suggests that improvements in health absorptive capacity of

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patients can result from the increased use of electronic health portals. I posited that post adoptive use would have a positive impact upon health absorptive capacity for two reasons. First, as patients continue to use electronic patient portals, they are provisioned with a variety of resources that enable them to obtain accurate information about their health status (AmmenIrth, Schnell-Inderst, & Hoerbst, 2012). Examples include review of electronic reports and medical history. For instance, health reports provide detailed information about the blood work results with respect to established benchmarks. Such provisioning of informational resources has the potential to increase the knowledge-base (i.e., health absorptive capacity) of patients as they obtain a better understanding of their health in comparison to established benchmarks. Second, patient portals also provide detailed explanations of test results and associated health conditions. For example, a patient who has higher than normal levels of glucose is likely provided with a risk indicator for diabetes with a link that redirects to detailed explanation of the condition. This means that patients can obtain the required explanation and knowledge about their health condition as and when they require, which substantially increases their knowledge-base (i.e., health absorptive capacity). This means that the higher levels of use of the electronic portal will likely result in higher levels of health absorptive capacity of the patient.

I also posited that health absorptive capacity would have a positive impact on patient satisfaction. As patients accumulate knowledge about their own health status, they are more likely to make informed decisions about their own health (van der Vaart et al., 2014). In other words, increased health absorptive capacity can mean that patients are highly likely to take specific measures to be in control of their own health. Such informed patients can proactively request specific and appropriate health information or services from their providers (Tuil et al., 2007). On the flip side, providers who interact with such engaged patients may react positively

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to such patients as their attentiveness will help reduce medical errors (AmmenIrth et al., 2012), and the patients' increased understanding of the care process helps them to be more involved in the decision-making processes (Goldberg, Ralston, Hirsch, Hoath, & Ahmed, 2003). This can result in the patients feeling higher levels of satisfaction with their providers. Taken together, this means that health absorptive capacity will act as a mediator of the relationship between post adoptive use and patient satisfaction. Hence, I posited that:

H₂: Health absorptive capacity mediates the positive impact of post adoptive use on patient satisfaction.

H_{2a}: Post adoptive use will have a positive impact on health absorptive capacity.

H_{2b}: Health absorptive capacity will have a positive impact on patient satisfaction.

Affective Factors

Affective factors can be defined as those which contribute to one's feelings about something (Fabrigar et al., 2005). Social cognitive theory suggests these feelings can adjust based on the inputs provided to them (Bandura, 2011); a basic example is getting over a fear of public speaking after doing it several times. Below I specifically examine how post adoptive usage provides input into gratification, positive effect, as well as health anxiety.

Gratification. Gratification has been defined in numerous ways, in particular in relation to uses and gratification theory (Ruggiero, 2000). In relation to internet usage, gratification has been defined specifically down to the niche or specialty of the user (Iaver, 1993). In this study, I defined gratification as a feeling of pleasure directly related to achieving a desired task through technology usage. This feeling is in regards to having performed such electronic patient portal actions as scheduling an appointment, reviewing test results, or looking up medical information. Put simply, the more patients use the system, the more they will know about their health and have satisfaction in meeting that information seeking behavior. This aligns with previous uses and gratification theory research finding that individuals may use a technology to seek information and obtain gratification upon receiving that information (Grellhesl & Punyanunt-Carter, 2012).

I therefore posited that gratification would have a mediating relationship between post adoptive use and patient satisfaction for three reasons. First, research has shown us that consumers seek computer mediated interactions and that such usage can provide gratification (Cho et al., 2003). This gratification feeling can be classified as an affective component of an attitude (Fabrigar et al., 2005), and our outcome variable was specifically measuring the satisfaction attitude of the entire care experience. Second, electronic portal usage provides a near instant ability to achieve health related tasks, rather than limiting individuals to accomplishing such tasks during business hours (Acquisti, 2004). Knowing that media usage is often determined with a goal such as information seeking or knowledge gathering (Grellhesl & Punyanunt-Carter, 2012), when that information is provided the patient is more likely to feel gratified. Such gratification feelings are achieved through accomplishing medical tasks and are affective components of attitudes, hence I posited these gratification feelings would lead to

higher assessments of the overall health care experience. Finally, knowing that patients can only draw upon a finite amount of information (Carlston, 2013), coupled with the uses and gratification theory (Grellhesl & Punyanunt-Carter, 2012) notion that users may embrace technology to help them gather information, it is posited that immediate access to test results will directly impact affective components of satisfaction attitudes, allowing users to feel like the electronic portals help patients to achieve their health care needs. In turn, this increased affective component of their satisfaction attitudes is posited to increase their overall satisfaction as they reflect upon their care experience. As such, gratification was hypothesized to mediate the positive effect of post adoptive electronic portal usage upon patient satisfaction.

H₃: Gratification mediates the positive impact of post adoptive use on patient satisfaction.

H_{3a}: Post adoptive use will have a positive impact on gratification.

H_{3b}: Gratification will have a positive impact on patient satisfaction.

Positive affect. In this study, positive affect is defined as having positive emotions about a person's health. Prior literature has posited that positive affect reflects a more positive mood disposition to a particular activity or context and is frequently modeled as a twin of negative affect (Watson, Clark, & Tellegen, 1988; Diener et al., 1985; Franklin et al., 2013). Prior work in psychology literature has shown the importance of positive affect as it improves creative problem solving (Isen et al. 1987) and satisfaction (Estrada et al. 1994) and increases likelihood of success (Lyobomirsky et al. 2005). Research in information systems literature has also pointed to the centrality of positive affect in terms of predicting systems use. For instance, knowledge gained via UTAUT (Venkatesh et al., 2003) pointed to affect and associated constructs such as computer playfulness as antecedents of behavioral intention to use a system.

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It is posited that positive affect would mediate the relationship between post adoptive use and patient satisfaction for three reasons. First, prior literature has informed us that positive affect can have an impact on outcome variables including practice satisfaction in physicians (Estrada, Isen, & Young, 1994; Lyubomirsky, King, & Diener, 2005; Watson et al., 1988). By users getting information they need to help them feel good about their health status, they experience this positive affect and this affective attitude component directly contributes to their satisfaction attitudes. Second, in our specific example it is found that electronic portal usage provides gratification as well as instant access to health related tasks (Acquisti, 2004). As long as the portal continues to enable this behavior, it has the potential to allow users to feel more positively about their health whether before or after care is provided. As patients have more positive feelings about their health status, they are more likely to rate the status of their health experience higher, leading to higher patient satisfaction scores. That is, positive affect impacts patient satisfaction evaluations since the positive affect is achieved as a result of the portal meeting the needs of the patient which necessitated the health care in the first place. Consequently, as the patient perceives that needs are met by the providers through the portal, these feelings of positive affect will translate to better patient satisfaction scores. Hence, positive affect was hypothesized to mediate the relationship between system usage and patient satisfaction.

H₄: Positive affect mediates the positive impact of post adoptive use on patient satisfaction.

H_{4a}: Post adoptive use will have a positive impact on positive affect.

H_{4b}: Positive affect will have a positive impact on patient satisfaction.

Health anxiety. In this study, health anxiety is defined as concern with a medical or perceived medical condition (Salkovskis & Warwick, 2001). While a certain level of health anxiety in general might be expected (Ferguson, 2009), it would also be expected that the average person experiences increased levels of health anxiety when presented with a cause for concern. For example, one might feel a lump on their person and seek medical treatment due to increased anxiety. Reducing such health anxieties has been extensively researched in prior works. For instance, innocuous media such as music have been consistently shown to reduce anxiety (Bradt, Dileo, & Potvin, 2013).

However, with regards to technology, anxiety is understood as a personal trait that can affect acceptance and usage of the technology (Calisir, Altin Gumussoy, Bayraktaroglu, & Karaali, 2014). Certain factors may reduce this anxiety, such as other user reviews (i.e., this technology did achieve what it says it does; K. Yang & Forney, 2013), limiting the number of choices (Chaurasia et al., 2016), or alleviating concerns to perceived risks in access or security (S. K. Howard, 2013). Thus, when applied to electronic health portals, allowing users to hear from others who have used the technologies successfully, creating clear and deliberate systems with few choices to accomplish tasks, and capturing and alleviating concerns related to system usage are all of paramount importance to anxiety reduction. Thus, considering these factors and how technology might facilitate functions which decrease health anxiety has become increasingly studied, from online patient communities (Intzer & Bygholm, 2013) to concerns about electronic communication (Walker, Meltsner, & Delbanco, 2015), or even how to share data from these online portals (Haug, 2016; Rockhold, Nisen, & Freeman, 2016).

Related to electronic portal usage, it was expected that usage helps to decrease anxiety through facilitating resolution of uncertainty. First, I already understood that system usage

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increases users' comfort level and ability with regards to system usage (Hackbarth et al., 2003). Because the users are more familiar and able to use a system as designed, they can then use the system to gain knowledge of their health condition, and knowledge concerning that which is causing anxiety is known to help decrease anxiety (Tomaino-Brunner, Freda, Damus, & Runowicz, 1998). For example, if a patient is feeling anxiety about having a certain condition and can access instantly test results that clearly state the condition is not affecting the patient, I posited the patient will experience decreased anxiety. Second, by feeling more certain about their health conditions, users can focus upon what actually occurred in the care experience rather than feeling pre-occupied with feelings about what might occur, or worse, feelings that their condition was not treated. The technology usage allows users to definitively receive results while simultaneously increasing exposure to the system. Finally, decreased anxiety impacts satisfaction through allowing users to accomplish what they intend to accomplish. Research has shown that anxious people have a decreased ability to accomplish intended tasks. Conversely, simulation or prior experience helps to decrease anxiety and enable performance of those tasks (Allan et al., 2010), leading to overall satisfaction with the care encounter. Thus, the more users use the patient portal to accomplish health related tasks, the less health anxiety they will experience due to greater access to health information, which leads to increased patient satisfaction.

H₅: Health anxiety mediates the impact of post adoptive use on patient satisfaction.

H_{5a}: Post adoptive use will have a negative impact on health anxiety.

H_{5b}: Health anxiety will have a negative impact on patient satisfaction.

Methods

Sampling Design and Procedures

This survey was designed a nationwide electronic survey to be disseminated within the United States. With the goal of conducting a population survey, an electronic survey tool was deemed appropriate (Berinsky et al., 2012). Similarly, noting the widespread importance of patient satisfaction, a population sample was deemed more appropriate than targeting a specific respondent demographic or group. Espousing a population sample set a target for 500 samples as a minimum based on prior research (Barratt et al., 2015), which worked nicely with the goal to use structural equation modeling to complete the path analysis of these relationships, which would also suggest 500 respondents for optimal results (Myers et al., 2011). 504 responses were obtained for this study.

This study utilized Qualtrics as the survey vendor, with an initially negotiated rate of \$5 per completed survey to assist with non-response bias. This study received more than 500 responses within 24 hours of opening the survey window (one week), thus eliminating any need for reminder emails. Qualification requirements were minimal, only requiring respondents to successfully answer that they were 18 or older and consented to taking the survey. This study in particular was seeking respondents who had used an electronic patient portal in the last 12 months. Exclusion criteria were minimal, including failing to consent to take the survey, failing to confirm they were over 18, or failing to complete the survey. Survey instructions made clear that participation in this research was completely anonymous and voluntary.

Research Design and Methods of Data Collection

With a focus on attitudes after adoption of electronic health portals, a positivist survey was designed for this study given the goal of further understanding respondents attitudes

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(Schuman & Presser, 1996). Additionally, survey tools have been noted as appropriate for theory testing research such as the present study (Yin, 2013). Here, significant research supported the structural model and the survey item would assist in providing data to test such a model. To test this model, partial least squares structural equation modeling was used.

This research data was collected in a single stage, cross-sectional, closed cohort web survey via the Qualtrics application in a single 24 period. There were four main sections to the survey tool. First, the screening section with the certification of age and consent questions, followed by sections two and three which focused on the electronic health portal and the respondents own characteristics, respectively. The fourth section focused upon patient satisfaction measurement items based off existing HCAHPS items, followed by demographic items. All responses were evaluated for reliability checks, explained in detail in the analysis section. There were no forced responses in this survey. Any missing or not applicable responses were imputed with a mean score imputation (Allison, 2002). At the completion of the data collection, there were 857 missing data points, predominantly as a result of missing demographic information.

Item development and expert review. Item development for this research began using established measures first. In those instances where established measures could not be used, or were modified to the extent that expert review suggested they be treated as new items, new items were established in a rigorous process. Prior research laid clear blueprints for item development for this survey (DeVellis, 2016; Netemeyer et al., 2003). For each new item, initial development was informed by literature review, and with close collaboration of an experienced information technology professor with experience in health care research. A panel of subject matter experts related to the topic at hand was then created, including physicians, nurses, health care

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administrators, and health care researchers. Following the insight and adjustments gained from the expert review, a pilot study was completed consisting 20 health care staff, nine of whom completed a survey. These results were used to modify and finalize the survey instruments; then an additional pilot survey was sent to 65 current and former doctoral students. 43 responses were received in a seven day collection window. A final round of analysis occurred, followed by minor tweaks of wording, order, and survey structure, and finally the survey tool was circulated for a final expert review. The result of this process was the final survey as shown in the appendix.

Measures

Dependent variable: Overall patient satisfaction. In Essay 1 of this dissertation, an overall patient satisfaction dependent variable is developed (as well as a three dependent variable outcome model). The use of these outcome variables provides further validation of the measurement of patient satisfaction in this way. In particular, the use of formative measures for satisfaction has proven necessary (Diamantopoulos & Winklhofer, 2001), especially with regards to establishing more than a single item outcome indicator. Many of the items that factor into the dependent variable construct in this survey were directly derived from established HCAHPS items, consisting of 10 point Likert scale ranging from *strongly agree* (10) to *strongly disagree* (1). An example item used in the survey includes, “Degree to which the doctor took your problem seriously.”

Independent variable: Post electronic portal usage. Electronic portal usage has been recorded countless ways in prior research; however, for the present research purposes the following definition was suggested. Respondents who confirmed that they were registered, activated, and had logged in to the patient portal at least once in the past 18 months counted as

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having portal usage. Additionally, patients documented the extent to which they use their patient portal as well as one of six specific capabilities. Six items were used to create this measure. A sample item is, “I use the electronic patient portal _____ time per month,” followed by five options: Less than once a month, 0-1 times, 2-3 times, 4-5 times, 6 or more. This survey was a new creation and also modified some of the items from UTAUT to apply to the portal setting and as such required expert review consisting of one mychart technician, two physicians, and a nurse. All survey items can be found in Appendix A.

Mediating variables

Cognitive efficiency. The principal of cognitive efficiency is centered on the notion that individuals seek to minimize effort when attempting to complete a task (Carlston, 2013). Coupled with the notion that increased technology usage decreases anxiety with usage (Hackbarth et al., 2003) and improves notions of ease of use (Bush, Connelly, Fuller, & Pérez, 2016), it was posited here that portal usage would continue to improve notions of cognitive efficiency. Understanding that established ease of use scales define ease of use in terms of use being free of effort (Davis et al., 1989), I sought to similarly measure these notions. Slightly modifying such established scales to the electronic patient portal setting yielded four survey items for this measure; an example item is, “The following question is about completing health care related tasks, e.g., scheduling, viewing lab results, or asking a question to my provider: I can accomplish my health care related tasks quickly,” which was rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of survey items can be found in Appendix A.

Health absorptive capacity. Health absorptive capacity refers to the ability of an individual to learn how to use a system such as an electronic portal. Research has supported the

notion that users become more comfortable with systems after using them (Hackbarth et al., 2003), and as such it was necessary to measure users' beliefs on system usage after they have used the system in terms of what they think the system can do for them. While scales of absorptive capacity exist, they typically measure research and development dollars divided by sales (W. Tsai, 2001), which was not applicable in this setting. Instead I were measuring the health absorptive capacity of the individual and the beliefs related to the electronic health portal. As such, this scale was a unique development for this research. Four items were developed for this measure. A sample item is, "I have a good understanding of my health status," which was rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of survey items can be found in Appendix A.

Gratification. Due to the previous research related to expectancy, internet usage, and satisfaction, it seemed prudent to consider a psychological variable which could help explain changes in attitudes and behavioral intentions to using after using the electronic portal. With the specific study of patient satisfaction and online health information seeking, prior research has noted some of the strategies that motivate communication and strategies used for gratification, which greatly informed this research (Tustin, 2010). The notion that electronic patient portals provide near instant access suggests strong correlations with previous gratification research (Acquisti, 2004), which has submitted that the instant gratification of the need to find an answer, schedule an appointment, or contact a provider will yield higher patient satisfaction. This strongly informed our research and assisted in item development. While many delayed gratification scales have been published, a unique immediate gratification scale was created for this research and validated by a psychologist expert reviewer. Four items were used for this measure. A sample item is, "I value the ability to accomplish health care related tasks when it is

convenient for me,” rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). All survey items can be found in Appendix A.

Positive affect. Positive affect has been long supported in literature for having a theoretical basis (Lyubomirsky et al., 2005; Watson et al., 1988) and was modified for this research to specifically examine the effect that one’s own notion of positive health has upon overall satisfaction. Rather than seeking whether happiness leads to success (Lyubomirsky et al., 2005), I sought to measure whether positive feelings of health lead to satisfaction with care received. Historical measurement of positive and negative affect has frequently been conducted through usage of the Positive and Negative Affect Schedule scales (Watson et al., 1988), however, this required slight modification to allow the individual to consider positive affect of one’s own health. As such, four items were used for this measure. A sample item is, “I feel excited about my health check-up results (e.g., blood pressure, cholesterol, glucose levels),” rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). All survey items can be found in Appendix A.

Health anxiety. The notion that system usage decreases anxiety with the system has long been supported in academic research (Hackbarth et al., 2003). Specifically with regards to HIT such as patient portals, I found that users find systems more usable the more experience they have with the system (Bush et al., 2016). Others have focused on the benefits of patient portals in providing meaningful and direct communication to patients and on presenting information in the portal in a way that decreases anxiety through improving understanding (Solomon et al., 2016). Despite these benefits, contemporary critics have cited the need to increase ease of use of these systems, either through more robust training or engineering solutions to make the portals more user friendly (Bush, Stahmer, & Connelly, 2015). For this reason, this study examined the

extent to which the portal is used, such that increased usage would lead to higher levels of decreased anxiety. Psychological researchers have found that self-completed surveys accurately measure anxiety in the health care setting (Zigmond & Snaith, 1983), and as such this method was used in our research. Previously validated technology usage and anxiety scales were slightly modified for the electronic patient portal setting (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). Five items were used for this measure. A sample item is, “I usually feel at very low risk for developing any serious wellness,” rated on a seven-point Likert scale from *Strongly Disagree* (1) to *Strongly Agree* (7). A full listing of survey items can be found in Appendix A.

Controlling for common method bias. Because this study was measuring predictor and criterion variables using the same system, time, and source (Jarvis et al., 2003; Podsakoff et al., 2003), it was necessary to test for common method bias. This was necessary, as common method bias is known to falsely influence data collection and measurement (Jarvis et al., 2003), increasing the possibility of inflated results (Jarvis et al., 2003; Podsakoff et al., 2003). A single-common-method-factor approach was used to test for statistical bias, none was found (Podsakoff et al., 2003). Additionally, the inclusion of multiple item and multiple dimension outcome variables resolved concerns raised regarding single item indicators (Boyd et al., 2005).

Control variables. The control variables measured for in this survey include age, gender, income, education and race. This data assisted in post-hoc analyses, allowing further statistical bias control.

Analysis and Results

This section discusses the survey data collected in this study, as well as the measurement and structural models used for analysis. SmartPLS 3.2.6 was used. The measurement model will first be examined to evaluate convergent and discriminant validity and reliability. Then, the

structural model will be presented to evaluate the specific hypotheses, followed by supplemental analysis.

Measurement Model

Prior to analysis, an exploratory factor analysis (EFA) was conducted on the data set to confirm there would be no issues with common method bias. This analysis revealed concerns with the loadings of cognitive efficiency and gratification. Two of the three items of cognitive efficiency cross-loaded at a high level cognitive efficiency item two = 0.724, cognitive efficiency item one = 0.813), while the third item loaded with all items of positive affect (cognitive efficiency item three = 0.474) and health anxiety. Physicians and patients indicated during the expert review process that they felt these items were too similar and recommended removing them from the model. When checking AVE, it was found that gratification (0.806) had a high correlation to cognitive efficiency (0.889), and the decision was made to eliminate the items from the model. Additionally, serious concerns were raised about health anxiety items being too similar to the positive affect items. While no issues presented during the EFA process in terms of cross-loading, the measurement model continued to experience issues with AVE across multiple items until the health anxiety construct was removed. Thus, the final model presented eliminated cognitive efficiency and health anxiety.

The confirmatory factor analysis was conducted to establish model, convergent, and discriminant reliability using published guidelines, as illustrated in Figure 3.2 (Gefen & Straub, 2005). All item loadings were above the acceptable threshold of 0.70 recommended by Nunnally (1978). Table 3.1 demonstrates the *t*-values of the outer model loadings of the model. The initial check for convergent validity was passed when all items presented in Table 3.1 had *t*-values which were equal to or greater than 1.96 (Gefen and Straub, 2005). Next, average

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variance extracted values were checked to ensure they were equal to or greater than 0.5 (Fornell and Larcker, 1981), which they were. This demonstrated that the items for these constructs explained at least 50% of the variance in the construct; all items in Table 3.3 specify this, which suggests high convergent validity for the constructs.

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Table 3.1

Outer Model Loadings

Construct	Item	Question	<i>t</i> Statistics
Gratification (GR)	<i>GR1</i>	I feel satisfied when I receive information regarding my health via the electronic patient portal.	86.951
	<i>GR3</i>	Accomplishing health care related tasks via the electronic patient portal when it is convenient for me is satisfying (e.g. scheduling appointments, checking test results, etc.)	97.429
	<i>GR4</i>	I feel satisfied about my experiences completing health care related tasks via the electronic patient portal (e.g., scheduling appointments, checking test results, etc.).	126.257
Health Absorptive Capacity (HAC)	<i>HAC1</i>	I have a good understanding of my health status.	58.489
	<i>HAC2</i>	I am informed regarding ideal targets for indicators of my health (e.g., weight, cholesterol, blood sugar, etc.).	68.58
	<i>HAC3</i>	I am knowledgeable about my health status.	114.953
Post Adoptive Use (PAU)	<i>PAU1</i>	Please select your usage frequency - Scheduling Appointments.	40.587
	<i>PAU2</i>	Please select your usage frequency - Emailing My Provider.	47.193
	<i>PAU3</i>	Please select your usage frequency - Checking Test Results.	39.05
	<i>PAU4</i>	The electronic patient portal is used frequently by me.	44.734
Positive Affect (PA)	<i>PA1</i>	I lead an active and healthy life.	51.588
	<i>PA2</i>	I feel optimistic about my health.	61.665
	<i>PA3</i>	I feel satisfied with my latest health check-up results (e.g., blood pressure, cholesterol, glucose levels).	62.677
	<i>PA4</i>	In general, I am enthusiastic about my health.	68.087

Note: Item GR2 was removed due to redundancy in wording during expert review process.

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Two criteria must be met in order to establish discriminant validity; the item-to-construct correlations have to be largest for that constructs (Gefen and Straub, 2005), and the square root of the AVE of the variable must explain more variance for that variable than all other variables (Fornell and Larcker, 1981). Table 3.2 highlights that the first requirement was met and Table 3.3 demonstrates the second requirement was met, establishing that the criteria were met for discriminant validity for these variables.

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Table 3.2

Item-to-Construct Correlations. The bolded sections in each column are the constructs associated with the corresponding items in each row.

Items	Gratification (GR)	Health Absorptive Capacity (HAC)	Positive Affect (PosAff)	Post Adoptive Use (PAU)
GR1	0.92	0.505	0.377	0.404
GR3	0.93	0.458	0.339	0.412
GR4	0.941	0.471	0.358	0.461
HAC1	0.474	0.917	0.468	0.133
HAC2	0.47	0.917	0.468	0.148
HAC3	0.485	0.942	0.506	0.147
PAU1	0.288	0.03	0.196	0.865
PAU2	0.277	0.035	0.19	0.884
PAU3	0.298	0.068	0.174	0.845
PAU4	0.546	0.268	0.222	0.818
PosAff1	0.312	0.403	0.846	0.243
PosAff2	0.295	0.399	0.876	0.215
PosAff3	0.377	0.542	0.854	0.148
PosAff4	0.338	0.425	0.891	0.233

Note: Item GR2 was removed due to redundancy in wording during expert review process.

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Table 3.3

Measurement Model Validation - Average Variance Extracted.

Dimensions	Age	Atmosphere	Care Team Communication	Education Level	Instruction Effectiveness	Gender	Gratification	Health Absorptive Capacity	Income	Positive Affect	Post Adoptive Use	Race
Age	1											
Atmosphere	0.227	1										
Care Team Communication	0.224	0.776	1									
Education Level	-0.01	-0.012	0	1								
Instruction Effectiveness	0.116	0.787	0.696	0.017	1							
Gender	-0.02	0.081	0.088	-0.122	0.071	1						
Gratification	-0.05	0.453	0.384	-0.003	0.475	-0.027	0.93					
Health Absorptive Capacity	0.143	0.54	0.496	0.03	0.528	0.035	0.515	0.925				
Income	-0.08	0.059	0.002	0.429	0.091	-0.216	0.105	0.06	1			
Positive Affect Post Adoptive Use	-0.12	0.398	0.321	0.037	0.444	-0.048	0.386	0.52	0.17	0.867		
Use	-0.24	0.076	-0.012	-0.07	0.148	-0.151	0.458	0.155	0.118	0.237	0.853	
Race	0.212	0.18	0.111	0.039	0.162	0.053	0.027	0.122	0.076	0.014	-0.079	1

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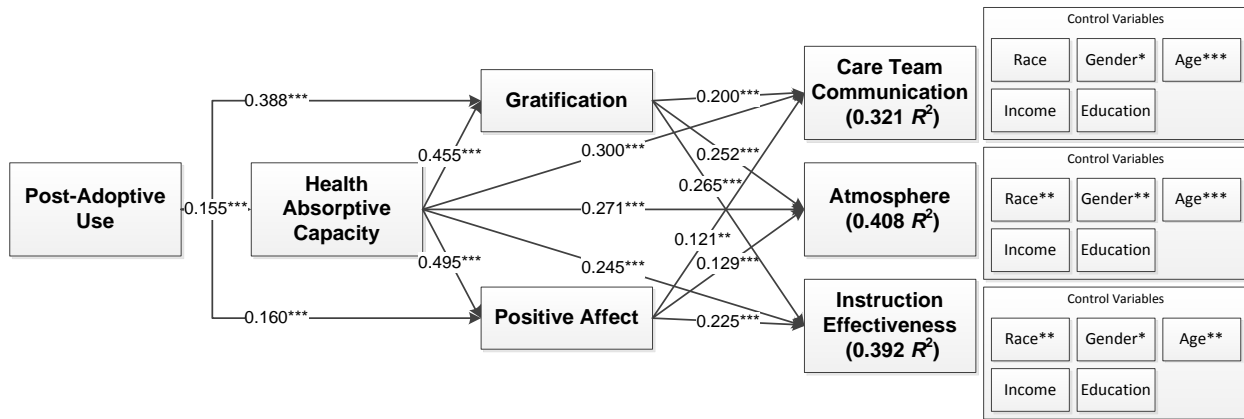


Figure 3.2. Structural model of post adoptive use impacts upon patient satisfaction outcomes.

Note: * p < .05, ** p < .01, *** p < .001

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The data in this study was also utilized to examine a single dependent variable model as depicted in Figure 3.3. While parsimony would suggest this model be used in further analysis, especially given the similar significance of path coefficients seen in Figure 3.3 and acceptable AVE, this was a problematic model for two reasons. First, the three dependent variable model allows practitioners to utilize this research to specifically focus upon areas of known Weakness or avoid overinvestment in areas of strength. Second, the single dependent variable model had an R^2 equaling 0.228 while each item in the three dependent variable model attained a higher R^2 , which was not unexpected given the three outcome variables are more specific constructs: care team communication had an R^2 equaling 0.321, atmosphere had an R^2 equaling 0.408, and instruction effectiveness had an R^2 equaling 0.392. For these reasons, the three dependent variable model was used throughout this analysis for increased practitioner and academic application.

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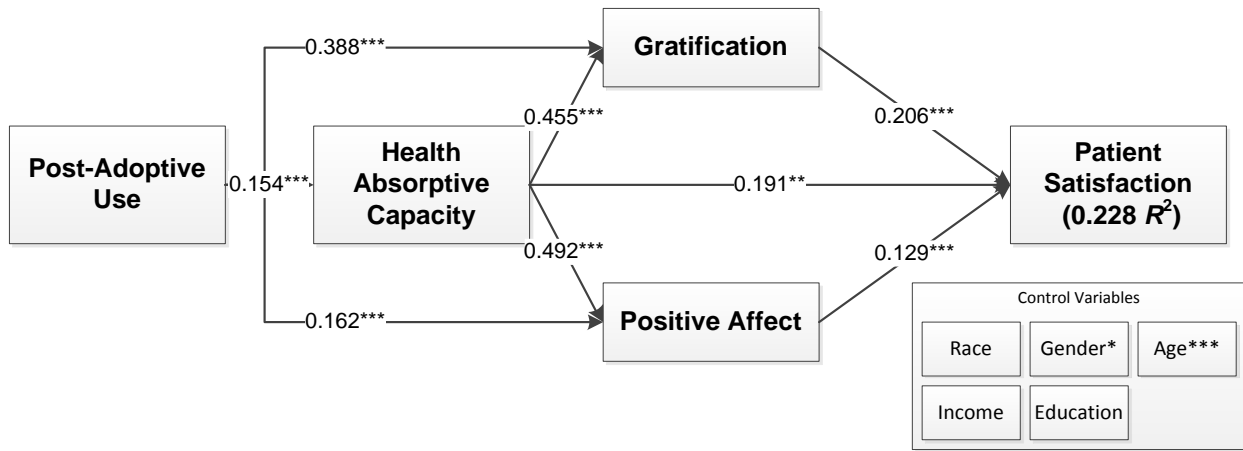


Figure 3.3. Revised structural model of post adoptive use impacts upon patient satisfaction.

* p < .05, ** p < .01, *** p < .001

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Table 3.4

Alternate Measurement Model Validation - Average Variance Extracted

Dimensions	Age	Education Level	Gender	Gratification	Health Absorptive Capacity	Income	Patient Satisfaction	Positive Affect	Post Adoptive Use	Race
Age	1									
Education Level	-0.007	1								
Gender	-0.024	-0.122	1							
Gratification	-0.052	-0.033	-0.027	0.93						
Health Absorptive Capacity	0.143	0.03	0.035	0.515	0.925					
Income	-0.082	0.429	-0.216	0.104	0.06	1				
Patient Satisfaction	0.134	0.003	0.086	0.354	0.396	0.092	0.966			
Positive Affect	-0.119	0.037	-0.049	0.384	0.517	0.172	0.3	0.868		
Post Adoptive Use	-0.243	-0.07	-0.151	0.458	0.154	0.118	0.086	0.238	0.854	
Race	0.212	0.039	0.053	0.027	0.122	0.076	0.124	0.014	-0.079	1

Structural Model

The structural model evaluated for this research is shown in Figure 3.2. Care team communication, instruction effectiveness, and atmosphere were second order factors and as such were modeled and validated following the procedure described in Pavlou and El Sawy (2006). As described previously, the items associated with the second order construct were first checked for convergent and discriminant validity. Next, the path coefficients from the first order constructs to the second order constructs were checked for significance. The corresponding path coefficients were found to be significant at $p < 0.001$: doctor communication to care team communication ($\beta = 0.537$, t -value = 64.164), nurse communication to care team communication ($\beta = 0.523$, t -value = 78.985), cleanliness and quietness to atmosphere ($\beta = 0.488$, t -value = 35.256), staff responsiveness to atmosphere ($\beta = 0.633$, t -value = 43.046), discharge instructions to instruction effectiveness ($\beta = 0.597$, t -value = 41.008), and communication about medicines to instruction effectiveness ($\beta = 0.482$, t -value = 37.271). This established that the second order constructs of formal and informal governance are each composed of two first order constructs. This did however present a problem with AVE given the three dependent variables listed, a limitation of the statistical model. By capturing the latent variables of the second order constructs derived from all first order constructs, these latent variables could be inserted into the model rather than the first order variables, allowing SmartPLS to overcome its limitations while still producing accurate statistical analysis. The results of all significant hypothesis tests are shown with asterisks in Figure 3.2.

The mediation effects of health absorptive capacity, gratification, and positive affect were modeled using the steps discussed in Lowry and Gaskin (2014). First, direct effect betas with mediators and without mediators were measured to ensure a reduction was evident with

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mediation. Next, betas and standard errors from the independent variable, post adoptive use, to the various mediators were measured, as well as betas and standard errors from the mediating variables to the dependent variables. Finally, using this information, a Sobel test was run for each mediating variable relationship in order to validate a Sobel test statistic greater than 1.96 and a probability better than $p < 0.05$. This is depicted in Table 3.5. After meeting these requirements, in order to measure full, partial, or no mediation, two conditions were measured: first, checking for the decrease in strength on the direct effects model and second, seeing if the relationship was significant. If the direct effects and mediated relationship are significant, then partial mediation was achieved; however, if only the mediated relationships were significant then full mediation was achieved.

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Table 3.5

Mediation and Sobel Test Values

Relationship	Health Absorptive Capacity -> Patient Sat			Gratification -> Patient Sat			Positive Affect -> Patient Sat		
	PAU-->HAC->COM	PAU-->HAC->ATM	PAU-->HAC->InstEf	PAU-->GR->COM	PAU-->GR->ATM	PAU-->GR->InstEf	PAU-->PA->COM	PAU-->PA->ATM	PAU-->PA->InstEf
Direct No Med	-0.172	-0.098	-0.046	-0.038	0.038	0.088	-0.144	-0.07	-0.014
Direct w/ Med	-0.154	-0.082	-0.03	-0.154	-0.082	-0.03	-0.154	-0.082	-0.03
IV->Med Beta	0.162	0.162	0.162	0.394	0.394	0.394	0.158	0.158	0.158
Med->DV Beta	0.296	0.265	0.241	0.27	0.288	0.279	0.131	0.19	0.227
IV->Med SE	0.041	0.041	0.041	0.037	0.037	0.037	0.037	0.037	0.037
Med->DV SE	0.064	0.06	0.057	0.056	0.046	0.055	0.05	0.058	0.054
Mediation COM	Partial	Partial	Full	Full	Full	Full	Partial	Full	Full
Sobel Test Stat	3.00417918	2.94478923	2.88684932	4.39219366	5.39713124	4.5796409	2.23317719	2.59916054	2.99572493
one tailed probability	0.00133149	0.00161587	0.0019456	0.00000561	0.00000003	0.00000233	0.01276863	0.0046726	0.00136897
two tailed probability	0.00266298	0.00323175	0.00389121	0.00001122	0.00000007	0.00000466	0.02553726	0.00934521	0.00273793

Note: IV=independent variable, DV=dependent variable, Med=mediating variable, SE=standard error, PAU=post adoptive use, HAC=health absorptive capacity, ATM=atmosphere, COM=care team communication, InstEf=instruction effectiveness, GR=gratification, PA=positive affect

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Hypothesis 1, 1a, and 1b could not be tested with cognitive efficiency being removed from the model. Hypothesis 2 (health absorptive capacity will mediate the relationship between post adoptive usage and patient satisfaction) was supported. Because the patient satisfaction variable had been conceptualized into three dependent variables (care team communication, atmosphere, and instruction effectiveness), it was necessary to test for the direct effects and mediation of each relationship. Therefore, health absorptive capacity partially mediated the relationship between post adoptive use and care team communication. While the Sobel test value (3.0042) was greater than 1.96 and the probability less than $p < 0.05$, the direct effect model of post adoptive use to care team communication was still significant on its own and with a negative effect (post adoptive use impact upon care team communication: $\beta = -0.154$, t -value = 3.728); when mediated, this relationship became positive and more significant (H_{2a} : post adoptive use impact upon health absorptive capacity: $\beta = 0.162$, t -value = 4.076; H_{2b} : health absorptive capacity impact upon care team communication: $\beta = 0.286$, t -value = 4.418). Health absorptive capacity partially mediated the relationship between post adoptive use and atmosphere. Here again, the Sobel test value (2.9448) was greater than 1.96 and the probability less than $p < 0.05$, although the direct effect model of post adoptive use to atmosphere was still significant on its own and with a negative effect: $\beta = -0.082$, t -value = 2.006); when mediated, this relationship became positive and more significant (H_{2a} : post adoptive use impact upon health absorptive capacity: $\beta = 0.162$, t -value = 4.076; H_{2b} : health absorptive capacity impact upon atmosphere: $\beta = 0.265$, t -value = 4.319). Health absorptive capacity partially mediated the relationship between post adoptive use and instruction effectiveness. Here, the Sobel test value (2.8868) was greater than 1.96 and the probability less than $p < 0.05$, although the direct effect model of post adoptive use to instructive effectiveness was not significant on its own: $\beta = -0.030$,

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t -value = 0.755); when mediated, this relationship became positive and significant (H_{2a} : post adoptive use impact upon health absorptive capacity: $\beta = 0.162$, t -value = 4.076; H_{2b} : health absorptive capacity impact upon instruction effectiveness: $\beta = 0.241$, t -value = 4.180).

Therefore, Hypotheses 2, 2a, and 2b were supported.

Hypothesis 3 (gratification will mediate the relationship between post adoptive usage and patient satisfaction) was supported. Because the patient satisfaction variable had been conceptualized into three dependent variables (care team communication, atmosphere, and instruction effectiveness) it was necessary to test for the direct effects and mediation of each relationship. Gratification fully mediated the relationship between post adoptive use and care team communication. The Sobel test value (4.3922) was greater than 1.96 and the probability less than $p < 0.05$, and the direct effect model of post adoptive use to care team communication was not significant on its own, with a negative effect: $\beta = -0.038$, t -value = 0.598); when mediated, this relationship became positive and significant (H_{3a} : post adoptive use impact upon gratification: $\beta = 0.394$, t -value = 11.413; H_{3b} : gratification impact upon care team communication: $\beta = 0.271$, t -value = 4.725). Gratification fully mediated the relationship between post adoptive use and atmosphere. Here again, the Sobel test value (5.3971) was greater than 1.96, with probability less than $p < 0.05$, and the direct effect model of post adoptive use to atmosphere was not significant on its own: $\beta = 0.038$, t -value = 0.687); when mediated, this relationship became positive and more significant (H_{3a} : post adoptive use impact upon gratification: $\beta = 0.394$, t -value = 11.413; H_{3b} : gratification impact upon atmosphere: $\beta = 0.288$, t -value = 5.860). Gratification fully mediated the relationship between post adoptive use and instruction effectiveness. Here, the Sobel test value (4.5797) was greater than 1.96 and the probability less than $p < 0.05$, although the direct effect model of post adoptive use to instructive

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effectiveness was not significant on its own: $\beta = 0.088$, t -value = 1.486); when mediated, this relationship became positive and significant (H_{3a} : post adoptive use impact upon gratification: $\beta = 0.394$, t -value = 11.413; H_{3b} : gratification impact upon instruction effectiveness: $\beta = 0.279$, t -value = 4.997). Therefore, Hypotheses 3, 3a, and 3b were supported.

Hypothesis 4 (positive affect will mediate the relationship between post adoptive usage and patient satisfaction) was supported. Because the patient satisfaction variable has been conceptualized into three dependent variables (care team communication, atmosphere, and instruction effectiveness) it was necessary to test for the direct effects and mediation of each relationship. Positive affect partially mediated the relationship between post adoptive use and care team communication. The Sobel test value (2.2332) was greater than 1.96 and the probability less than $p < 0.05$, and the direct effect model of post adoptive use to care team communication was significant on its own, with a negative affect: $\beta = -0.144$, t -value = 3.320); when mediated, this relationship became positive and significant (H_{4a} : post adoptive use impact upon positive affect: $\beta = 0.158$, t -value = 4.618; H_{4b} : positive affect impact upon care team communication: $\beta = 0.131$, t -value = 2.632). Positive affect fully mediated the relationship between post adoptive use and atmosphere. Here again, the Sobel test value (2.5992) was greater than 1.96, with probability less than $p < 0.05$, and the direct effect model of post adoptive use to atmosphere was not significant on its own: $\beta = -0.070$, t -value = 1.706); when mediated, this relationship became positive and more significant (H_{4a} : post adoptive use impact upon positive affect: $\beta = 0.158$, t -value = 4.618; H_{4b} : positive affect impact upon atmosphere: $\beta = 0.190$, t -value = 3.955). Positive affect fully mediated the relationship between post adoptive use and instruction effectiveness. Here, the Sobel test value (2.9957) was greater than 1.96 and the probability less than $p < 0.05$, although the direct effect model of post adoptive use to instructive

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effectiveness was not significant on its own: $\beta = -0.014$, t -value = 0.338); when mediated, this relationship became positive and significant (H_{4a} : post adoptive use impact upon positive affect: $\beta = 0.158$, t -value = 4.618; H_{4b} : positive affect impact upon instruction effectiveness: $\beta = 0.227$, t -value = 4.540). Therefore, Hypotheses 4, 4a, and 4b were supported.

Hypothesis 5, 5a, and 5b could not be tested with health anxiety being removed from the model.

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Table 3.6

Supported Hypotheses

Hypothesis	Supported	Path
H_1	N/A	PAU-->CE-> Patient Satisfaction
H_{1A}	N/A	PAU-->CE
H_{1B}	N/A	CE-->Patient Satisfaction
H_2	Supported (Partial, Partial, Full Mediation)	PAU-->HAC->PS
H_{2A}	Supported	PAU-->HAC
H_{2B}	Supported	HAC-->PS
H_3	Supported (Full Mediation)	PAU-->GR->PS
H_{3A}	Supported	PAU-->GR
H_{3B}	Supported	GR-->PS
H_4	Supported (Partial, Full, Full)	PAU-->PA->PS
H_{4A}	Supported	PAU-->PA
H_{4B}	Supported	PA-->PS
H_5	N/A	PAU-->HA->PS
H_{5A}	N/A	PAU-->HA
H_{5B}	N/A	HA-->PS

Note: PAU=Post adoptive use, CE=cognitive efficiency, HAC=health absorptive capacity, PS=patient satisfaction, GR=gratification, PA=positive affect, HA=health anxiety.

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Amongst the control variables, there were numerous significant relationships observed. Age had a significant relationship for all three dependent variables, specifically atmosphere ($\beta = 0.193$, t -value = 5.164), care team communication ($\beta = 0.172$, t -value = 4.307), and instruction effectiveness ($\beta = 0.101$, t -value = 2.445). Education was insignificantly related to atmosphere ($\beta = -0.039$, t -value = 1.082), care team communication ($\beta = -0.008$, t -value = 0.225), and instruction effectiveness ($\beta = -0.008$, t -value = 0.239). Gender was however significantly related to atmosphere ($\beta = 0.079$, t -value = 2.270) and instruction effectiveness ($\beta = 0.081$, t -value = 2.048). Gender was not significantly related to care team communication ($\beta = 0.067$, t -value = 1.765). Income was insignificantly related to atmosphere ($\beta = 0.034$, t -value = 0.825), care team communication ($\beta = -0.017$, t -value = 0.390), and instruction effectiveness ($\beta = 0.035$, t -value = 0.853). Finally, race was significantly related to atmosphere ($\beta = 0.085$, t -value = 2.340) and instruction effectiveness ($\beta = 0.091$, t -value = 2.722), but insignificantly related to care team communication ($\beta = 0.017$, t -value = 0.436). The R^2 values for the dependent variables were as follows: care team communication ($R^2 = 0.334$), atmosphere ($R^2 = 0.410$), and instruction effectiveness ($R^2 = 0.391$).

Common Method Bias Analysis

Harmon's single factor test was used by performing an exploratory factor analysis of all principle components in the study (Podsakoff & Organ, 1986). Results from the exploratory factor analysis indicated that all items loaded on more than one factor, which provided reassurance that method bias should not be a serious concern in this study. To further explore this using SmartPLS, the primary factors (care team communication, atmosphere, and instruction effectiveness) were modeled as second order constructs as discussed previously using the model proposed by Lowry and Gaskin (2014); the latent variables of these constructs were then used to

allow verification of proper item loadings and significance. To further check for common method bias, given the recent concerns of the adequacy of Harmon's single factor test (Podsakoff et al., 2003), the constructs were also compared using Pearson's correlations to ensure none were over 0.90, which is indicative of a common method bias (Pavlou, Liang & Xue, 2007). None of these issues presented in this research, suggesting the chances of common method bias are low.

Chapter Summary

The measurement model tested in this study showed adequate construct validity and reliability. These data supported Hypotheses 2, 2a, 2b, 3, 3a, 3b, 4, 4a, and 4b. Of particular interest is the high significance of many of the dependent variables, which presents a distinct opportunity for future research. Additional analysis occurred to model the data using a single dependent variable versus three, and was so mentioned in the model. No issues presented during common method bias tests for the final model.

Discussion, Limitations, and Conclusions

This study espoused a techno-centric view in order to examine the effects of electronic patient portal usage upon patient satisfaction. Social cognitive theory (Bandura, 2011) and adaptive structuration theory helped us conceptualize that using technologies can increase satisfaction in individuals (DeSanctis & Poole, 1994), hence this perspective offers a unique yet theoretically supported look into the complex patient satisfaction variable. This research contributes to our understanding of the nomological network of factors affecting patient satisfaction in three ways. First, reviewing post adoptive use of health information technology and how it leads to patient satisfaction is long overdue as this concept has been previously supported related to satisfaction (DeSanctis & Poole, 1994). Second, this study extended the TAM and UTAUT models into post adoptive use to inform the understanding of how

implementation of electronic patient portals affects patient satisfaction (Davis et al., 1989; Venkatesh et al., 2003), which in turn builds upon previous conceptualizations of patient satisfaction as a model (Aragon & Gesell, 2003; Linder-Pelz, 1982b). Finally, gratification as constructed in this research, built from uses and gratification theory, also expands this theory into the health information technology space. These three contributions combine to provide a substantially greater understanding of the network of factors impacting patient satisfaction, providing rigorous support to the development of a theory of patient satisfaction.

Discussion

The findings from each hypothesis are discussed in the following sections; the analysis of the results is also included. First, health absorptive capacity is discussed, followed by an examination of the gratification construct and the significance of its mediation to the patient satisfaction variables, and finally positive affect and its data are reviewed for further interpretation.

Health absorptive capacity. Research at the organizational has previously defined absorptive capacity as the ability to take in information, assimilate that information, and apply it in a defined setting (W. M. Cohen & Levinthal, 1990). Historically, information technologies have been seen as providing a competitive edge towards firm performance; however, absorptive capacity has been seen as a mediating factor (Liu et al., 2013). As such, health absorptive capacity was suggested as a mediating variable between post adoptive use and the patient satisfaction outcomes defined in the study (care team communication, atmosphere, and instruction effectiveness). Additionally, as patients accumulate knowledge about their health status, they are more likely to make informed decisions about their own health (van der Vaart et al., 2014). In examination of the measurement and structural model for this survey, it was

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confirmed that health absorptive capacity not only has a significant relationship with the patient satisfaction outcome variables defined in this research but also that this construct significantly mediates the relationship between post adoptive use and these variables (care team communication: partial mediation, atmosphere: partial mediation, instruction effectiveness: full mediation). This is particularly important in terms of instruction effectiveness where full mediation was found—without health absorptive capacity in the structural model, no significant relationship with instruction effectiveness is realized. That is to say, efforts to design technologies which facilitate user learning and knowledge acquisition play a critical role in care teams' ability to provide instruction, which in turn results in greater patient satisfaction scores. The potential for expanded research in this space is paramount for practitioners and academics alike.

Gratification. In this study, I defined gratification as a feeling of pleasure directly related to achieving a desired task through technology usage, as informed by uses and gratification theory (Ruggiero, 2000). In layman's terms, this study examined whether the more patients use the system, the more they know about their health, achieving satisfaction in meeting that information seeking behavior. This suggested mediating role between system usage and patient satisfaction was fully supported. This aligns with previous uses and gratification theory research finding that as individuals use a technology to seek information, gratification is gained upon receiving that information (Grellhesl & Punyanunt-Carter, 2012). In an era when research has demonstrated that consumers seek computer mediated interactions and that such usage can provide gratification (Cho et al., 2003), it is not surprising to find gratification playing such a critical mediating role. After the gratification feeling is achieved, this affective component of an attitude (Fabrigar et al., 2005) directly affects the measurement of the patient's satisfaction

attitude of the entire care experience. As such, gratification plays a critical mediating role between post adoptive electronic portal usage and patient satisfaction; future academic research into ways for practitioners to influence this variable seem critically important to understanding HIT and patient satisfaction.

Positive affect. Positive affect was found in this study to be a mediating variable between post adoptive use of the electronic patient portal and patient satisfaction outcomes. Prior literature has taught us that positive affect has an impact on satisfaction variables (Estrada et al., 1994; Lyubomirsky et al., 2005; Watson et al., 1988). Users obtain data they perceive a need for in order to feel good about their health status and then experience this positive affect, an affective attitude component which directly contributes to their satisfaction attitudes. This study highlighted the notion that electronic portal usage provides gratification as well as instant access to health related tasks (Acquisti, 2004). As the portal continues to enable this behavior, it has the potential to allow users to feel more positively about their health whether before or after care is provided. Consequently, as patients have more positive feelings about their health status, they are more likely to assess their health experience in a more positive manner, leading to higher patient satisfaction scores (and potentially higher reimbursement for health care providers). Simply put, positive affect impacts patient satisfaction evaluations since the positive affect is achieved as a result of the portal meeting the needs of the patient which necessitated the health care in the first place. Consequently, as patients perceive that their needs are met by the providers through the portal, these feelings of positive affect will translate to better patient satisfaction scores.

Limitations

Despite the many significant relationships discovered in this research, several limitations exist. An important limitation of this study centers on the fact that the concept will require testing across numerous methodologies and HIT; despite having 504 survey respondents, several of these constructs are new conceptualizations and require specific follow up to expand and generalize these definitions. Measuring through a single survey presents concerns of common method bias due to the independent and dependent variables being gathered from the same respondent at the same survey session. While common method bias was not found to be a concern during the measurement and structural validation, it remains possible that respondents may not have fully understood the system's capabilities or may have over- or underestimated their usage habits. A novel data collection which allows actual feedback of users' habits would illuminate this discussion greatly. Additionally, survey respondents were paid to participate in this survey; it is possible that those who participate in online surveys may be more technologically savvy than the population. Another major concern is the lack of identification of which electronic portal system patients were using; at a minimum, future research should identify this metric for at least a control variable.

Implications for Research

This study presents several important opportunities for future research. First, the study of gratification has an extensive history (Acquisti, 2004; Dimmick, Kline, & Stafford, 2000). This research points out a pivotal role the variable plays in mediating all three patient satisfaction outcome variables used in this research (care team communication, atmosphere, and instruction effectiveness). Future work combining uses and gratification theory, this research, and digital self-efficacy may yield important insights to continued expansion of knowledge in this area.

Second, this research highlights the opportunity to take validated survey results of self-reported data and determine a way to attempt a similar study using actual reports of user actions from the information systems themselves, rather than reports from the patients. This could provide either strong confirmation of the present study or yield important new research streams into how the cognitive and affective variables actually impact patient satisfaction and post adoptive usage.

Third, absorptive capacity has already been seen as a mediating factor (Liu et al., 2013). By expanding this knowledge into the health care space, efforts to specifically facilitate or enable health absorptive capacity offer the potential to greatly expand the understanding of patient satisfaction research. The identification of those variables which might have an interaction effect on post adoptive usage and health absorptive capacity in particular offer the potential to shed tremendous light on key variables within the nomological network of patient satisfaction.

Implications for Practice

Practitioners benefit from the findings of this research in this study for three direct reasons. First, the ability to either choose to impact all aspects of their patient satisfaction scores is depicted in the single outcome variable model, or they can refine this approach in the three dependent variable model and focus specifically on the needs of their system. Second, the understanding that post adoptive usage has so many direct and mediated impacts upon patient satisfaction outcomes gives providers clear direction: enroll patients into the electronic health portal systems. Third, the three mediating variables offer practitioners a direct look into their own strengths or shortcomings. Health absorptive capacity is recognized to obtain significant results in this study; only by taking efforts to measure and then influence these capacities can a system truly harness this data. This is also true of positive affect or gratification; both were shown to have significant roles in mediating between portal usage and patient satisfaction. If

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health care organizations truly seek to maximize their scores, this research suggests they take one of their key assets (access to patients) and determine which factors make them feel positively about their health or what makes them gratified as they interact with the health system.

Understanding these factors allows providers to manipulate this variable to their own advantage.

Conclusion

This study highlighted the critical crossroads where patient satisfaction and HIT currently meet. The usage of HIT continues to expand in response to the HITECH Act of 2009, yet there is lack of complete understanding as to why to push for these changes (as evidenced by the lack of organizations making this change prior to receiving financial incentives to do so). The HITECH Act committed nearly \$27 billion to incentivize providers to adopt electronic health records over 10 years (Blumenthal & Tavenner, 2010). As previously mentioned, in 2010, the Patient Protection and Affordable Care Act, through the value based purchasing program, confirmed a regulatory focus upon patient satisfaction, withholding 2% of all Medicare payments which can be restored in part by achieving high levels of HCAHPS patient satisfaction scores (A. M. Epstein, 2012). This research demonstrated that usage of the specific health information technology of the electronic health portal provides a positive impact to patient satisfaction, and an even greater impact is experienced when the mediating variables of health absorptive capacity, gratification, and positive affect can be harnessed.

Concluding Remarks

Patient satisfaction, while widely acknowledged by health care organizations as useful and important (Petrullo et al., 2012), has often been criticized as an incomplete and difficult to measure metric (Berkowitz, 2016; Kupfer & Bond, 2012; Tsai et al., 2015; Tzeng & Yin, 2008). As the trends toward patient-centric care and use of patient portals continue to grow,

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understanding the role of the patient portal in enabling patient satisfaction becomes increasingly imperative for hospitals and health care organizations. Although prior research has provided a foundation for such enquiry, there has been limited research on building a generalized theory on patient satisfaction and the role of technology in enhancing patient satisfaction.

Our endeavor in this dissertation was to move towards a theory of patient satisfaction by rethinking the patient satisfaction construct and the modalities through which patient portal use impacts patient satisfaction. I believe that this dissertation accomplished that goal through a combination of three studies. First, I theorized and empirically validated the multi-dimensionality of the patient satisfaction construct consisting of: care team communication, atmosphere, and instruction effectiveness. Second, I established that patient-technology fit consists of information gathering, patient-provider coordination, and patient social-sharing and demonstrated its significant impacts on patient satisfaction. Additionally, I also showed that digital self-efficacy and technological capabilities can drive patient-technology fit. Finally, I illustrated that post adoptive use of a patient portal affects patient satisfaction through cognitive (health absorptive capacity) and affective factors (gratification and positive affect).

With the increasing influx of technology, our research has several important implications for future researchers desiring to delve into some of the interesting (patient-technology fit, post adoptive use) as well as divergent findings in our study (patient social-sharing) and to understand how those data impact patient satisfaction. Notably, by understanding the dimensionality of patient satisfaction and by utilizing patient portals effectively, practitioners can benefit from this study as they continue to strive for higher patient satisfaction through patient-centric care.

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Appendix A

Survey Measures

Construct	Item	Question
Consent		By completing the survey I certify that I am at least 18 years of age, and I agree to participate in the project as outlined above. (Answer for this question is required)
Quality Check		I care about the quality of our data. In order for us to get the most accurate measures of your opinions, it is important that you thoughtfully provide your best answers to each question in this survey.
		Do you commit to thoughtfully provide your best answers to each question in this survey?
Communication about Medicines (CM)	<i>CM1</i>	How often did hospital staff describe possible side effects?
	<i>CM2</i>	How often did hospital staff tell you what the medicine was for?
	<i>CM3</i>	I clearly understood the purpose for taking each of my medications.
Cleanliness and Quietness (CQ)	<i>CQ1</i>	How often are public restrooms found clean?
	<i>CQ2</i>	How often was the noise level quiet during appointments?
Doctor Communication (DC)	<i>DC1</i>	Did providers (e.g., doctors) treat you with courtesy and respect?
	<i>DC2</i>	Did providers (e.g., doctors) listen carefully to you?
	<i>DC3</i>	Did providers (e.g., doctors) explain things in a way you could understand?
Discharge Information (DI)	<i>DI_1</i>	Staff took my preferences into account in deciding what my health care needs would be.
	<i>DI_2</i>	Whenever I left my typical health care facility, I had a good understanding of the things I was responsible for in managing my health.
	<i>DI_3</i>	I received information in writing summarizing the visits and describing any symptoms or health problems to look out for.
Nurse Communication (NC)	<i>NC1</i>	How often did nurses treat you with courtesy and respect?
	<i>NC2</i>	How often did nurses listen carefully to you?
	<i>NC3</i>	How often did nurses explain things in a way you could understand?

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Appendix A Continued

Construct	Item	Question
Staff Responsiveness (SR)	<i>SR1</i>	How often did you get help from any staff as soon as you wanted it?
	<i>SR2</i>	How often did you get an appointment as soon as you needed?
	<i>SR3</i>	When contacting my typical health care facility with a question, I typically received an answer the same day.
Willingness to Recommend (WR)	<i>WR1</i>	I am satisfied with my health care facility.
	<i>WR2</i>	I would recommend this health care facility to my friends and family.
Digital Self-Efficacy (DSE)	<i>DSE1</i>	I believe I have the ability to effectively use the electronic patient portal.
	<i>DSE2</i>	I am confident about my ability to check information (e.g., test results) on the electronic patient portal.
	<i>DSE3</i>	I am confident about my ability to find specific information (e.g., messages from my provider) on the electronic patient portal.
	<i>DSE4</i>	I am able to effectively use digital devices such as computers or mobile phones to accomplish tasks.
Information Gathering (IG)	<i>IG1</i>	The electronic patient portal allows me to gather information related to my health.
	<i>IG2</i>	I trust information I receive about my health from the electronic patient portal.
	<i>IG3</i>	I pay attention to information about my health from the electronic patient portal.
Patient-Provider Coordination (PPCom, PPCoord)	<i>PPCom1</i>	Using the electronic patient portal, I can communicate easily with my provider/providers' office.
	<i>PPCom2</i>	Using the electronic patient portal, I can effectively communicate my needs to my provider/providers' office.
	<i>PPCom3</i>	Using the electronic patient portal, my provider/providers' office has interacted effectively with me.
	<i>PPCoord1</i>	The electronic patient portal enables me to keep track of personal health information (e.g., care received, test results, upcoming medical appointments).
	<i>PPCoord2</i>	The electronic patient portal enables me to exchange diagnostic information (e.g., medical illnesses or diseases) with my provider.
	<i>PPCoord4</i>	The electronic patient portal enables me to manage my health care needs with my provider.
	<i>PPCoord5</i>	The electronic patient portal enables me to coordinate with my provider conveniently.

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Appendix A Continued

Construct	Item	Question
Patient-Social Sharing (PSS)	<i>PSS1</i>	After using the electronic patient portal, I have often visited a social networking site (e.g., Facebook, LinkedIn) to share information about health or medical topics.
	<i>PSS2</i>	After using the electronic patient portal, I found the information useful when participating in an on-line support group for people with a similar health or medical issue.
	<i>PSS3</i>	After using the electronic patient portal, I was better able to update my on-line diary or blog (i.e., web logs).
	<i>PSS4</i>	After using the electronic patient portal, I have often felt more informed when sharing information regarding my health with friends or family members.
Technical Capabilities (TC)	<i>TC1</i>	Using the electronic patient portal helps me to schedule appointments.
	<i>TC2</i>	Using the electronic patient portal helps me to securely email my provider.
	<i>TC3</i>	Using the electronic patient portal helps me to obtain test results.
	<i>TC4</i>	Using the electronic patient portal helps me to receive appointment reminders.
Gratification (GR)	<i>GR1</i>	I feel satisfied when I receive information regarding my health via the electronic patient portal.
	<i>GR3</i>	Accomplishing health care related tasks via the electronic patient portal when it is convenient for me is satisfying (e.g., scheduling appointments, checking test results, etc.).
Health Absorptive Capacity (HAC)	<i>GR4</i>	I feel satisfied about my experiences completing health care related tasks via the electronic patient portal (e.g., scheduling appointments, checking test results, etc.).
	<i>HAC1</i>	I have a good understanding of my health status.
Post Adoptive Use (PAU)	<i>HAC2</i>	I am informed regarding ideal targets for indicators of my health (e.g., weight, cholesterol, blood sugar, etc.).
	<i>HAC3</i>	I am knowledgeable about my health status.
	<i>PAU1</i>	Please select your usage frequency - Scheduling Appointments.
	<i>PAU2</i>	Please select your usage frequency - Emailing my Provider.
	<i>PAU3</i>	Please select your usage frequency - Checking Test Results.
	<i>PAU4</i>	The electronic patient portal is used frequently by me.

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Appendix A Continued

Construct	Item	Question
Positive Affect (PA)	<i>PA1</i>	I lead an active and healthy life.
	<i>PA2</i>	I feel optimistic about my health.
	<i>PA3</i>	I feel satisfied with my latest health check-up results (e.g., blood pressure, cholesterol, glucose levels).
	<i>PA4</i>	In general, I am enthusiastic about my health.
Age	<i>N/A</i>	Please select your age from 18-65+
Gender	<i>N/A</i>	
Education	<i>N/A</i>	Highest level of education
Income	<i>N/A</i>	Income by ranges
Race	<i>N/A</i>	Please select race (all that apply).

Appendix B

Implied Consent Statement

**University of Wisconsin Whitewater
Implied Consent Statement for Research Involving Human Subjects**

Consent to Participate In UW-Whitewater Approved Research

The information below provides a summary of this survey. Please read the information presented and acknowledge your consent prior to moving forward.

Title: Health Information Technology and Patient Satisfaction Survey

Time Commitment: Under twenty minutes

Investigators:

Doctoral Candidate

Aaron Kinney
800 W Main Street
Whitewater, WI 53190
Email: kinneyA22@uww.edu
Phone: 262-472-1945

Faculty Coordinator

Dr. Balaji Sankaranarayanan
800 W Main Street,
Whitewater, WI 53190
Email: sankarab@uww.edu
Phone: 262-472-5467

Risks and Benefits: This study seeks to gather information about patient satisfaction and electronic patient portals. The study will present you with four short sections focused on patient satisfaction, electronic patient portals, and your current health status, followed by some minor demographic information. As the study relates to patient satisfaction over the past 12 months, you may feel some stress in making some of your selections. Please note, however, that no confidential information will be obtained and you will be providing a great benefit to the literature in understanding of how some of your demographics, health status, and perceptions of the electronic patient portals impact patient satisfaction.

Safeguarding of Identity: The survey does not request any specific identifying information. In addition, all information that is generated by this study will be analyzed and presented in summary form only. Please note, however, as an online participant in this research, there is

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always a risk of intrusion by outside agents, i.e., hacking, and therefore the possibility of being identified. Such a statement highlights concerns related to data confidentiality and the risk/benefit of participation in the study. Finally, upon completion of this survey, the responses will be removed from online storage and stored locally by the researchers shown above.

Right to Withdraw: Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been submitted.

IRB Approval: This study has been reviewed and approved by The University of Wisconsin-Whitewater's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the Researcher. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Chair via email at katchc@uww.edu.

VITA

Aaron P. Kinney was born January 22, 1983, in Oakland, California. He completed his undergraduate work at the University of California at Davis where he received a Bachelor's of Arts degree in Political Science with a minor in history (2005). He holds a Master of Science degree in Management from New England University (2009). Aaron also served as a Medical Service Corps Officer in the United States Army from 2005-2012, serving as an aero medical evacuation officer, and earning a bronze star each for his deployments in Iraq (2007-2008) and Afghanistan (2010-2011). Aaron is currently the Executive Director of the Herma Heart Institute at the Children's Hospital of Wisconsin in Milwaukee, Wisconsin, and a credentialed Fellow of the American College of Healthcare Executives.