Factors Associated with the Adoption of Health Information Technologies to Increase Patient Engagement in US Hospitals

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Since 2009, substantial investments have been made to incentivize the meaningful use of electronic health records (EHR) and other health information technology (HIT). Emphasis is placed on the adoption of HIT for patient engagement, a policy priority. However, different hospitals are at different stages in their adoption. Some are hesitant and slow to adopt new HIT, while others have adopted technologies with a wide range of patient engagement functionalities. This study applies open systems theory to determine which organizational and environmental factors are salient in predicting the number of adoption of HIT functionality for patient engagement.

Keywords: Patient Engagement, Health Information Technology, Open Systems Theory, Environmental Factor, Organizational Factors

INTRODUCTION

Service industries in the U.S. including retail, travel, and banking, have been said to far outpace the U.S. health services sector in their adoption and use of information technology. Consequently, it is presumed that the healthcare industry underperforms compared to these other industries because it receives minimal benefit from cost decreases due to coordination of information processing (Brynjolfsson and Hitt, 2003; Stiroh, 2002).

To incentivize change, the U.S. Congress passed the Health Information Technology for Economic and Clinical Health (HITECH) Act as part of the American Recovery and Reinvestment Act (ARRA) of 2009. The Act anticipates that the adoption of health information technology (HIT) will improve health care quality, reduce health disparities, and promote patient-centered delivery of medical care. Substantial investments have been made to encourage physicians and hospitals participating in Medicare and Medicaid to use certified Electronic Health Record (EHR) systems in a "meaningful" way (Blumenthal, 2010).

In 2017, the meaningful use program was replaced by the Medicare EHR Incentive Program under the Merit-Based Incentive Payment System (MIPS), part of the Medicare Access and CHIP Reauthorization Act (MACRA). The goals of the program remain the same (HealthIT.gov, 2019). A core pillar of the program is engaging patients and their families in their health. The U.S. Department of Health and Human Services' National Quality Strategy views patient engagement as vital to health care policy (Agency for Healthcare Research and Quality, 2016), and supports new care delivery models aimed at improving care quality and health outcomes (Ahern et al, 2011).

According to Coulter, patient engagement may be defined as actions that promote and support active patient involvement in health and health care (Coulter, 2011). Hospitals are adopting HIT as a strategy to facilitate patient engagement (Asagbra, Burke, and Liang, 2018; Coulter, 2011). Moreover, the Centers for Medicare and Medicaid (CMS) recommend and require that physicians and hospitals use HIT that provides functionality that will engage patients in their care (Centers for Medicare & Medicaid Services, 2018). Such functionality allows patients to view, download, and transmit their health information. These features are beneficial in supporting information acquisition, decision support, patient–provider communication, and patient self-monitoring (Wald and McCormack, 2011).

As hospitals work towards meeting these requirements, different hospitals are at different stages in their adoption. Even with the incentives offered and the benefits promised, some hospitals are hesitant and slow to adopt HIT solutions, while others have adopted solutions with a wide range of patient engagement functionalities. Thus, this study aims to document the internal and external factors influencing hospitals' decision regarding how many patient engagement HIT functionalities to adopt. This study will apply the open systems theory (Thompson, 2017) to explain the relationship between these factors and the breadth and number of patient engagement HIT functionalities adopted. This study also focuses on the number of functionalities adopted, and not on the type(s) of technology. It is important to identify what factors determine a hospital's strategic choice to make available a technological functionality that may better engage their patients and offer greater competitive advantage.

CONCEPTUAL FRAMEWORK

Hospitals' adoption of patient engagement HIT functionalities may be viewed as a strategy to improve quality of care and overall hospital performance. It also has the added benefit of meeting legislative requirements and satisfying consumer demand (Centers for Medicare & Medicaid Services, 2018; Fox and Duggan, 2014).

The overarching theoretical framework used in this study is derived from the open systems theory (Thompson, 2017). The theory recognizes the interdependence that exists between an organization and its environment, suggesting that activities that impact the environment will invariably affect the organization and how it performs. Therefore, organizations must take actions and advance strategies to ensure that they survive and thrive in their environment. Strategy involves positioning the organization relative to the environment and competitors to meet organizational goals and assure survival (Shortell and Zajac, 1990).

This study also draws from the resource dependency theory (Pfeffer and Salancik, 1978), which has features in common with the open system perspective, suggesting that organizations depend on external resources that are critical to their success. As such, organizations must be proactive in managing their resources to reduce the uncertainty in their environment (Proenca, Rosko, and Zinn 2003). Therefore, this framework captures the internal and external organizational factors influencing IT strategic positioning.

Accordingly, both internal and external factors will affect the breadth of adoption of patient engagement HIT functionalities by hospitals. Organizations will regularly exchange feedback with their external environment and are dependent on resources in their external environment to be successful. An organization's capacity to quickly react and exploit its environment is instrumental to its success. As such, because of regulatory pressures as well as the potential benefits associated with HIT adoption and the meaningful use of information technology, the environment may prove to be both coercing and enticing hospitals in the United States to adopt HIT that will promote patient engagement.

In addition, such adoption will help hospitals boost their reputation and attract more patients interested in using novel technologies in their health care. Patient engagement HIT functionalities have been suggested to help engage and empower patients to participate in their care, thereby leading to better health outcomes (Ahern et al, 2011). If adapting these functionalities can help hospitals improve efficiency and patient outcomes, this may increase revenues and create more slack resources, thus making it easier for them to adopt even more patient engagement HIT functionalities.

Internal Organizational Factors

The internal organizational factors considered in this study include hospital size, ownership type, system membership, teaching status, and financial capability. Previous studies have shown that organizational characteristics are important for innovation adoption (Damschroder et al*,* 2009; Kimberly and Evanisko, 1981). It is proposed that these hospital characteristics indicative of the organizational context are associated with the adoption of patient engagement HIT functionalities.

Hospital Size. Size has been widely studied and acknowledged to be an important measure of hospital resource capacity; it is also considered to be essential to understanding why organizations adopt innovations (Jensen and Morrisey, 1986; Dewar and Dutton, 1986; Damanpour, 1991). It has been determined that larger organizations are more likely to adopt different innovations than their smaller counterparts (Burke, 2002; Damanpour, 1991; Wang et al., 2005). It is generally argued that this is true because larger organizations have more and/or better infrastructure in place (e.g., IT infrastructure, space, personnel, and capabilities) and so are better able to manage and support new IT innovations. Thus:

H1a: *Large hospitals will adopt more patient engagement HIT functionalities than medium and small hospitals.*

Hospital Ownership. Hospitals are often differentiated based on their tax status (Trinh and Oconnor, 2000; Wheeler et al., 1999) into non-profit and for-profit hospitals. It has been suggested that for-profit hospitals pursue profits for their shareholders, while non-profit hospitals use any surplus to serve the community (Walker and Humphreys, 1993). For-profit hospitals are therefore more likely to adopt the minimum number of functionalities possible, as adopting more may reduce the profits available to their stakeholders. Conversely, non-profit hospitals are more likely to reinvest their surpluses in the adoption of more patient engagement HIT functionalities, given the promise such functionalities offer for their patients (Menachemi et al., 2007; Shin et al., 2012). Therefore:

H1b: *Non-profit hospitals will adopt more patient engagement HIT functionalities than for-profit hospitals.*

System Membership. Some hospitals belong to a larger health system made up of three or more hospitals; these system-affliated hospitals often have advantages typically unavailable to standalone hospitals. For example, health systems are able to communicate and share innovation with their member hospitals through communication channels (Westphal, Gulati, and Shortell, 1997; Rogers, 2010). System-affiliated hospitals benefit from economies of scale and scope, knowledge-sharing, and are better able to coordinate services across their different facilities (Hikmet et al., 2007; Katz and Shapiro, 1986; Li et al., 2008; Madison, 2004; Rosko et al., 2007). System-affiliated hospitals are able to share their costs and risks and have more bargaining power compared to standalone hospitals. Therefore, the following is proposed:

H1c: *System-affiliated hospitals will adopt more patient engagement HIT functionalities than standalone hospitals.*

Teaching Status. Hospital teaching status has been linked to HIT adoption; it is expected that academic hospitals will place a higher emphasis on research, innovation adoption, and quality improvement when compared to other hospitals (Cutler et al., 1998). In support of their patient care, teaching, and research mission, academic hospitals typically have more complex and specialized services that require the adoption of more advanced innovations and technologies (Wang et al., 2005). Thus, it is proposed that:

H1d: *Teaching hospitals will adopt more patient engagement HIT functionalities than non-teaching hospitals.*

Financial Capacity. Studies have generally found that the financial capacity of an organization will typically influence its strategic decisions. Based on this perspective, organizations with excess revenue or cash flow may apply these funds to finance projects that may or may not directly support the primary mission of the organization. It has been argued that an attempt to increase compensation motivates top managers to increase their firm's size and capital investments, since these metrics are closely linked (Burke and Menachemi, 2004). Therefore:

H1e: *Hospitals with more financial capacity will adopt more patient engagement HIT functionalities than hospitals with less financial capacity.*

External Environmental Factors

The external environmental factors considered here are based on three dimensions of the environment: uncertainty, munificence, and complexity (Dess and Beard, 1984).

Environmental Uncertainty. Changes or turbulence in the environment may result in instability in the environment. This often causes concern for organization operating within the environment, because it could mean disruption of their operations that may negatively affect their bottom line. Some organizations, however, are more used to and better able to cope with uncertain environments than others; these organizations are better able to manage their resources and resource stability (Kazley and Ozcan, 2007).

Environmental uncertainty has been operationalized in the healthcare literature as managed care penetration (Kim, Thompson, and Herbek, 2012; Mazurenko and Hearld, 2015). It is suggested that environments with high managed care penetration will impose more uncertainty on hospitals, since managed care organizations will often pressure hospitals to improve quality and cost-effectiveness (Brown, 2003; Proenca, Rosko, and Zinn, 2000; Sari, 2002). Additionally, given the legislative pressures to adopt HIT for patient engagement, as well as its linkage to reimbursements from Medicare, environmental uncertainty is increased for hospitals highly dependent on Medicare for revenue (Hsieh, Clement, and Bazzoli, 2010; Thompson and McCue, 2004). Hence:

H1f: *As environmental uncertainty increases, hospitals will adopt more patient engagement HIT functionalities*.

Environmental Munificence. Environmental munificence reflects the amount of critical resources available in the environment to support organizational activities. Munificent environments provide organizations with a rich pool of skilled employees, access to financial resources (e.g., loans, investments and donations), as well as a choice of potential suppliers.

Environmental munificence has been operationalized in the healthcare literature as areas with high per capita income and urban areas. Hospitals located in areas with high per capita income or in urban areas (vs. rural areas) can leverage their location to acquire more resources (Burke et al., 2002; Furukawa et al., 2006). These hospitals will be able to acquire the necessary infrastructure and attract skilled IT professionals to help adopt and manage increased HIT capacity. On the other hand, it may be more costly for hospitals located in less munificent environments to find the resources (both personnel and financial) to develop and manage their IT infrastructure (Reddy, Purao, and Kelly, 2008). Therefore:

H1g: *As environmental munificence increases, hospitals will adopt more patient engagement HIT functionalities.*

Environmental Complexity. This describes the many similar types of organization, as well as inter-organizational relationships, that exist in the organization's environment. It is important to consider this characteristic, since organizations in the same environment often compete for limited resources in order to survive (Pfeffer and Salancik, 1978). Competition for these resources will increase as the number of similar organizations in the market increases. In order to differentiate themselves and be more competitive in their markets, organizations will often adopt innovations that could help enhance their

sustainable competitive advantage (Pfeffer and Salancik, 1978). Furthermore, studies have indicated that offering HIT is associated with positive patient's experiences, clinical outcomes, and organizational productivity. On the other hand, there is little incentive for hospitals that have less competition to invest in new technologies. Thus:

H1h: *As environmental complexity increases, hospitals will adopt more HIT functionalities for patient engagement.*

METHOD

Study Setting and Data Sources

This study focused on non-government-owned acute care hospitals located in the United States. Data were obtained from four different sources: the American Hospital Association's (AHA) 2012–2013 annual survey, the 2012–2013 AHA annual survey information technology supplement, the Area Health Resource File (AHRF), and the Centers for Medicare and Medicaid (CMS). These datasets were merged based on Medicare provider numbers. Hospitals that did not have a match across all datasets and years were excluded. The definition and description of the variables included in this study, and sources of data, are presented in Table 1.

TABLE 1
SUMMARY AND OPERATIONALIZATION OF VARIABLES

Variables	**Definition**	**Data Source**
Adoption categories (Dependent variable)	Categories of hospitals based on the total count of patient engagement HIT functionalities adopted. High adoption (9–11), medium adoption (5–8), low adoption (1–4), and no adoption	American Hospital Association (AHA) IT Survey Supplement
Organizational Factors		
Hospital size	Number of staffed inpatient beds. Small ≤ 99; Medium 100–399; Large ≥ 400	American Hospital Association (AHA) Annual Survey
Ownership status	Hospital Ownership Type: For-profit ownership, Non-profit ownership	
System membership	Affiliation with hospital system (Yes/No)	
Teaching status	Membership in council of teaching hospitals (Yes/No)	
Measures of financial strength (Independent variable)	Total margin, [net income / total revenues *100] Operating margin, [net operating income / operating revenues * 100]	Centers for Medicare and Medicaid (CMS) Cost Report
Environmental Factors		
Medicare penetration rate	# of Medicare enrollees in managed care plans per number of eligible Medicare beneficiaries	Area Health Resource File
Per capita income	Average income per person for hospital's market area (county)	
Geographic location	Urban (metro metropolitan statistical area (MSA) with population > 50,000) Rural (micro metropolitan statistical area (MSA) with population < 50,000)	
Competition: Herfindahl-Hirschman Index (HHI)	Sum of the squared ratios of each hospital's admission to the market total admissions	

The AHA Annual Survey and the AHA Annual Survey IT Supplement are prepared annually by the AHA. In this study, data from the AHA Annual Survey was used to measure the hospital characteristics and the IT Supplement provided hospital-level details on hospitals' adoption of patient engagement HIT functionalities. The Area Health Resource File (AHRF) was used to assess county level information about a hospital's market area. The Centers for Medicare and Medicaid (CMS) cost report is a consistent and standard source of financial information used for health research purposes. It contains provider information such as facility characteristics, utilization data, costs and charges by cost center (in total and for Medicare), Medicare settlement data, and financial statement data.

Variables

Adoption Categories. This variable reflects the number or breadth of HIT functionalities offered to facilitate patient engagement. The breadth of patient engagement HIT functionalities was the predictor variable. It was calculated by counting, for each hospital, the number of functionalities that may be considered to promote patients' involvement in their care. These functionalities were obtained from the AHA IT supplement dataset. Table 2 presents a list of the patient engagement HIT functionalities examined in this study. Based on the breadth of functionalities adopted, four categories of hospitals were identified: those with high (9–11), medium (5–8), low (1–4), and no adoption.

TABLE 2
LIST OF MEASURED PATIENT ENGAGEMENT FUNCTIONALITIES

1. Patient can access an electronic copy of their discharge instructions upon request
2. Patient can access an electronic copy of their record upon request within 3 business days
3. Patient can access self-specific education resources
4. Patient can view information from their health/medical record online
5. Patient can download information from their health/medical record
6. Patient can electronically send care/referral summaries to a third party
7. Patient can request an amendment to change/update their health/medical record
8. Patient can request refills for prescriptions online
9. Patient can schedule appointments online
10. Patient can pay bills online
11. Patient can submit self-generated data

Internal Organizational Factors. Hospital size was measured as the total number of staffed inpatient beds, categorized to include three possible values: large, with 400 beds or more; medium, with 100 to 399 beds; and small, with 99 beds or less. Hospital ownership is a binary variable, measured as whether the hospital is for-profit or non-profit. System membership is a binary variable measured as whether a hospital is affiliated with a health system. Teaching status is a binary variable measured as whether the hospital has membership in the Council of Teaching Hospitals (COTH). Two hospital profitability measures, operating margin and total margin (Je'McCracken et al., 2001) obtained from the CMS cost report data were used to operationalize financial capability. Operating margin takes into account hospital revenue from direct patient care only, operating income, and excludes non-operating sources of income or expenses such as government appropriations, philanthropy, endowments, grants, investments, gift shops, and all other non-patient care-related expenses or revenues. It is calculated as operating income (net patient revenue minus total gross operating expenses) divided by operating revenues. Total margin refers to the overall hospital revenue from both direct patient and non-patient care-related income, including investments, public appropriations, and donations. It is important to include total margin here, since this study examines hospitals that experience both non-operating revenue and expenses with some frequency. It is calculated as all revenues minus all expenses, divided by total revenues.

External Environmental Factors. These reflect the characteristics of the environment in which each hospital is located. Environmental uncertainty was operationalized as Medicare penetration rate. It is computed as the number of Medicare enrollees in managed care plans per the total number of eligible Medicare beneficiaries in a hospital's local market. Environmental munificence was operationalized as the per capita income of potential customers in the county. It reflects the amount of wealth in a hospital's market area. Natural log transformations were performed for per capita income to normalize its values. Geographic location (urban vs rural) was also used to assess munificence. It was computed as a binary variable. Environmental complexity was operationalized using the Herfindahl–Hirschman Index (HHI). According to the Department of Justice's guidelines for antitrust enforcement, it is the standard measure of hospital competition. The index ranges from approaching 0 to 1. It is calculated as the hospital's inpatient days as a percentage of total inpatient days in the county. Competitive markets will have HHI values approaching 0, while an HHI value of 1 indicates a monopoly. Medicare penetration rate, per capita income, and geographic location were obtained from AHRF, while HHI was calculated from the AHA Annual Survey.

Analytical Strategy

TABLE 3
PATIENT ENGAGEMENT HIT FUNCTIONALITIES ADOPTED

Adoption Categories		**2012**	**2013**	**Combined Years**
		Count (Mean)	Count (Mean)	Count (Mean)
No	–	65 (–)	30 (–)	95 (–)
Low	1–4	855 (3.00)	730 (3.24)	1,585 (3.11)
Medium	5–8	544 (6.32)	537 (6.45)	1,081 (6.38)
High	9–11	158 (9.40)	325 (9.70)	483 (9.60)
Total		1,622 (4.62)	1,622 (5.54)	3,244 (5.08)

The unit of analysis is the hospital-year. A longitudinal study design was used for data analysis. A total sample size of 1,612 hospitals was obtained from the merged datasets from 2012 to 2013. Natural log transformation was also performed for per capita income to normalize its values. A multinomial logistic regression was then performed with high adoption hospitals (9–11) as the reference group. The multinomial logistic regression is an extension of logistic regression which analyzes dichotomous outcome variables. Multinomial logistic regression was used with a categorical outcome variable with more than two levels. In this case, the outcome variable was measured as the adoption categories reflecting the breadth of patient engagement HIT functionalities adopted by a hospital.

The predictor variables included in the model were the organizational and environmental factors highlighted above. Non-profit hospitals, non-system member hospitals, non-teaching hospitals, and hospitals located in rural areas were used as reference groups for the respective categorical predictors (ownership type, system membership, teaching status, and geographic location) included in the model. A chi-square analysis was used to test the relationship between adoption category and categorical organizational characteristics, including hospital size, ownership type, system membership, and teaching status. This analytic strategy served to examine which factors were important in predicting the number and breadth of patient engagement HIT functionalities hospitals are likely to adopt. SPSS v.23 was used for data management and STATA v.14 for data analysis. Only statistically significant results ($p < 0.05$) are discussed.

RESULTS

Univariate and Bivariate Analysis

Data from two years—2012 and 2013—were included in this study. Thus, the total sample size of 1,612 hospitals translated to a total of 3,224 hospital-year observations examined. On average, the hospitals included in this study had adopted of 5.08 out of a total of 11 patient engagement functionalities. An increase from 4.62 functionalities in 2012 to 5.54 functionalities in 2013 was observed (Table 3). Overall, low-, medium-, and high-adoption hospitals offered a respective average of 3.11, 6.38, and 9.60 patient engagement HIT functionalities to their patients. From the cross-tabulation presented in Table 4, it can be observed that there were statistically significant differences in functionality adoption based on hospital characteristics. The cross-tabulations show that for each hospital category, a higher proportion of hospitals that were large, non-profit, system members, and teaching hospitals were medium and high adopters.

Multivariate Analysis

This study further revealed that some organizational and environmental factors were important in determining the number of patient engagement HIT functionalities. Specifically, high adopters were larger hospitals compared to those with low ($\beta = -0.002$, $p < 0.01$) and no adoption ($\beta = -0.005$, $p < 0.01$). Hospitals with high adoption were also more likely to be for-profit and members of a health system. High adopters had better total margins and operating margins compared to hospitals with no adoption ($\beta = -0.075$, $p < 0.01$) and ($\beta = -0.058$, $p < 0.05$), but high-adoption hospitals show better total margins only compared to hospitals with low adoption ($\beta = -0.050$, $p < 0.01$). Moreover, high adopters were more likely to be located in highly uncertain environments than hospitals with medium ($\beta = -0.025$, $p < 0.01$), low ($\beta = -0.039$, $p < 0.01$), and no adoption ($\beta = -0.027$, $p < 0.01$). Additionally, compared to hospitals with low adoption ($\beta = -1.182$, $p < 0.01$), high adopters were more likely to be located in areas with higher per capita income. These results are presented in Table 5.

TABLE 4
CROSS-TABULATION OF HOSPITAL CHARACTERISTICS AND ADOPTION CATEGORY

Table 4a: Cross-tabulation of Hospital Size and Adoption Category

Hospital Size	No Adoption	Low Adoption	Medium Adoption	High Adoption	Total
Small	62 (4.9%)	723 (56.9%)	350 (27.6%)	135 (10.6%)	1270 (100%)
Medium	29 (1.9%)	716 (47.3%)	540 (35.7%)	229 (15.1%)	1514 (100%)
Large	4 (0.9%)	146 (31.7%)	191 (41.5%)	119 (25.9%)	460 (100%)
Total	95 (2.9%)	1585 (48.9%)	1081 (33.3%)	483 (14.9%)	3244 (100%)

Chi-square (6 df) = 151.01 ($p < 0.001$)

Table 4b: Cross-tabulation of Ownership Status and Adoption Category

Ownership Status	No Adoption	Low Adoption	Medium Adoption	High Adoption	Total
For-profit	21 (5.7%)	250 (67.8%)	94 (25.5%)	4 (1.1%)	369 (100%)
Non-profit	74 (2.6%)	1335 (46.4%)	987 (34.3%)	479 (16.7%)	2875 (100%)
Total	95 (2.9%)	1585 (48.9%)	1081 (33.3%)	483 (14.9%)	3244 (100%)

Chi-square (3 df) = 102.25 ($p < 0.001$)

Table 4c: Cross-tabulation of System Membership and Adoption Category

System Membership	No Adoption	Low Adoption	Medium Adoption	High Adoption	Total
System member	58 (2.6%)	977 (43.6%)	800 (35.7%)	405 (18.1%)	2240 (100%)
Non-system member	37 (3.7%)	608 (60.6%)	281 (28%)	78 (7.8%)	1004 (100%)
Total	95 (2.9%)	1585 (48.9%)	1081 (33.3%)	483 (14.9%)	3244 (100%)

Chi-square (3 df) = 105.50 ($p < 0.001$)

Table 4d: Cross-tabulation of Teaching Status and Adoption Category

Teaching Status	No Adoption	Low Adoption	Medium Adoption	High Adoption	Total
Teaching hospital	2 (0.8%)	64 (24.2%)	124 (47%)	74 (28%)	264 (100%)
Non-teaching hospital	93 (3.1%)	1521 (51%)	957 (32.1%)	409 (13.7%)	2980 (100%)
Total	95 (2.9%)	1585 (48.9%)	1081 (33.3%)	483 (14.9%)	3244 (100%)

Chi-square (3 df) = 89.66, ($p < 0.001$)

TABLE 5
DETERMINATION OF THE NUMBER OF PATIENT ENGAGEMENT HEALTH IT FUNCTIONALITIES ADOPTED

	Variables	No Adoption β	Low Adoption β	Medium Adoption β
Organizational factors				
	Hospital size (small)	1.757**	0.829***	0.364
	Hospital size (medium)	0.653	0.411**	0. 277
	For-profit	3.610***	3.189***	2.443***
	System member	-1.268***	-1.259***	-0.669***
	Teaching hospital	-0.622	-0.658**	0.024
	Total margin	-0.077***	-.050***	-0.021
	Operating margin	-0.059**	-0.015	0.006
Environmental factors				
Uncertainty	Medicare penetration rate	-0.026**	-0.038***	-0.025***
Munificence	Urban location	0.231	-0.040	-0.042
	Ln per capita income	-1.708**	-1.170**	-0.419
Complexity	Herfindahl-Hirschman Index (HHI)	-0.635**	-0.208	-0.048
	Constant	16.994	14.960**	6.101

*p < 0.1; **p < 0.05; ***p < 0.001

DISCUSSION

This study examines the internal and external factors important in determining the number and degree of adoption of patient engagement HIT functionalities adopted by a hospital. This study accepts the adoption of patient engagement HIT functionalities as a strategy that an organization uses to position itself relative to the environment and its competitors.

The hypotheses proposed in this study suggest that the number of adoption varies among hospitals based on their organizational characteristics and environmental conditions. Six of the eight hypotheses proposed were found to be supported. This study found that several hospital characteristics are significantly associated with the number of patient engagement HIT functionalities adopted. Hospitals that are larger, non-profit, system members, and have a teaching program were more likely to adopt a high number of patient engagement functionalities. Moreover, environmental uncertainty and complexity appear to influence the number of functionalities hospitals will adopt. The findings for environmental munificence, however, were mixed.

The findings related to the first five hypotheses are explained as follows: first, for hospital size, the relative log odds of adopting no functionalities versus adopting a high number of functionalities increase by 1.757 for small hospitals compared to larger hospitals. Subsequently, the relative log odds of being a low functionality adopter versus a high functionality adopter increase by 0.411 for medium sized hospitals compared to larger hospitals. Second, adoption of a high number of patient engagement HIT functionalities was shown to be significantly associated with hospital ownership status. Simply put, the relative log odds of adopting no, or a low, or medium number of HIT functionalities versus adopting a high number of functionalities increase for for-profit hospitals compared to non-profit hospitals. Third, the relative log odds of adopting no, low, or a medium number of functionalities versus adopting a high number of functionalities decrease for system member hospitals compared to non-member hospitals. Fourth, the relative log odds of adopting low functionalities versus adopting a high number of functionalities decrease for teaching hospitals when compared to non-teaching hospitals. For the sixth hypothesis, financial capacity is significantly associated with adopting more patient engagement functionalities. Accordingly, it may be explained that a one-unit increase in total margin is associated with a 0.077 decrease in the relative log odds of adopting no functionality and a 0.050 decrease in the relative log odds of adopting a low versus a high number of patient engagement functionalities. Additionally, a one-unit increase in operating margin is associated with a 0.059 decrease in the relative log odds of adopting no functionality versus adopting a high number of patient engagement functionalities.

Hospitals with certain internal characteristics have the capacity to explore and adopt more innovations of all types, including patient engagement HIT functionalities. For instance, larger hospitals are better able to manage and support new IT innovations than their counterparts. Non-profit hospitals, given their community-oriented mission, are more likely to reinvest their surplus on innovations like patient engagement HIT functionality that may benefit their patients. System-affiliated hospitals have more bargaining power than standalone hospitals, as well as the ability to share their costs and risks with other hospitals in the system. As such, they are in a better position to adopt more innovations that could benefit their patients. Given the type of complex and specialized services teaching hospitals offer, they are more likely to adopt more advanced innovations and technologies that support patient care and outcomes. Finally, hospitals with more financial resources will be able to afford to implement more HIT to engage with patients, especially if these functions are required by governmental legislation and/or public demand.

The findings based on the hypotheses related to environmental factors are interpreted as follows: for the seventh hypothesis, uncertainty, operationalized as Medicare penetration rate, is shown to be significantly associated with adopting more patient engagement functionalities. A one-unit increase in Medicare penetration rate is associated with a 0.026 decrease in the relative log odds of no adoption, a 0.038 decrease in the relative log odds of low adoption, and a 0.025 decrease in the relative log odds of medium adoption versus adopting a high number of patient engagement HIT functionalities. Environmental uncertainty will urge hospitals to adopt a high number of functionalities in an effort to

minimize the instability arising from governmental legislation, such as the meaningful use requirements and pressures from commercial health plans as they conform to policy changes.

Environmental munificence was operationalized as both geographic location (urban and rural) and per capita income. This study, however, reveals mixed results in explaining the adoption of patient engagement HIT functionalities. Per capita income is significantly associated with adopting a greater number of patient engagement functionalities (vs. no adoption: $\beta = -1.708$, $p < 0.05$; vs. low adoption: $\beta = -1.170$, $p < 0.05$), but no significant association was observed for geographic location (vs. no adoption: $\beta = 0.231$, $p = 0.352$; vs. low adoption: $\beta = -0.040$, $p = 0.732$; vs. medium adoption: $\beta = -0.042$, $p = 0.724$). A one-unit increase in per capita income is associated with a 1.708 decrease in the relative log odds of no adoption, and a 1.170 decrease in the relative log odds of low adoption versus adopting a high number of patient engagement HIT functionalities. Hospitals located in environments with higher per capita income adopt more patient engagement HIT functionalities. Environmental complexity, operationalized as competition, is also significantly associated with adopting more patient engagement functionalities. As competition increases by one unit, the relative log odds of no adoption versus adopting a high number of patient engagement HIT functionalities decreases by 0.635. In other words, hospitals located in more competitive environments are more likely to adopt a greater number of patient engagement HIT functionalities.

Despite the important findings of this study, several potential limitations of this research have been identified. First, the sample was limited to hospitals that responded to the AHA annual IT supplement survey from 2012 to 2014, which may have introduced selection bias. Therefore, the results may not necessarily be generalizable to all hospitals in the United States. Also, this study uses secondary data derived from surveys, which are subject to potential control and transcription problems. However, the secondary data used here are widely accepted and used in health care research. Additionally, it is also likely that other factors, like culture, leadership, physician acceptance, IT governance and readiness (Wang, Wang, and Yang, 2010; Pan and Jang, 2008; Oliveira and Martins, 2010; Cresswell and Sheikh, 2013; Agarwal et al., 2010) may have influenced the breadth of adoption of patient engagement HIT functionalities; however, data on these factors are however not readily available from secondary data sources, and so they could not be included in this study. Lastly, this study was a nonrandomized longitudinal study and its ability to establish causality may be limited. Notwithstanding, this study reveals associations important to healthcare managers and policymakers.

CONCLUSION

The HITECH Act encourages the adoption of HIT in anticipation that this will help improve health care quality, reduce health disparities, and promote patient-centered delivery of medical care (Coulter, 2011). This study presents a categorization of hospitals based on the number of patient engagement functionalities they offer through HIT. It finds an overall positive trend in the number of HIT functionalities hospitals offer to engage patients. However, organizations will often weigh political pressure in light of their economic realities. This study suggests that even with the incentives provided to hospitals, administrators are still obligated to consider their unique organizational characteristics, including their financial position, in their strategic adoption of technology for patient engagement. They also consider the characteristics of the environment in which they are located to determine what external factors are likely to impact the strategic decisions they make. Policy makers should consider these organizational and environmental factors as they attempt to reduce hindrances to achieving nationwide adoption of HIT for patient engagement.

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