Electronic Healthcare's Relationship With Patient Satisfaction and Communication

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Abstract: Healthcare information technology (HIT) has been examined and shown to be a tool to improve patient healthcare quality. This study seeks to define the relationship between HIT applications such as computerized physician order entry, clinical decision support systems, and handheld device use and select Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) measures (doctor and nurse communication, discharge instructions, and whether the patient would highly recommend the hospital). Several control variables were used that represent the hospital level and contextual hospital service area level. The analysis had mixed results: the aforementioned HIT applications may add and support certain HCAHPS measures (Always Given Discharge Information), whereas there were no significant findings for the more interpersonal quality measures (nurse and doctor communication, recommendation). These results show that although patients may not score doctors and nurses significantly higher for their communication in hospitals that use HIT, they did receive discharge instructions significantly at a higher rate than the non-HIT hospitals.

Keywords
patient experience
healthcare information technology
HCAHPS
doctor communication
discharge instructions

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Introduction

Implementation of any healthcare information technology (HIT) tool or application can present several challenges to a healthcare organization. One challenge in particular that may pose a risk to the healthcare organization's value-based purchasing (VBP) quality incentive payment is patient satisfaction (Centers for Medicare and Medicaid Services (CMS), HHS, 2011). Patient experience measures account for 30% of the value-based payment. Several studies, as outlined below, demonstrate associations and causal links between HIT and improved quality; however, few have investigated the link between HIT and what happens in regard to provider–patient communication, discharge instructions, or if the patient was more or less likely to recommend the hospital.

The HIT and its many subcomponents have been shown to have mixed results on clinical healthcare quality (Ash et al., 2004; Kazley and Ozcan, 2007; Mitchell et al., 2013; Swanson Kazley and Diana, 2011). Moving beyond clinical improvements, one important implication of HIT use that has not been thoroughly addressed is its relation to patient-reported quality data. Similarly to healthcare process quality, HIT and patient experience measures have also seen mixed results. Recently, Jarvis and colleagues (2013) found no difference between Electronic Healthcare Record (EHR) user hospitals and experience of care scores. In practice, nurses have noticed that by focusing too much on the technology, they sometimes get overwhelmed and stop observing the patient as a whole (Lomas, 2010). Contrarily, Restuccia and colleagues (2012) found that hospitals with high levels of HIT implementation had significantly better patient satisfaction measures. The purpose of this study is to determine any associations between HIT applications and characteristics and patient-reported quality using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) dataset. Specifically, this study focused on computerized physician order entry (CPOE), clinical decision support systems (CDSS), and handheld devices and their relationship with select HCAHPS measures.

Patient and Contextual Factors

Patient-reported data may be influenced by factors outside the immediate control of a hospital. In a 2010 study, Elliott and colleagues (2010) reported that race (African American and Hispanic), gender (female), education, and language (Spanish or other) were all significant predictors of lower HCAHPS measures. The disparity in HCAHPS measures between male and female has been shown to be more dramatic in for-profit hospitals as compared with not-for-profit hospitals (Elliott et al., 2012). Moreover, Goldstein and colleagues (2010) found that non-Hispanic White patients received care at hospitals with higher HCAHPS than their racial minority counterparts. Contextual factors may influence the patient satisfaction measures. Casey and Davidson (2010) found that hospitals within rural areas had significantly higher HCAHPS ratings than those in urban areas.

Methods

Conceptual Model/Variables

This study used both the Donabedian model for healthcare quality of Structure–Process–Outcome, within the context of the Andersen Behavioral Model to incorporate environmental factors. The Donabedian model justified the independent variables of CDSS, CPOE, and handheld technologies (structural), as well as the dependent variables of doctor and nurse communication, discharge information (process), and finally the patient's high recommendation (outcome). Other control variables that the Donabedian provided were for-profit status, number of physicians, bed size, and payer mix. The Andersen Behavioral Health Model justified the contextual factors of rural/urban location, percent of White race, percent of high-school graduate, median household income, and percent of people who do not or speak English poorly. Contextual variables were collected from the Research Triangle Institute's (RTI) Spatial Impact Factor Database (2013) at the Zip Code Tabulation Area (ZCTA) level and were aggregated to the Hospital Service Area (HSA) using a weighted average.

Data

Secondary data were used from the 2013 Research Triangle Institute's Spatial Impact Factor Database (RTI International, 2013), the 2013 Centers for Medicare and Medicaid Service's (CMS) HCAHPS survey (HCAHPS, 2014), and lastly the 2011 HIMSS Analytics (formerly Dorenfest Institute) healthcare IT database (HIMSS Analytics, 2011). All HIT variables were collected from the HIMSS Analytics database. The 2-year difference between datasets allowed for the structure (HIT elements) to settle and integrate into the provider workflow before the patient-reported HCAHPS data were collected. Although there are limitations to this methodology, it allows for time for the HIT to mesh with providers' workflows. All contextual zip code–level variables were collected from the RTI Spatial Impact Factor Database, which were then aggregated to the hospitals' HSA using the Dartmouth Atlas of Health Care's crosswalk using a weighted (by ZCTA population) average (Dartmouth Atlas of Health Care, 2014). Finally, all patient-reported hospital quality measures were collected from HCAHPS.

Patient satisfaction, as measured by the CMS HCAHPS (HCAHPS, 2014) is the first national survey that represents patients' perceptions of hospital care. The survey measures communication with nurses and doctors, staff responsiveness, pain management, medication communication, and discharge instructions. The survey also includes patient room cleanliness and quietness, along with a hospital rating and whether patients would recommend the hospital. Due to the scope of this study focusing specifically on patient interactions, the four HCAHPS measures used were nurse (always) communication, physician (always) communication, discharge instructions, and whether the patient would highly recommend the hospital. Specifically, for both doctor and nurse communication, the HCAHPS survey asked the patient, "How often did nurses/doctors communicate well with you?" Being aggregated to the hospital level, the responses were "Percent Never," "Percent Usually or Sometimes," and "Percent Always"; this study used the "Percent Always" for the independent variables of doctor and nurse communication. Likewise, for discharge instructions, patients were asked, “Were you given information about what to do during your recovery?” The responses to this question were “Percent Yes” and “Percent No”; this study used “Percent Yes” for the corresponding independent variable. Finally, for a high recommendation, the variable used was the percentage of respondents that said, “Would definitely recommend.”

Statistical Analysis

All analyses were conducted in SAS (Cary, NC). The study population started with 4,948 hospitals that responded to the HIMSS survey. After merging with the HCAHPS survey, the final study population consisted of 3,221 hospitals. Hospitals with missing data were not included in the analysis. Preliminary analysis described the study population of hospitals across type of HIT used. Unadjusted analysis estimated select HCAHPS measures across hospitals that do and do not use those HIT elements. Significant differences were identified using Wald chi-square tests for categorical variables and Student *t* tests for continuous variables. Finally, multivariable ordinary least squares regression analyses were performed, adjusted for hospital and environmental characteristics.

Results

Descriptive statistics of the study population are represented in Table 1. The acute care hospitals with CDSS were significantly more likely to have more physicians, lower revenue percentage from Medicare or Medicaid, more beds, be located in a nonrural location, be in a HSA with a higher population that speaks no or poor English, and a lower percentage of high school graduates, as compared with hospitals that do not have a CDSS. The CPOE usage was divided into five categories: none, 1–25%, 25–50%, 51–75%, and 75–100%. Generally, hospitals with CPOE had more physicians, less revenue derived from Medicare and Medicaid, more beds, more likely not-for-profit, in an urban area, and in HSAs with higher median household income, higher percentage of White people, and lower percentage of high school graduates. Hospitals that use handheld devices along with an EMR were more likely a higher number of physicians, lower percentage of revenue from Medicare and Medicaid, more beds, be not-for-profit, be located in urban areas, higher median household income area, and lower rates of high school graduates.

Table 2 introduces unadjusted analyses for the three HIT elements (CDSS, CPOE, and handhelds) with their respective percentages for nurse and doctor communication, discharge instructions, and the patient’s high recommendation. Hospitals with CDSS had significantly lower percentages of nurses and doctors always communicating with patients. Conversely, those hospitals using CDSS did have higher percentages of giving discharge instructions to those patients. Hospitals with CPOE had significantly higher percentages of nurse and doctor communication, discharge instructions, and a high recommendation from the patient. Hospitals using handheld devices as part of their HIT strategy had significantly lower scores of nurse and doctor communication.

Table 3 represents the adjusted analysis for the patient rating “always” for being given discharge information. When placed in adjusted analysis, none of the other HCAHPS variables of interest were significantly predicted by any of the HIT elements (therefore omitted from the table). In Table 3, all three of the HIT elements (CDSS, CPOE, and handheld devices) had independent positive associations with discharge information given to the patient all the time. In the same models, payer mix and median household income were both negatively associated with discharge information always given to the patient, although non-Hispanic White percentage in the HSA had a positive association.

Discussion

In the unadjusted analysis, while the models measuring discharge information and a high recommendation did not show

Table 1. Description of Study Variables and Select Covariates

	CDSS		CPOE					Handheld Devices	
	Yes	No	1–25%	26–50%	51–75%	76–100%	None	Yes	No
Hospital level									
Number of physicians	308.23 (405.27)*	102.32 (218.29)*	250.46 (320.04)*	289.40% (353.22)*	273.01 (285.27)*	483.89 (538.62)*	234.86 (356.31)*	381.29 (441.44)*	231.23 (356.70)*
Percent revenue from public (payer mix)	53.83% (13.85)*	61.24% (15.68)*	55.01% (11.67)	52.79% (13.44)	54.72% (13.28)	51.72% (13.02)*	56.38% (15.04)*	51.84% (13.51)*	56.56% (14.55)*
Number of beds	190.22 (194.41)*	79.79 (126.38)*	166.89 (181.39)	198.78 (194.11)	201.28 (206.24)	273.85 (252.55)*	146.86 (165.93)*	227.58 (205.18)*	147.45 (176.97)*
Control									
Non-Federal Government	71.81%	28.19%	32.80%*	17.36%*	11.90%*	37.94%*	72.52%	21.45%*	78.55%*
For profit	78.61%	21.39%	38.10%*	13.33%*	17.14%*	31.43%*	89.21%	12.79%*	87.21%*
Not-for-profit	88.13%	11.87%	23.23%*	12.36%	15.24%*	49.16%*	64.28%	35.51%*	64.49%*
Contextual									
Location									
Urban	86.87%*	13.13%*	22.04%*	12.63%*	14.58%*	50.75%*	66.15%	32.13%*	67.87%*
Micropolitan	88.11%*	11.89%*	38.05%*	11.71%*	16.59%*	33.66%*	74.85%	30.88%*	69.12%*
Rural	67.56%*	32.44%*	32.30%*	17.70%	12.92%*	37.08%*	77.28%	17.05%*	82.95%*
Median house income	$39,997.50 ($11,520.77)	$36,541.00 ($9,678.66)	$39,567.38 ($10,691.71)	$39,394.04 ($11,028.15)	$41,083.21 ($12,443.62)*	$43,413.96 ($13,213.98)*	$38,502.38 ($10,687.55)*	$40,788.80 ($11,465.61)*	$38,834.10 ($11,158.38)*
Poor or no English	19.21% (9.50)*	18.20% (10.32)	18.07% (9.05)	18.94% (9.55)	19.11% (9.92)	18.51% (8.76)	19.27% (9.87)	18.79% (8.92)	19.12% (9.93)
Percent White	73.59% (21.41)	75.01% (22.59)	76.35% (20.89)*	76.04% (18.45)*	74.34% (21.46)	71.21% (22.22)*	74.55% (21.74)	74.35% (19.82)	73.63% (22.27)
High school graduates	33.71% (5.98)*	34.96% (6.09)*	34.23% (6.01)	33.66% (5.68)	33.75% (5.58)	32.45% (6.56)*	34.25% (5.91)*	33.62% (5.85)*	34.05% (6.07)*

*Significantly different at $p < .05$.
Standard deviations are shown in parenthesis.

Table 2. Unadjusted (Bivariate) Analysis of HIT and Select HCAHPS Measures

	Nurse communication			Doctor communication			Discharge instruction		Recommend hospital
	Never	Usually	Always	Never	Usually	Always	No	Yes	Highly yes
CDSS									
Yes	4.75% (2.58)	17.44% (3.39)*	77.81% (5.15)*	4.36% (2.17)*	14.66% (3.35)*	80.98% (4.86)*	15.78% (4.20)*	84.22% (4.20)*	70.44% (9.14)
No	4.77% (3.68)	16.27% (4.34)*	78.97% (6.96)*	4.05% (3.04)*	13.15% (4.42)*	82.80% (6.41)*	16.41% (6.27)*	83.60% (6.27)*	69.81% (10.84)
CPOE									
None	4.97% (2.16)*	17.30% (3.53)	77.73% (5.09)*	4.39% (2.09)*	14.37% (3.79)*	81.24% (5.28)*	16.26% (4.75)*	83.74% (4.75)*	69.43% (8.87)*
1–25%	4.08% (2.22)*	17.00% (3.45)	78.92% (4.86)*	3.82% (2.21)*	14.17% (3.62)*	82.01% (5.21)*	14.90% (4.07)*	85.10% (4.07)*	71.83% (9.23)*
26–50%	4.16% (2.34)*	16.88% (3.11)*	78.97% (4.79)*	4.03% (1.77)	14.01% (2.90)*	81.97% (4.25)*	15.33% (4.10)*	84.67% (4.10)*	71.48% (7.97)*
51–75%	4.47% (2.36)*	17.62% (3.04)*	77.91% (4.66)	4.41% (1.97)*	15.03% (2.95)*	80.56% (4.23)*	15.44% (3.50)*	84.56% (3.50)*	71.75% (7.96)*
76–100%	4.41% (2.90)*	17.49% (3.66)*	78.10% (5.65)*	4.33% (2.41)*	15.15% (3.62)*	80.51% (5.28)*	14.83% (3.63)*	85.17% (3.63)*	73.11% (9.64)*
Handheld									
Yes	4.58% (2.32)*	17.64% (3.23)*	77.78% (4.81)	4.40% (2.03)	15.13% (3.11)*	80.47% (4.49)*	15.72% (4.08)	84.28% (4.08)	70.80% (9.09)
No	4.83% (2.90)*	17.14% (3.65)*	78.03% (5.66)	4.29% (2.41)	14.19% (3.67)*	81.53% (5.33)*	15.92% (4.68)	84.08% (4.68)	70.17% (9.48)

*Significantly different at $p < .05$.
Standard deviations are shown in parenthesis.

Table 3. Adjusted Analysis for Discharge Information

	Discharge information = all the time		
	CDSS model	CPOE model	Handheld model
Intercept	82.489*	82.745*	83.369*
CDSS			
Yes	0.960†		
CPOE (ref: none)			
76–100%		1.341†	
51–75%		0.516	
26–50%		1.778†	
1–25%		0.722	
Handheld			
Yes			0.682†
Number of physicians	0.001†	0.001	0.001
Percent revenue from public (payer mix) (n = 1,056)	−0.045†	−0.045†	−0.046†
Number of beds	−0.001	−0.001	−0.001
Control (ref: not-for-profit)			
For profit (n = 977)	−0.646	−0.518	−0.588
Non-Federal Government (n = 2,957)	−0.560	−0.542	−0.574
Location (ref: urban)			
Micropolitan (n = 816)	0.281	0.285	0.336
Rural (n = 1,560)	0.292	0.188	0.297
Median house income	−0.001†	−0.001†	−0.001†
Poor or no English	0.879	1.254	1.083
Percent White	8.016*	7.820*	7.874*
High school graduates	−4.039	−3.145	−3.031
R^2	0.1734	0.1889	0.1748

*Significantly different at $p < .0001$.
†Significantly different at $p < .05$.

significantly lower estimates for CDSS users and handheld device users, both doctor and nurse communication did; however, those differences became no longer significant in the adjusted analysis while controlling for other factors. This may be due to contextual factors in the HSA's environment that influence the hospital patient demographics. Adjusted analyses suggests that nurse communication, doctor communication, and a patient's high recommendation can be predicted from the contextual factors of the HSA's payer mix, being in a rural location, median household income, percent non-Hispanic White, and percent with a high school education (not shown). Patients reporting received discharge information can be predicted by CDSS, CPOE, and handhelds, controlling for other hospital and contextual variables.

With regard to reimbursement, in 2012 CMS began its VBP program, which provides incentive payments for high-quality hospitals (Centers for Medicare and Medicaid Services (CMS), HHS, 2011). As part of the penalty/bonus calculation, 45% will be in relation to inpatient clinical process measures, 30% to patient-reported experience of care measures, and 25% to medical outcomes. Therefore, moving forward, hospitals will not only be judged on their clinical care and outcomes but almost one third of this measure is directly tied to patient experience. The VBP highlights the importance of maintaining good patient communication (with other HCAHPS measures) and experience measures in conjunction with clinical processes and outcomes.

Limitations

The data presented here were used in a cross-sectional study design; therefore true causality between HIT and patient-reported data cannot be inferred. Due to the newness of the data, future research should apply a longitudinal design to determine true causality of HIT and certain HCAHPS measures. Secondly, the data in the HIMSS dataset are at the hospital level; individual doctor/nurse usage of HIT elements cannot be determined, thus creating a possibility for spatial ambiguity—the hospital may say that they use CDSS/CPOE/handhelds, but these data do not tell if all the doctors use them. Moreover, in this dataset, the level of detail provided to describe CDSS is absent—it could mean simple drug–drug interactions to full clinical pathways. Lastly, without the presence of patient-level data, the results of this study should be viewed with caution. The HCAHPS patient satisfaction data are presented on the hospital level; therefore, patient-level reported data were aggregated up to hospital level, and the research could not control for other patient-level variables that may explain variations in satisfaction.

Directions for Future Research

As mentioned in the limitations, this study could be strengthened from the use of longitudinal and patient-level data. Currently, national data are limited to hospital level; therefore, smaller scoped studies are encouraged to avoid use of confounding variables and unobserved biases in this study. Beyond strengthening this study, researchers should test HIT implementation strategies to determine if there may be a module to help maintain interpersonal communications with the patient while using HIT.

Implications for Practice

This study bore several implications for practice. The common theme in recent research is HIT and EHR adoption improves quality—process and outcome level. However, the results of this study will hopefully start a conversation about HIT and patient experience, namely patient communication. In a recent article in the *Wall Street Journal* (Reddy, 2014), a physician stated that to be a better listener (because of some negative online reviews), he is making an effort to put down his PDA (where he makes documentation) and focuses more on patient communication (eye contact and attentiveness). In sum, the benefits of addressing patient experience during HIT implementation could be seen in patient care and financially through VBP. Moreover, the work of Jha and colleagues (2008) supports the relationship between patient satisfaction and clinical adherence to treatment guidelines.

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