RESEARCH ARTICLE

INCLUDING STAKEHOLDERS WHEN IMPLEMENTING NEW TECHNOLOGIES

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ABSTRACT

OBJECTIVE

Technologies such as Radio Frequency Identification (RFID) offer many benefits to health care providers and may raise stakeholder concerns. This study reviews a new technology from another industry, summarizes previous research on medical applications of RFID, and analyses survey responses on RFID applications. The goal is to develop recommendations for evaluating and implementing new technologies.

DESIGN

Marketing and stakeholder theories were used to develop lessons from the case study and prior research. A survey was mailed to adults in four Midwestern states in the US.

MAIN OUTCOME MEASURES

Respondent support ratings for two medical and two non-medical applications of RFID were analysed using principal component analysis and binary logistic regressions. Profiles of those supporting the applications were developed.

RESULTS

The case study highlighted the importance of considering the needs and concerns of all stakeholders. Previous studies suggested that many hospital administrators who examined RFID may not have included some stakeholders. This research found that support for RFID varied across respondents and applications. Anxiety about technology was negatively linked with RFID support. Religiosity also had negative coefficients for some applications.

CONCLUSIONS

Administrators considering new technologies need to consider patient privacy needs and stakeholder concerns. Surveying stakeholders and utilizing advisory boards could help administrators tailor their actions to the communities they serve. A few opponents of a technology can limit its adoption. Regular, two-way communications may help health care organizations improve technology decisions and enhance the odds of implementation success.

KEYWORDS

radio frequency identification; privacy; trust, religiosity; marketing orientation

INTRODUCTION

Medical organizations regularly face large capital spending decisions. Often these decisions involve technologies that may affect patients and staff. Several frameworks may guide these decisions. One involves marketing and emphasizes the importance of customer needs. Another framework, stakeholder theory, suggests that the concerns of owners, employees, suppliers, customers, and the community should be considered and addressed. Both frameworks have valuable implications for new technology decisions.

Several new technologies that are available to hospitals have potential privacy concerns for patients and staff. These issues include unauthorized secondary use of information, errors in data, and improper access. Privacy concerns can stem from the negative effects of having privacy violated or from the psychological effects of

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knowing that others accessed personal data, even if there were no negative consequences.[1] Matzner argued that individuals can be harmed even when none of their data has been collected or processed.[2] Researchers believed that privacy concerns can reduce patient interest in wireless sensor networks,[3] electronic records,[4] mobile wellness programs,[5] online health communities,[6] and health care information exchanges.[7] Patient privacy concerns were considered to be the biggest impediment to E-healthcare.[8]

This paper examines how new technologies with potential effects on privacy such as radio frequency identification (RFID) should be considered according to marketing and stakeholder theories. A technology adopted without considering patient needs or stakeholder concerns may face greater difficulties. After reviewing the two frameworks, a case study of a new technology from another industry is discussed where the decision process created problems. Given the lessons learned from this case, prior studies on RFID are reviewed and the results of a consumer survey are analysed. The paper concludes with a discussion on how hospitals could benefit from integrating more patient needs and stakeholder concerns into their technology plans.

MARKETING ORIENTATION

Marketing is essential for healthcare organizations. [9, 10] Several studies noted correlations between being marketing-oriented and healthcare organization performance. [11,12] Administrators should consider decisions from the patient's perspective. Some managers assume that a decision will not interest patients or that they know patient needs without asking them. Lee and Meuter suggested that interviews with hospital employees can adequately represent patient sentiments.[13] A case study showed that this might not always be true.[14]

An important patient need is privacy and this need has been linked to trust. [15] Trust is very important for a hospital's brand equity. [16, 17] Therefore, to address key patient needs, organizations should place a priority on enhancing perceptions of privacy and building trust.

STAKEHOLDER THEORY

Another business construct, stakeholder theory, suggests that administrators need to incorporate opinions from everyone who can affect or who are affected by the achievement of an objective into their decisions. Integration of stakeholder concerns can, at least indirectly, create a competitive advantage for organizations.[18] The weight of the evidence favours operating with a focus on the long-term interests of stakeholders over focussing on short-term shareholder interests.[19] How an organization responds to stakeholders can be as important as the response.[20] Good stakeholder relations are positively-linked to brand equity.[21]

One key stakeholder group is employees. A case study found that healthcare staff had a range of opinions about a new initiative. The case authors believed that employee involvement was critical for developing a competitive advantage and concluded that all staff opinions should be recognized.[22] Hospitals that surveyed their medical staff tended to have higher performance.[23] Employee satisfaction and loyalty have been connected to patient satisfaction and loyalty.[24]

Another key stakeholder group is customers or patients. Hospitals that surveyed the public also tended to have better performance.[23] One hospital system conducted in-depth analyses of patient comments and improved both admissions and patient satisfaction.[25] As important stakeholders, patients should be involved in many decisions.

CASE OF A PROBLEMATIC TECHNOLOGY

A problem can emerge if managers assume some stakeholders do not have legitimate concerns or do not integrate them into the decision process. When Monsanto developed genetically-modified agricultural seeds, they faced difficulties gaining societal acceptance, especially in Europe. Monsanto did not appreciate that economic, technical, and regulatory pressures were not the only constraints that could limit their technology.[26] The firm focussed on those perceived to be core stakeholders: investors, scientists (both at the firm and in academia), farmer-customers, and government regulators.[27] Food consumers were not considered. Activist groups and the general public added unexpected societal uncertainty and constraints. If Monsanto had a better understanding of the European environment, the company may have adjusted their actions and had more success in Europe.[28]

Other research on genetically-modified foods suggests that initial acceptance does not necessarily imply that key concerns have been addressed. Deeply-felt concerns

often persist and accumulate, causing problems later.[29] Monsanto's decisions to not involve the public early in the process and to not address the concerns of critics during and after the technology rollout made it more difficult to gain acceptance.[30, 31] A lesson for organizations is that they should monitor the concerns of all stakeholders, including groups with negative opinions about a technology, for an extended period of time.

PREVIOUS RESEARCH ON RFID

The medical field is striving to control costs while improving patient care. To accomplish these goals, many technologies have been tested. RFID has been successfully used for tracking equipment and employees, monitoring and identifying patients, matching patients with the prescribed dosages of medicine, and preventing the use of counterfeit medicines.[32] An RFID tag can be smaller than a grain of rice. The tag is attached to an antenna. If batteries are included, the "active" tags can broadcast information to a reader that is more than 100 yards away. If batteries are not included, the "passive" tags can be scanned from several feet away. Passive tags can be added to medicine containers, blood supplies, name badges, and folders and can be incorporated into patient wrist or ankle bands. They could also help count surgical sponges, making sure none is left in patients, and help match dentures to patients. [33, 34]

RFID technology raises privacy concerns with some consumers. These concerns can be major impediments to widespread adoption.[35, 36] Some believe that additional technologies could provide the needed security, but these privacy-enhancing technologies are generally not sufficient.[37] A few hospitals did not consider the privacy concerns of employees or patients in their RFID evaluations.[32[Several surveys asked management about factors that might influence their decisions. One survey asked about the benefits and challenges but did not mention patient privacy.[38] Another asked respondents to rank the reasons for adopting RFID (patient comfort was rated last) and the perceived impediments (stakeholder concerns were not listed).[39] A third survey asked about perceived risks and resistance to change but did not directly mention stakeholders or privacy.[40] These study designs and the responses received suggest that patient needs and employee and patient concerns were not priority issues at some hospitals.

LESSONS FROM RFID ADOPTION CASE STUDIES

Leonard discussed five critical success factors for the adoption of new technology in healthcare: resistance to change, training, buy-in from stakeholders, reporting of outcome measures, and dealing with system shocks. Unfortunately, when some hospitals considered new technologies like RFID, they did not examine the third factor, stakeholder concerns.[41] A survey of hospital managers, consultants, and researchers in Indonesia and Malaysia did not find that getting feedback from stakeholders was a critical success factor for RFID adoption.[42] One stakeholder group with limited consideration was nurses. Nurses from around the US expressed concern about tracking technologies and several hospitals had their RFID implementations blocked by nurse unions.[43] Another survey of nurses found their intention to use RFID was significantly related to basic attitudes about the technology and subjective norms (e.g., how others would feel about them using the technology) and was not linked to privacy concerns.[44] A survey of medical staff in Thailand also noted the importance of social factors for gaining acceptance of new technologies.[45]

Descriptions of early RFID adoptions usually emphasized the feasibility and benefits generated.[46-50] Issues included testing for radio wave interference, addressing infrastructure limitations, working with good vendors, and educating staff.[32, 51, 52] Only a few case studies mentioned the importance of patients. One noted that many RFID applications are potentially disruptive innovations and highlighted the need to be sensitive to patient privacy concerns.[53] Another believed one-way communication with patients (e.g., lectures and brochures) should be sufficient to address any privacy concerns.[54] A third mentioned that patient tags would require patient consent and assumed that this would not be difficult to get because the tags would not contain any data.[55] There appeared to be little concern that patients may resist the use of this technology. An Ohio hospital was surprised by the negative response when they required mothers and babies to wear RFID bracelets for identification.[56]

Only one published survey was found that examined the public's attitudes toward RFID adoption by hospitals.[57] It focussed on mobile healthcare devices and found considerable support with some differences across applications. Unfortunately, the authors used a non-symmetrical, 5-point scale with "4" indicating "No interest" and "5" labelled as "It's a bad idea." Some respondents

who were neutral on an idea may have assumed that the middle of the scale was "neutral." In surveys, it is often recommended that higher numbers should represent positive responses.[58] Despite these methodological issues, the authors found that between 5 and 10 percent of respondents thought the various applications were "bad ideas." The authors concluded that there were not high levels of public concern about RFID applications. However, if those responding "bad idea" had particularly strong feelings, ignoring their concerns could cause problems (e.g., at least one supermarket and library have been picketed by consumers when they started using RFID tags in their loyalty cards or books).[59, 60]

METHOD

To understand attitudes toward hospital applications of RFID, this research mailed an anonymous survey to about 4900 adults, aged 25 to 60, in Illinois, Indiana, Michigan, and Ohio during 2010. After explaining the technology, the applications were described (Table 1). Respondents rated their support using a 7-point Likert scale (i.e., 1 indicates strongly disagree and 7 indicates strongly agree). There were 268 usable responses about wrist bands and badges and 276 usable responses about medications. The low response rate was expected because the mailing list was generated at random, the topic was unfamiliar, and there was little incentive to complete the survey.

TABLE 1. DESCRIPTIONS OF RFID APPLICATIONS IN SURVEY

> Hospitals are exploring the use of RFID tags in medical wrist bands and employee badges in order to identify where any patient, doctor, or nurse is located whenever that information is needed.
>
> Prescription drug manufacturers are considering adding RFID tags to their medication containers to help identify counterfeit drugs and to reduce the likelihood that patients receive the wrong drug.
>
> If RFID tags with batteries were added to automobile license plates or car tires, scanners could quickly track stolen cars on the highway and tickets for speeding or for failing to stop at traffic signals could automatically be sent to car owners.
>
> Retailers are testing the use of RFID tags on individual items in stores. This may help them identify when shelves are close to empty of certain items and may help reduce shoplifting (if they place scanners at exits). If every package had these tags, the store checkout process could be much faster because scanners could quickly identify all the items in carts.

Table 2 shows the demographic profile of the survey respondents. The responses from the oldest age group and non-whites were lower than anticipated. More people with college degrees responded to the survey than were expected. Otherwise, the profile of the respondents was similar to the target audience.

Besides demographics, respondents were asked if they attended organized religious services at least once per month during the last year. Religiosity, often measured with self-reported religious attendance, may be linked with RFID support because it is associated with stronger ethical norms and judgments.[61, 62] Opponents of RFID based some

objections on religion.[63] Respondents were asked to rate their knowledge of RFID before they read the entire survey and 21 percent said they were very informed (i.e., a top-two-box response, a "6" or a "7"). Using a 7-point Likert scale, respondents were also asked about their attitudes toward privacy using a set of 13 questions (Table 3), adapted from other studies.[64, 65] Some health technology studies have used single-item questions and response scales with limited breadth to measure privacy.[66, 67] Multiple item scales with seven response options generally work better, especially with a concept that has several components or dimensions.[68, 69]

TABLE 2. SAMPLE DESCRIPTIVE DATA

Independent Variable	Percentage of Sample
Female Dummy Variable	46%
Age in the 30s Dummy Variable	29%
Age in the 40s Dummy Variable	52%
Age of at least 50 Dummy Variable	9%
Single/Separated/Divorced Dummy Variable	34%
No Children Dummy Variable	45%
Some College But No Degree Dummy Variable	30%
4-Year College Degree or More Dummy Variable	57%
Non-white Ethnicity Dummy Variable	13%
Household Income of $30,000 to $59,000	26%
Household Income of $60,000 to $89,000	26%
Household Income of $90,000 or More	31%
Religious Attendance Dummy Variable	44%
Knowledge of RFID: Informed about RFID (Top-Two-Box)	21%

TABLE 3. PRIVACY ATTITUDE SCALE STATEMENTS

1. When companies ask me for personal information, I sometimes think twice before providing it.
2. Computer databases that contain personal information should be protected from unauthorized access - no matter how much it costs.
3. I am anxious and concerned about the pace of automation in the world.
4. Sometimes I am afraid the data processing department will lose my data.
5. Companies should never sell the personal information in their computer databases to other companies.
6. Computers are a real threat to privacy in this country.
7. Companies should have better procedures to correct errors in personal information.
8. It bothers me to give personal information to so many companies.
9. Companies should take more steps to make sure that the personal information in their files is accurate.
10. Companies should never share personal information with other companies unless it has been authorized by the individuals who provided the information.
11. I am easily frustrated by computerized bills.
12. I am sometimes frustrated by increasing automation in my home.
13. People should refuse to give information to a business if they think it is too personal.

RESULTS

Principal component analysis (with varimax rotation) was used to reduce the 13 privacy variables to three factors. The first factor was dominated by questions 12, 11, 3, 4, and 6 from Table 3. These questions were the computer or technology anxiety scale. A review of consumer health information technology acceptance noted that three papers tested for computer anxiety effects and found them to have significant negative impacts.[70] A survey on patient privacy concerns and health information exchanges also found computer anxiety to be a significant factor.[7] The second factor, nicknamed company policies, was primarily questions 2, 9, 7, 5, and 10. The third factor, nicknamed individual control, was primarily questions 13, 1, and 8. Cronbach's alpha was 0.814, which indicated very good reliability for the privacy scale.[71]

For RFID in wrist bands and badges, 42.5 percent of respondents were very supportive, giving this application a "7" and 20.5 percent gave it a "6". About 10.8 percent gave it little support or were not supportive, a "2" or "1." For the question on medicine containers, 49.3 percent gave it a "7," 16.8 percent gave it a "6," and 8.2 percent gave it a "2" or "1."

Binary logistic analyses were used to identify which measures affected the probability of support for an application. The dependent variables indicated whether a respondent gave an application top-two-box support. The twelve demographic measures, religiosity, prior knowledge, and the three privacy factors served as independent variables.

Table 4 shows the results for including RFID tags in wrist bands and badges. Sex, age, marital status, the presence of children, education, ethnicity, and income were not linked with support, which suggests that demographic profiling may not help identify individuals with concerns. Religiosity and knowledge about RFID were also not significant. The only significant variable was a privacy factor. Those who were more anxious about computers and technology were less likely to support this RFID application.

The right-hand columns in Table 4 show the results for including RFID tags on medications. Only one demographic variable was significant. Respondents in the high-income class tended to be more supportive of this application (at the 90 percent confidence level). Those classified as being religious were significantly less supportive. Computer and technology anxiety was also related to support for this application.

One question is whether consumer opinions about the two medical applications are typical of all RFID applications. To answer this, two more survey questions were analysed. Table 1 includes an application that involved including RFID tags in car license plates. Only 27.5 percent gave this application a top-two-box score while 40.1 percent gave it a score of "1" or "2". The results in Table 5 show that those at least 30 years of age were significantly more likely to support this application than people under 30. Non-whites were significantly more likely to support it than whites and the middle-income category was significant and positive. Both the first privacy factor (computer anxiety) and the third factor (individual control) were significant and negative. The negative coefficient on individual control suggested that those who do not like sharing personal information were also less likely to support this application.

TABLE 4. BINARY LOGISTIC REGRESSION RESULTS FOR RFID IN WRIST BANDS AND ON DRUGS PACKAGES

	Hospital Wrist Bands and Badges			Chips to Receive Correct Drug		
	Coefficient Estimate	Standard Error	P-Value	Coefficient Estimate	Standard Error	P-Value
Constant	**1.429**	**0.718**	**0.047***	0.827	0.745	0.267
Female Dummy Variable	-0.246	0.283	0.385	0.437	0.288	0.128
Age in the 30s Dummy	0.398	0.514	0.438	-0.354	0.547	0.517
Age in the 40s Dummy	0.294	0.483	0.542	-0.468	0.520	0.368
Age of at least 50 Dummy	0.582	0.644	0.366	0.103	0.696	0.882
Single/Separated/Divorced	-0.500	0.312	0.109	0.033	0.319	0.917
No Children Dummy Variable	-0.006	0.284	0.982	0.341	0.288	0.237
Some College But No Degree	-0.373	0.461	0.418	-0.202	0.459	0.659
4-Year College Degree or More	-0.700	0.473	0.139	-0.520	0.467	0.266
Non-white Ethnicity Dummy	-0.017	0.426	0.967	0.755	0.474	0.111
Income $30k-59k	-0.111	0.432	0.797	0.313	0.438	0.475
Income $60k-89k	-0.271	0.469	0.564	0.528	0.476	0.267
Income $90 plus	-0.207	0.482	0.667	**0.876**	**0.490**	**0.074***
Religious Attendance Dummy	-0.410	0.284	0.149	**-0.707**	**0.283**	**0.013***
Knowledge of RFID	-0.136	0.336	0.686	-0.444	0.333	0.183
Privacy: 1. Computer Anxiety	**-0.568**	**0.149**	**0.000***	**-0.402**	**0.146**	**0.006***
Privacy: 2. Company Policies	0.055	0.138	0.690	0.218	0.137	0.112
Privacy: 3. Individual Control	-0.198	0.148	0.181	-0.003	0.144	0.985

* Bold and underlined indicate P-Value less than 0.10

TABLE 5. BINARY LOGISTIC REGRESSION RESULTS FOR RFID IN LICENSE PLATES AND ON STORE PACKAGES

	Chips in Car License Plates			Chips on Item Packages in Stores		
	Coefficient Estimate	Standard Error	P-Value	Coefficient Estimate	Standard Error	P-Value
Constant	**-2.622**	**0.835**	**0.002***	-0.601	0.724	0.407
Female Dummy Variable	0.223	0.315	0.480	0.030	0.278	0.915
Age in the 30s Dummy	**1.265**	**0.654**	**0.053***	0.500	0.523	0.339
Age in the 40s Dummy	**1.133**	**0.626**	**0.070***	-0.004	0.491	0.993
Age of at least 50 Dummy	**2.296**	**0.775**	**0.003***	0.613	0.646	0.342
Single/Separated/Divorced	0.315	0.354	0.374	-0.004	0.309	0.989
No Children Dummy Variable	-0.361	0.320	0.259	0.079	0.284	0.781
Some College But No Degree	-0.088	0.495	0.858	0.364	0.448	0.416
4-Year College Degree or More	-0.577	0.516	0.263	0.315	0.457	0.491
Non-white Ethnicity Dummy	**1.806**	**0.450**	**0.000***	**1.788**	**0.530**	**0.001***
Income $30k-59k	0.381	0.507	0.453	0.044	0.434	0.920
Income $60k-89k	**1.127**	**0.532**	**0.034***	0.255	0.463	0.582
Income $90 plus	0.734	0.555	0.186	**0.949**	**0.486**	**0.051***
Religious Attendance Dummy	-0.515	0.320	0.107	**-0.567**	**0.280**	**0.043***
Knowledge of RFID	0.056	0.367	0.880	0.095	0.331	0.773
Privacy: 1. Computer Anxiety	**-0.275**	**0.161**	**0.087***	**-0.303**	**0.140**	**0.031***
Privacy: 2. Company Policies	0.165	0.159	0.300	-0.039	0.133	0.768
Privacy: 3. Individual Control	**-0.317**	**0.151**	**0.036***	**-0.248**	**0.143**	**0.081***

* Bold and underlined indicate P-Value less than 0.10

The last application involved incorporating RFID tags into packages in stores (Table 1). About 55.9 percent gave this application a top-two-box score and only 9.4 percent gave it a "1" or a "2." These scores were closer to those for the medical applications, but the regression results were different.   Non-whites and high-income respondents tended to support RFID in stores while those with greater religiosity or privacy concerns (factor 1 and factor 3) tended to have less support. The findings that knowledge of RFID and college experience were not associated with support for any application suggest that more education about the technology may not ameliorate concerns. Comparisons across analyses show that the profile of supporters differs by application.

DISCUSSION

The surveys of managers and case studies of RFID implementations suggest that some administrators did not consider patient needs or stakeholder concerns when they evaluated the technology. Perhaps they assumed that stakeholders would not be interested. This research does not support that assumption. This study and a previous survey [57] suggest that about 10 percent of consumers were very concerned about the medical uses of RFID technology. The Monsanto case suggests that only a few concerned opponents can limit a technology's adoption.

Many demographic measures (gender, education, marital status, and presence of children) along with prior knowledge of RFID were not linked with support for any application. Therefore, it would be difficult to develop demographic profiles of those who are likely to support or oppose this technology. The link between religiosity and support for some RFID applications provides some help for targeting information at sceptical consumers. Variations in the support across applications suggest that acceptance of a technology in one area does not guarantee acceptance in other areas.

Individuals with greater anxiety about computers and technology offered less support for RFID applications. The links between support and this anxiety and between support and religiosity suggest these attitudes and values are deep-felt and may be difficult to change. One-way communications after technology decisions are made are likely to have limited effects. Longer-term, more intensive educational efforts and regular, two-way communications may be needed with all stakeholder groups.

When healthcare administrators consider new technologies, they need to integrate patient needs and stakeholder concerns into their decisions. Integration could involve periodic surveys of stakeholders and regular meetings with advisory boards who represent various groups. If hospitals discover opposition to a new technology, adopting it without addressing concerns could reduce trust, damage brand equity, and create public relations challenges. Even if only a small group is concerned, the public response could even reach the level similar to what Monsanto experienced. Because the response process is important, efforts should be made to improve the response process. In-depth discussions may be needed to understand concerns and develop effective responses to the issues involved with the technology. Surveys and meetings with advisory boards need to continue throughout the implementation process so that any opinion changes can be identified and thoughtful responses can be developed.

This research generated several recommendations for healthcare administrators when they evaluate new technologies. First, consider decisions from the patient's perspective. Enhancing patient privacy perceptions and building trust will boost brand equity. Do not assume staff feedback is a sufficient proxy for patient feedback, patients are not interested in a technology, or other stakeholders do not have concerns. Gain insights from periodic surveys of patients and staff and from regular stakeholder advisory board meetings. Track stakeholder opinions before, during, and after a new technology is adopted. Reach out to the religious community and recruit their members for a patient advisory board. Ask patients more than "satisfaction" questions to produce new insights. Do not assume that a technology that is acceptable in some applications will be accepted for other applications. And, finally, remember that how a response is presented is as important as the contents of the response.

Like most research, this study has some limitations. It focussed on one technology. Other research could examine whether the principles apply to other technologies. The survey was mailed to just one US region and the response rate was low. Some groups were under-represented (e.g., non-whites) and others were over-represented (e.g., college graduates) in the sample. A national or international survey with response incentives could provide a more balanced sample. Including other scales (e.g., personality profiles) and more in-depth questions about the reasons why some applications were not supported could also be helpful.

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