# A Survey-based Study of Pharmacist Acceptance and Resistance to Health Information Technology

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## Abstract

**Purpose:** Because user acceptance and resistance to the use of health information technology (HIT) affects system utilization and previous studies in this area have typically excluded pharmacists, this study specifically addresses the response of institutional pharmacists to HIT.

**Methods:** A survey investigating pharmacists' responses to electronic medical record (EMR) system use was developed using questions modified from previously validated research. The survey was distributed electronically to the mailing list for pharmacy preceptors for the University of Tennessee College of Pharmacy. Descriptive statistics and univariate and multivariate analyses were used to analyze the collected data based on a previously validated dual-factor model.

**Results:** Of the 96 responses from institutional pharmacists, 64 responses (66.7 percent) were complete and usable. Of the acceptance and resistance constructs evaluated, only attitude and perceived behavior control were found to be significantly associated with acceptance of use ($p$ = .036 and $p$ = .025, respectively), and only transition cost was found to be significantly associated with resistance to use ($p$ = .018). System vendor and interface integration were also significantly associated with acceptance of use. These findings suggest that attitude, perceived behavior control, and transition costs may have the most impact on pharmacists' responses to the use of EMR systems.

**Conclusion:** It is reasonable for hospitals to focus efforts on specific factors influencing acceptance of and resistance to EMR use and, before a system is selected, to consider the effects of vendor selection and level of interface integration on acceptance of use.

**Keywords:** electronic medical records; health information technology; clinical pharmacy information systems; behavior and behavior mechanisms

## Introduction

Although the use and implementation of health information technology (HIT) has become a prominent topic within the healthcare industry in recent years, the implementation and use of this technology within the pharmacy setting has largely been unaddressed and unstudied. President Bush created the Office of the National Coordinator for Health Information Technology (ONC) in 2004, and President Obama continued this support in the American Recovery and Reinvestment Act of 2009, providing incentives for implementing electronic health records. The adoption of HIT has been greatly encouraged by the ONC and by incentive programs for the meaningful use of electronic health records.[1]

The incentive programs do not directly address the role of pharmacies in meeting technology goals. However, the use of HIT in an inpatient pharmacy setting is crucial to providing optimum patient care and may contribute to a hospital or hospital system's ability to qualify for federal programs. Pharmacist use of the electronic medical record (EMR), when incorporated appropriately into the workflow, may improve efficiency and efficacy in pharmacy-dependent areas of care, such as medication monitoring, medication reconciliation, and discharge planning, through increased access to patient information and as a mechanism for documentation and communication.[2] Additionally, the inclusion of pharmacists in the creation of order sets, reports, and other HIT tools may be valuable for meeting patient care goals.[3]

Although these EMR systems potentially confer great benefits for clinical practice, which may promote acceptance by clinicians, it is also not uncommon for practitioners, including pharmacists, to resist the use of HIT systems. Therefore, it is important to identify the major contributing factors in a healthcare professional's response to the utilization of HIT so that these tools may be more effectively implemented. Although previous research has examined clinicians' responses to HIT implementation and use, those studies have largely excluded pharmacists.[4–6] Therefore, in this study, we evaluate institutional pharmacists' acceptance of and resistance to the incorporation and use of EMR systems, and we consider how differences in pharmacists' interaction with and demands of the EMR system, versus those of other users, affect their responses.

## Background

### *Models of Acceptance and Resistance*

A variety of factors may contribute to a user's willingness to utilize technology and integrate it into workflow and practice. Therefore, multiple models have been developed to evaluate and describe the mechanisms of both technology acceptance and resistance. The original acceptance model, the Technology Acceptance Model (TAM), was developed to evaluate the attitudes, beliefs, and perceptions that influence intentions to use technology and subsequent behaviors.[7] This model evaluates multiple factors. It is limited by its ability to determine the influence of external variables on the behaviors themselves and instead focuses solely on intention.[8, 9] The theory of planned behavior is better able evaluate the performance behaviors associated with acceptance but may be more setting dependent than TAM because of the greater ambiguity of its constructs.[10, 11] Finally, the unified theory of acceptance and use of technology expands on predecessor models to further elucidate the effects of additional factors on technology acceptance behavior.[12] Alternatively, other theories focus more specifically on the likelihood of user resistance and the reasons for it. The status quo bias theory was developed to evaluate resistance to change through three categories of factors.[13] The equity-implementation model depends on the user's perception of HIT utility based on trade-offs.[14]

Although technology acceptance and resistance are correlated, the two are not simply inverses but have distinct roles in determining user intention.[15] Therefore, the integration of these concepts into a dual-factor theory is useful for acquiring a more complete understanding of user intentions. Kim and Kankanhalli[16] proposed an integrative framework that includes concepts from the previously described models, and Hsieh[17] developed and validated a similar, more streamlined version of this integrated model, confirming the influence of both acceptance and resistance concepts on the clinician response to HIT.

### *Clinician Response to and Use of Healthcare Technology*

Acceptance and resistance models have previously been used to evaluate clinicians' responses and behavior related to HIT implementation, with the bulk of the available research having been completed with physician and, to some extent, nursing populations. Yarbrough and Smith used, studied, and modified TAM constructs within a physician population.[18, 19] Although the results of the review were generally consistent with the TAM, they did find that perceived ease of use was not necessarily predictive of a physician's perceived usefulness of or attitude toward HIT.[20] More recently, Hsiao and Chen, using a similarly structured model, found perceived usefulness, attitude toward use, social factors, and organizational support to be the most predictive factors in a physician's intention to use technology.[21]

As discussed previously, the questionnaire-based study conducted by Hsieh used an integrative model to assess clinicians' intention to use new HIT. Hsieh's study, being multidisciplinary and incorporating a dual-factor model, was more comprehensive than the previously described research. Ultimately, the results of the study supported the utility of concurrent use of acceptance and resistance models for evaluating clinicians' intention to use HIT, affirming that both systems of theories contribute to the clinician response.[22] However, physicians and nurses constituted a large majority of the respondent population, which limits the applicability of study findings to pharmacist users. As discussed previously, use of EMRs is vital to a pharmacist's ability to ensure proper medication use throughout hospital systems, which may improve the hospital's ability to meet its clinical goals.[23, 24] Although pharmacists were excluded from the Hsieh model, this study evaluating pharmacist response to HIT, namely EMRs, will be patterned after the Hsieh model because of its dual-factor structure and use of validated constructs.[25]

# Methods

## *Study and Survey Design*

We conducted an electronic survey-based study approved by the University of Tennessee Health Science Center (UTHSC) institutional review board. No identifying information was requested, allowing participants to take the survey anonymously. This survey for institutional pharmacists (see Appendix 1) was created using the Qualtrics platform and consisted of three portions: respondent background information, the dual-factor theory items, and additional pharmacy-specific items. The pharmacy-specific portion included three Likert-scale items and a free-response question elucidating how the needs of a pharmacist may differ from those of other EMR users.

The acceptance and resistance section included a modified version of the 37 survey items validated by Hsieh's research. The survey items were modified to increase applicability and specificity to pharmacists practicing within an institutional setting. This portion of the survey was designed as sets of survey items that could be used to evaluate three constructs: attitude, subjective norm, and perceived behavior control. Those items were shown by Hsieh to contribute to acceptance. Also included were six constructs—sunk cost, regret avoidance, inertia, perceived value, transition costs, and perceived threat—that were suggested to contribute to resistance. The remaining survey items evaluated overall acceptance of use and resistance to use. Each survey item was evaluated on a seven-point Likert scale ranging from "strongly agree" to "strongly disagree."

## *Participant Recruitment and Survey Distribution*

A link to the survey was distributed via email to the UTHSC College of Pharmacy (UTCOP) electronic mailing list of the college's 770 Introductory Pharmacy Practice Experience and Advanced Pharmacy Practice Experience preceptors. This email list comprised all UTCOP preceptors throughout the state of Tennessee, including community and institutional pharmacists. Therefore, the email instructions specified that only pharmacists practicing within an institutional setting should enter and complete the survey, and a survey question was utilized to confirm the practice setting of each participant.

## *Data Collection and Analysis*

The survey was distributed on January 8, 2018, and survey results were collected on February 8, 2018. Only the responses of those who fully completed the survey were analyzed. Data collection was completed using the UTHSC Qualtrics Survey Service (Qualtrics; Provo, UT). Descriptive statistics were calculated for each of the scaled survey items, and pooled descriptive statistics were calculated for each of the evaluated constructs. Cronbach's alpha was used as an analysis of reliability for each of the acceptance and resistance constructs and was evaluated to determine the applicability of the survey items to the study population. Individual questions were evaluated for exclusion if they caused Cronbach's alpha to fall into the unacceptable range ($\alpha < 0.5$). Using the pooled statistics, multiple regression analyses were performed for each of the constructs to examine correlation with either acceptance of use or resistance to use. Three constructs were evaluated for their ability to predict acceptance of use, and six separate constructs were evaluated for their ability to predict resistance to use. One-way analysis of

variance (ANOVA) tests were performed to evaluate correlation of acceptance of use and resistance to use within the subgroups to determine which pharmacist respondent and practice site characteristics may be useful in predicting acceptance of use and resistance to use. Statistical analysis was performed using the IBM SPSS Statistics for Windows, version 25 (IBM Corp.; Armonk, NY). The a priori level of significance was set at .05.

## Results

### *Survey Response*

The response rate for this study cannot be determined because the UTCOP electronic mailing list included both community and institutional pharmacists and our survey instrument indicated that only institutional pharmacists were to complete it. Nevertheless, of the 770 pharmacists on the electronic mailing list, 96 pharmacists entered the survey, and 64 of these fully completed it, for a completion rate of 66.7 percent. As stated previously, only the 64 completed responses were considered in the final analysis.

### *Respondent Characteristics*

The majority of survey respondents were 25 to 44 years of age ($n$ = 48; 75 percent) and had 5 to 14 years of practice experience ($n$ = 35; 54.7 percent). Most of the participants ($n$ = 59; 92.2 percent) had a doctoral degree; many participants also reported one or more forms of additional education or certifications. Most respondents practiced at a site utilizing Cerner EMR ($n$ = 31; 48.4 percent) or Epic ($n$ = 14; 21.9 percent) systems. Survey participants reported that the pharmacy interface was a separate component, defined as a component functioning separately from the main EMR system that may open as a separate window or program, for most of the systems ($n$ = 36; 56.3 percent). Background characteristics are reported in Table 1.

### *Cronbach's Alpha for Reliability*

Cronbach's alpha was calculated for each of the survey item groupings; these values are reported in Table 2. Based on the results, all survey items were included except item 8. Exclusion of this item resulted in an increase of Cronbach's alpha for the subjective norm construct from 0.467 to 0.658.

### *Dual-Factor Theory and Construct Analysis*

Multiple regression analysis was used to test which acceptance and resistance constructs, serving as the dependent variables, are significantly associated with the respondents' ratings of acceptance of use and resistance to use. These results are displayed in Figure 1. Multicollinearity was tested using the variation inflation factor score, which ranged from 1.167 to 2.079, indicating that the constructs were independent of one another. Normality was not tested, because the limited sample size ($n$ = 64) meant that the sample would be reflective of the underlying population.

The results of the regression indicated that the three acceptance constructs explained 15 percent of the variance ($R^2$ = 0.150, F(3,60) = 3.533, $p$ = .020). The only construct significantly associated with overall attitude of acceptance was behavioral control (β = −0.371, $p$ = .017). Alternately, the results of the regression indicated that the six resistance constructs explained 15.8 percent of the variance but did not achieve overall significance ($R^2$ = 0.158, F(6,57) = 3.533, $p$ = .120). However, transition costs did significantly contribute to overall resistance to use (β = 0.456, $p$ = .018). The relationship between acceptance of use and resistance to use was negative but did not achieve significance (β = −0.213, $p$ = .207).

### *Subgroup Analysis*

One-way ANOVA was used to analyze acceptance of use and resistance to use based on respondent characteristics, and the results are reported in Table 3 and Table 4. Levene's test was used to determine homogeneity of variance. All results of this test were nonsignificant ($p$ > .05), indicating that the comparison groups had similar degrees of variance. Personal characteristics such as age, years of practice experience, gender, and so forth did not seem to significantly affect acceptance of use or resistance to use.

The choice of vendor significantly affected acceptance of use ($F(5,58) = 3.511$, $p = .008$) but did not affect resistance to use ($F(5,58) = 0.464$, $p = .802$). A Tukey post hoc test revealed that acceptance of use was significantly higher for Epic users ($5.93 \pm 0.88$, $p = .003$) than for Cerner users ($4.74 \pm 1.09$). Comparisons between other systems did not reach significance. Additionally, those who practice in a facility where the pharmacy interface is a separate component reported lower overall acceptance of use ($4.57 \pm 0.93$, $p < .001$) than those where the pharmacy interface is integrated into the EMR ($5.60 \pm 0.88$). There was no statistically significant difference for this group when analyzing resistance to use ($p = .396$).

### *Free-Text Response*

Fifty-seven of the 64 complete survey responses (89.1 percent) included answers to the free-text response question about how the respondents perceived the needs of a pharmacist being different from the needs of those in other healthcare professions. Responses indicated that variations in pharmacists' focus and function from those of other users contributed to most of the differing EMR needs. The need for extended information and the need for interoperability and resulting efficiency and speed were also common themes throughout the responses.

## Discussion

Overall, respondents reported that pharmacists utilize the EMR system differently, and often more comprehensively, than other healthcare professionals and therefore may have unmet needs. One respondent noted dissimilarities in EMR needs from other clinicians and even for various pharmacist roles: "The EMR is tailored towards nursing and prescribers. Portions of the EMR delegated to pharmacists are too focused on traditional dispensing methods and hinder the abilities of clinical pharmacists." Other responses indicated the larger breadth of pharmacist EMR usage by stating that pharmacists "have additional needs[,] not different needs" and that it is "important for pharmacists to see [it] all."

The dual-factor theory utilized in this research, which analyzes the relationship of acceptance of use and resistance to use to various constructs and to one another, has been previously validated.[26] Although a survey item similar to question 8, "Patients think I should use the EMR," was included in the Hsieh study, Cronbach's alpha indicated that this item caused the internal consistency of the subjective norm construct to fall into the unacceptable range ($\alpha < 0.5$) and therefore was not appropriate for this survey population. Institutional pharmacists in varying roles and practice settings have drastically different amounts of patient interaction, which may have led to the inconsistency seen in this survey item.[27]

In our study, we used the dual-factor theory to assess and model the constructs that had the most influence on both acceptance of technology use and resistance to technology use specifically by pharmacists. Although the $R^2$ value from the multiple regression analysis was low for both acceptance of use and resistance to use, it is difficult to control for all behavioral variables—a limitation that is not uncommon in behavioral research. Nonetheless, attitude and perceived behavior control were shown to be significantly associated with acceptance of use, and only transition cost was shown to be significantly associated with resistance to use. The positive correlation between attitude and acceptance of use and between transition costs and resistance to use is consistent with previous research.[28] While previous research also suggests that most of the other constructs should also be significantly associated with acceptance of use and resistance to use, this sample size may have been too small to identify any of these correlations.

Interestingly, perceived behavior control was inversely related to acceptance of use, which was not consistent with previous studies. This relationship indicates that an increased perception of knowledge of the system and provision of training and resources for use of the EMR may decrease acceptance of use. This finding could be due to lack of an adequate respondent sample to accurately reflect the behavior of the population. However, it could also indicate that those who are most accepting of the system may be more technologically inclined and therefore require less training. Another potential explanation is that the training and resources provided are not appropriately formulated or comprehensive enough to meet pharmacists' needs and therefore serve to decrease acceptance of use. As one respondent noted, "At my

institution it appears pharmacists utilize the EMR in more thorough ways . . . [Providers are] trained solely on what they need to complete their daily activities."

Because our study found that the difference in acceptance of use was significant for EMR system vendors, it is reasonable to conclude that the system itself does contribute to pharmacists' acceptance of the EMR. This variation may reflect the usability of the vendors' systems overall or the pharmacy components specifically, indicating that system selection is vital to user acceptance. With certified EMR systems being supplied by more than 150 distinct vendors, identifying the best system for the facility may be an extensive process that should identify and evaluate factors of importance to all stakeholders.[29–31] Therefore, the inclusion of the frontline staff who will be implementing and using the technology in the selection of a system is critical.[32] This interdisciplinary approach ensures that the technological needs of these stakeholders are met and that their most prominent concerns are addressed, which may promote acceptance of and willingness to use the system.[33]

Similarly, respondents who practiced in facilities where the EMR and pharmacy components functioned on separate interfaces had significantly lower acceptance of the EMR. With the pharmacy components functioning as separate entities, information transfer between them is not always seamless, and interoperability may be an issue. This arrangement has major effects on workflow because, as medication systems consultant Ray Vrabel notes, users may "have to repeat the same task in a second system, just because the two systems don't effectively talk with each other."[34] Disparate components may be utilized because they offer better features or functionality for a particular department or particular tasks, but they also may effectively segregate their documentation and data from the remainder of the system.[35]

Overall, pharmacy departments may often get overlooked in HIT decisions, which may have significant consequences. As Kraig McEwen, CEO of Aesynt Inc., stated, "From a pharmacy standpoint, one of the most common things we see from an interoperability challenge is getting IT resources to prioritize pharmacy projects. That's a constant theme we see across the country."[36] This lower prioritization of pharmacy projects may lead to reduced efficiency and efficacy of pharmacy-related pursuits, as well as increased frustration by pharmacists and potential patient-safety concerns. This frustration, in addition to other factors, may contribute to pharmacists' response to HIT and tendency to either accept or reject its implementation.

The utility of this research is based on the examination of a previously understudied targeted population, distribution of the survey to multiple sites across an entire state, and use of a previously validated dual-factor model. Pharmacists are a population that is not often studied in relation to HIT. Our literature search revealed that little to no research on pharmacists' acceptance of and resistance to the use of HIT has been completed, with the only identified previous research that included the pharmacist population having minimal representation of pharmacists and no separate analysis for these individuals.[37]

This study did have its limitations. First, the survey was distributed only to UTCOP preceptors, making the sample population fairly specific, which may influence application of results to other regions and to nonacademic sites. Additionally, the survey population ($n = 64$) was relatively small, which may have limited the number of significant conclusions that could be reached. The limited sample size may not be totally reflective of the distribution of the underlying population and negates the need for tests of normality. One of the UTCOP preceptor sites had recently transitioned to a new system, which may have influenced pharmacists' responses to the survey. Within the survey population, the use of Epic systems was likely underrepresented (21.9 percent) and the use of Cerner systems was likely overrepresented (48.4 percent) in comparison with hospital market share for EMR vendors.[38] Finally, the *p*-values were not adjusted for the multiple simultaneous subgroup ANOVA tests that were run, making significant findings more likely for the subgroups.

## Conclusions

The results suggest that it is reasonable to recommend that hospital systems focus on increasing pharmacists' attitude toward the system and minimizing transition costs. Promoting attitude may be possible by including pharmacist representation in decisions that involve EMRs, since stakeholder engagement and inclusion has been shown to increase attitudes for other healthcare-related initiatives.[39] Attitude can also be increased by demonstrating how the use of EMRs is beneficial.[40] Transition costs could be decreased by minimizing the number of updates and changes to the EMR and properly testing any updates to troubleshoot issues before the updates go live.[41, 42] The effects of perceived behavior control on acceptance of use suggest that it would also be reasonable to tailor training for the system more specifically to the needs of the pharmacists. Future research should be conducted with a more representative sample, rather than the convenience sample that was used for this study. A larger sample, including a more representative array of vendors and functionalities, could allow for nonparametric Wilcoxon-rank sum testing and for further conclusions to be drawn. Finally, it is evident that some system vendors have higher acceptance of use than others, which could also be partially due to interface integration and interoperability, so it may be prudent for management to consider the effects of these factors on user acceptance when selecting HIT vendors and infrastructure.

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## Notes

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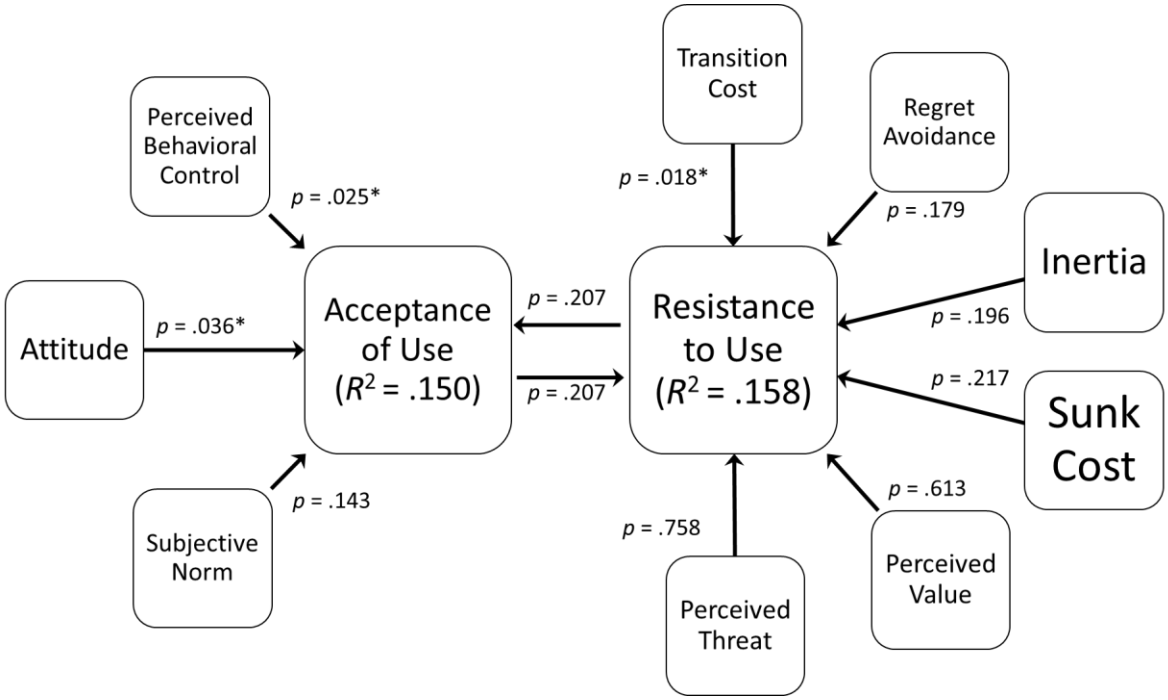
**Figure 1**

Dual-Factor Theory Constructs




*Note:* Asterisks indicate that the relationship of the construct to either acceptance or resistance was significant ($p < .05$) based on the results of the multiple linear regression.

**Table 1**

Background Characteristics (*n* = 64)

| **Characteristic** | **Number (Percent)** |
|---|---|
| ***Pharmacist Respondent*** | |
| Age | |
| Under 24 years | 0 (0) |
| 25–34 years | 26 (40.6) |
| 35–44 years | 22 (34.4) |
| 45–54 years | 11 (17.2) |
| 55–64 years | 2 (3.1) |
| 65–74 years | 3 (4.7) |
| Over 75 years | 0 (0) |
| Gender | |
| Female | 35 (54.7) |
| Male | 29 (45.3) |
| Practice experience | |
| Less than 5 years | 8 (12.5) |
| 5–14 years | 35 (54.7) |
| 15–24 years | 12 (18.8) |
| 25–34 years | 5 (7.8) |
| 35–44 years | 3 (4.7) |
| 45–54 years | 1 (1.6) |
| More than 55 years | 0 (0) |
| Highest pharmacy degree received | |
| Bachelor's | 5 (7.8) |
| Master's | 0 (0) |
| Doctorate | 59 (92.2) |
| Additional education/certifications | |
| Residency | 53 (82.8) |
| Fellowship | 3 (4.7) |
| Board certification | 43 (67.2) |
| Other certification | 6 (9.4) |
| Other advanced degree | 12 (18.8) |
| None | 5 (7.8) |
| ***Practice Site*** | |
| Number of beds | |
| Less than 100 | 2 (3.1) |
| 100–199 | 4 (6.3) |
| 200–299 | 22 (34.4) |
| 300–399 | 10 (15.6) |
| 400–499 | 4 (6.3) |
| More than 500 | 22 (34.4) |
| Main EMR system vendor | |
| Cerner EMR[a] | 31 (48.4) |

| | |
|---|---|
| Epic | 14 (21.9) |
| CPRS/VISTA | 6 (9.4) |
| Allscripts-McKesson | 6 (9.4) |
| Meditech | 4 (6.3) |
| Cerner Soarian[b] | 3 (4.7) |
| Pharmacy interface | |
| Separate component | 36 (56.3) |
| Integrated into EMR | 28 (43.8) |

*Abbreviation:* EMR, electronic medical record.
[a] One respondent reported Cerner EMR as the hospital's main vendor and answered questions based on experience with Cerner EMR, although that respondent noted that the hospital system used a mixture of systems.
[b] Formerly Siemens Soarian.

**Table 2**

Descriptive Statistics Acceptance and Resistance Constructs

| **Construct (Corresponding Survey Question Numbers)** | Cronbach's α | **Score Descriptive Statistics** | | |
|---|---|---|---|---|
| | | Pooled Mean (Range of Means) | Pooled SD (Range of SD) | Pooled Variance (Range of Variances) |
| Attitude (1–4) | 0.780 | 6.18 (5.41–6.86) | 1.14 (0.66–1.47) | 1.31 (0.44–2.15) |
| Subjective norm (5–7)[a] | 0.658 | 6.80 (6.75–6.86) | 0.79 (0.35–0.54) | 0.21 (0.12–0.29) |
| Perceived behavioral control (9–12) | 0.691 | 5.80 (4.92–6.28) | 1.42 (1.11–1.78) | 2.03 (1.22–3.18) |
| Sunk cost (13–14) | 0.691 | 5.99 (5.94–6.05) | 1.07 (1.07–1.08) | 1.15 (1.14–1.16) |
| Regret avoidance (15–16) | 0.670 | 3.13 (2.72–3.55) | 2.05 (2.00–2.11) | 4.21 (3.98–4.44) |
| Inertia (17–21) | 0.797 | 2.87 (2.33–3.86) | 1.51 (1.24–1.82) | 2.27 (1.53–3.33) |
| Perceived value (22–24) | 0.809 | 1.76 (1.70–1.80) | 1.11 (1.06–1.18) | 1.23 (1.13–1.40) |
| Transition costs (25–27) | 0.555 | 4.96 (4.38–5.77) | 1.49 (1.12–1.65) | 2.22 (1.26–2.74) |
| Perceived threat (28–30) | 0.844 | 1.95 (1.77–2.13) | 1.03 (0.81–1.27) | 1.07 (0.66–1.60) |
| Acceptance of use (31–33) | 0.817 | 5.02 (4.44–5.63) | 1.21 (1.11–1.27) | 1.47 (1.22–1.62) |
| Resistance to use (34–37) | 0.929 | 3.42 (3.11–3.86) | 1.52 (1.31–1.66) | 2.32 (1.72–2.76) |

*Abbreviation:* SD, standard deviation.
[a] Survey item 8 was removed because of the effect on reliability, as measured by Cronbach's alpha.

**Table 3**

Subgroup Analysis of Acceptance and Resistance Based on Pharmacist Characteristics

| **Characteristic** | **Acceptance of Use (Mean ± SD)** | **Resistance to Use (Mean ± SD)** |
|---|---|---|
| ***Pharmacist Respondent*** | | |
| Age | | |
| 25–34 years | 5.13 ± 0.95 | 3.44 ± 1.28 |
| 35–44 years | 4.77 ± 1.14 | 3.51 ± 1.40 |
| 45–54 years | 5.00 ± 0.84 | 3.30 ± 1.54 |
| 55–64 years | 6.50 ± 0.24 | 2.63 ± 0.88 |
| 65–74 years | 5.00 ± 1.45 | 3.50 ± 2.41 |
| Gender | | |
| Female | 5.08 ± 1.01 | 3.46 ± 1.46 |
| Male | 4.95 ± 1.09 | 3.36 ± 1.31 |
| Practice experience | | |
| Less than 5 years | 5.21 ± 1.05 | 2.72 ± 0.81 |
| 5–14 years | 4.92 ± 1.10 | 3.52 ± 1.42 |
| 15–24 years | 4.89 ± 0.64 | 3.75 ± 1.17 |
| 25–34 years | 5.40 ± 1.23 | 3.00 ± 1.87 |
| 35–44 years | 5.78 ± 1.54 | 2.50 ± 0.75 |
| 45–54 years | 4.33 | 4.33 |
| Highest pharmacy degree received | | |
| Bachelor’s | 5.67 ± 1.25 | 2.30 ± 0.60 |
| Doctorate | 4.97 ± 1.01 | 3.51 ± 1.39 |
| Additional education/certifications | | |
| Residency | 4.99 ± 1.04 | 3.36 ± 1.32 |
| Fellowship | 4.67 ± 0.88 | 3.33 ± 0.58 |
| Board certification | 5.04 ± 1.12 | 3.51 ± 1.39 |
| Other certification | 5.78 ± 1.28 | 2.75 ± 1.52 |
| Other advanced degree | 5.17 ± 1.44 | 3.46 ± 1.71 |
| None | 4.80 ± 1.07 | 3.45 ± 1.81 |
| ***Practice Site*** | | |
| Number of beds | | |
| Less than 100 | 5.83 ± 0.71 | 2.50 ± 0.71 |
| 100–199 | 5.25 ± 0.96 | 3.00 ± 0.58 |
| 200–299 | 4.62 ± 0.52 | 3.60 ± 1.40 |
| 300–399 | 5.30 ± 0.95 | 3.38 ± 0.87 |
| 400–499 | 5.75 ± 1.45 | 4.38 ± 2.17 |
| More than 500 | 5.05 ± 1.32 | 3.24 ± 1.53 |
| EMR system vendor | | |
| Cerner EMR[a] | 4.74 ± 1.09 | 3.34 ± 1.48 |
| Epic | 5.93 ± 0.88 | 3.23 ± 1.34 |
| CPRS/VISTA | 4.61 ± 0.57 | 3.88 ± 1.56 |
| Allscripts–McKesson | 5.11 ± 0.93 | 3.79 ± 0.75 |
| Meditech | 4.83 ± 0.19 | 3.88 ± 1.49 |

| | | |
|---|---|---|
| Cerner Soarian[b] | 4.56 ± 0.51 | 2.83 ± 1.61 |
| Pharmacy interface | | |
| Separate component | 4.57 ± 0.93 | 3.55 ± 1.42 |
| Integrated into EMR | 5.60 ± 0.88 | 3.25 ± 1.34 |

*Abbreviation:* EMR, electronic medical record.
[a] One respondent reported Cerner EMR as the hospital's main vendor and answered questions based on experience with Cerner EMR, although that respondent noted that the hospital system used a mixture of systems.
[b] Formerly Siemens Soarian.

**Table 4**

Subgroup Analysis of Variance (ANOVA) of Acceptance and Resistance Based on Pharmacist Characteristics

| **Characteristic** | **Degree of Freedom** | | **Acceptance of Use** | | **Resistance to Use** | |
|---|---|---|---|---|---|---|
| | **Between-Group df** | **Within-Group df** | **F** | ***p*-value** | **F** | ***p*-value** |
| ***Pharmacist Respondent*** | | | | | | |
| Age | 4 | 59 | 1.437 | .233 | 0.205 | .935 |
| Sex | 1 | 62 | 0.217 | .643 | 0.085 | .771 |
| Practice experience | 5 | 58 | 0.674 | .645 | 1.909 | .107 |
| Highest pharmacy degree received | 1 | 62 | 2.135 | .149 | 3.696 | .059 |
| Residency | 1 | 62 | 0.208 | .650 | 0.479 | .491 |
| Fellowship | 1 | 62 | 0.362 | .549 | 0.012 | .915 |
| Board certification | 1 | 62 | 0.038 | .845 | 0.525 | .472 |
| Other certification | 1 | 62 | 3.665 | .060 | 1.558 | .217 |
| Other advanced degree | 1 | 62 | 0.288 | .594 | 0.012 | .912 |
| ***Practice Site*** | | | | | | |
| EMR system vendor | 5 | 58 | 3.511 | .008 | 0.464 | .802 |
| Pharmacy interface | 2 | 61 | 1.577 | .215 | 1.107 | .337 |
| | | | | | | |

*Abbreviation:* EMR, electronic medical record.

## Appendix 1

Survey

The purpose of this research is to better understand pharmacist response to health information technology (HIT), namely Electronic Medical Records (EMRs), by assessing the contribution of various reasons for both acceptance and resistance to the technology. The benefits of this study for society include a better understanding of how pharmacists approach HIT, the promotion of more pharmacy-relevant policies and procedures, and the encouragement of pharmacists' adoption of HIT. This implementation will also likely lead to more effective use of the safety features of these systems, promoting patient safety.

The survey will consist of some general background information, a series of scaled questions, and one free response opportunity. The survey should take only 10–15 minutes to complete. There are no foreseeable risks to the completion of this survey. None of the information requested by the survey is personally identifiable, which means that identities will remain confidential. Your participation is voluntary, and if you choose to not participate or to stop participating at any time, your decision will not result in a penalty or affect your association with UTHSC or the College of Pharmacy.

For the purposes of this survey, Electronic Medical Record (EMR) refers to the electronic system and associated components that serve as the patient record. This is the system that is accessed and maintained by providers for specific encounters in hospitals and ambulatory environments. Associated components of the system may include pharmacy ordering systems, laboratory interfaces, etc. even if they are not directly linked to the primary system.

**Section One: Background**

1. What is your gender?
    - Male
    - Female
2. What is your age?
    - Under 18
    - 18–24
    - 25–34
    - 35–44
    - 45–54
    - 55–64
    - 65–74
    - 75–84
    - 85 or older
3. How many years of practice experience do you have?
    - Under 5
    - 5–14
    - 15–24
    - 25–34
    - 35–44
    - 45–54
    - Over 55
4. What pharmacy degree have you received?

   - Bachelor's
   - Master's
   - Doctorate
5. What additional education have you received? Please specify type/level, if applicable. (Select all that apply.)
   - Residency
   - Fellowship
   - Board certification
   - Other certification
   - Other degree
   - None
6. What is your current title? *(free text response)*
7. At what type of practice site do you work?
   - Hospital
   - Community
   - Other *(free text response)*
8. What is the zip code at your main practice site? *(free text response)*
9. What is the number of beds at your main practice site?
   - Less than 100
   - 100–199
   - 200–299
   - 300–399
   - 400–499
   - Over 500
10. Who is your EMR system vendor? (i.e., Epic, Cerner, McKesson, etc.) *(free text response)*
11. Is the pharmacy interface a separate component than the EMR? (i.e., the pharmacy interface functions separately from the main EMR system and may open as a separate window/program)
    - Yes
    - No
12. Is the pharmacy system interoperable with the EMR? (i.e., the pharmacy interface automatically populates and pulls information into/from the main EMR)
    - Yes
    - No
    - Don't know

**Section Two: Acceptance and Resistance**

Please choose the most appropriate response

| | Strongly Agree | Agree | Somewhat Agree | Neither Agree or Disagree | Somewhat Disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|---|
| 1. Use of the EMR within my institution is a good idea. | | | | | | | |
| 2. My interaction with the EMR is pleasant. | | | | | | | |
| 3. In the past, my experience with updates and new features of the EMR has been positive. | | | | | | | |
| 4. Using the EMR is beneficial to my care and management of patients. | | | | | | | |
| 5. The healthcare industry, as a whole, thinks I should use the EMR. | | | | | | | |
| 6. The organizational management at my institution and my supervisors think I should use the EMR. | | | | | | | |
| 7. My coworkers think I should use the EMR. | | | | | | | |
| 8. Patients think I should use the EMR. | | | | | | | |
| 9. I am able to effectively utilize the EMR in my patient care and management. | | | | | | | |
| 10. I do not have adequate knowledge to use the EMR effectively in my patient care and management. | | | | | | | |
| 11. I have received adequate training and have access to sufficient resources to use the EMR effectively in my patient care and management. | | | | | | | |
| 12. Using the EMR effectively is entirely within my control. | | | | | | | |
| 13. I have invested a lot of time in learning to use my institution's current EMR. | | | | | | | |
| 14. Prior to past updates and implementation of new features of the EMR, I had already invested a lot of time in perfecting my existing method and skills. | | | | | | | |
| 15. I feel sorry for my institution's decision to use our particular EMR. | | | | | | | |
| 16. I feel regret for bad outcomes that may be consequences of utilizing or implementing our EMR and its features. | | | | | | | |
| 17. I do not use some features or updates of the EMR (…) | | | | | | | |
| 18. Because it would be stressful to change. | | | | | | | |
| 19. Because I enjoy the way I currently do things. | | | | | | | |
| 20. Because it would negatively impact my current workflow. | | | | | | | |
| 21. Even though I know it is not the best way of doing | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| things. | | | | | | | |
| 22. The EMR does not enhance my effectiveness on the job any more than working without it. | | | | | | | |
| 23. The change to the new way of healthcare, which utilizes the EMR, is not good value. | | | | | | | |
| 24. Working with the EMR does not improve the quality of the work I do any more than working without it. | | | | | | | |
| 25. I have already put a lot of time and effort into mastering the current EMR. | | | | | | | |
| 26. In my experience, implementing EMR updates and new features requires a lot of time and effort. | | | | | | | |
| 27. In my experience, implementing EMR updates and new features results in unexpected hassles. | | | | | | | |
| 28. I fear that I may lose control over the way I work if I use the features of the EMR. | | | | | | | |
| 29. I am worried that I may lose control over the way I make clinical decisions if I use the features of the EMR. | | | | | | | |
| 30. I fear that I may lose control over patient care if I use the features of the EMR. | | | | | | | |
| 31. I intend to increase my use of the EMR and its features in the foreseeable future. | | | | | | | |
| 32. I intend to invest my time and effort in fully utilizing the EMR. | | | | | | | |
| 33. I intend to change my current way of working so that I can fully utilize the EMR. | | | | | | | |
| 34. I don’t want the EMR to change the way I care for patient processes. | | | | | | | |
| 35. I don’t want the EMR to change the way I make clinical decisions. | | | | | | | |
| 36. I don’t want the EMR to change the way I interact with other people on my job. | | | | | | | |
| 37. Overall, I don’t want the EMR to change the way I currently work. | | | | | | | |

**Section Three: Pharmacy-Specific**

Please choose the most appropriate response.

| | Strongly Agree | Agree | Somewhat Agree | Neither Agree or Disagree | Somewhat Disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|---|
| 1. The EMR is designed well for the workflow of my pharmacy. | | | | | | | |
| 2. The EMR was designed with pharmacists in mind. | | | | | | | |
| 3. EMR needs for pharmacists are different than the needs for other healthcare professionals (e.g., nurses, physicians, etc.). | | | | | | | |
| 4. How do you perceive the EMR needs of pharmacists being different from other professions? *(free text response)* | | | | | | | |