Clinician Acceptance of Order Sets for Pain Management: A Survey in Two Urban Hospitals

Yifan Liu[1] Haijing Hao[2] Mohit M. Sharma[1] Yonaka Harris[1] Jean Scofi[3] Richard Trepp[4] Brenna Farmer[3] Jessica S. Ancker[5] Yiye Zhang[1,3]

[1] Department of Population Health Sciences, Weill Cornell Medicine, New York, New York, United States
[2] Department of Computer Information Systems, Bentley University, Waltham, Massachusetts, United States
[3] Department of Emergency Medicine, Weill Cornell Medicine, New York, New York, United States
[4] Department of Emergency Medicine, Columbia University, New York, New York, United States
[5] Department of Biomedical Informatics, Vanderbilt University Medical Center, New York, New York, United States

Address for correspondence Yiye Zhang, PhD, MS, 425 E, 61st Street, New York, NY 10065, United States (e-mail: yiz2014@med.cornell.edu).

Appl Clin Inform 2022;13:447–455.

Abstract

Background Order sets are a clinical decision support (CDS) tool in computerized provider order entry systems. Order set use has been associated with improved quality of care. Particularly related to opioids and pain management, order sets have been shown to standardize and reduce the prescription of opioids. However, clinician-level barriers often limit the uptake of this CDS modality.

Objective To identify the barriers to order sets adoption, we surveyed clinicians on their training, knowledge, and perceptions related to order sets for pain management.

Methods We distributed a cross-sectional survey between October 2020 and April 2021 to clinicians eligible to place orders at two campuses of a major academic medical center. Survey questions were adapted from the widely used framework of Unified Theory of Acceptance and Use of Technology. We hypothesize that performance expectancy (PE) and facilitating conditions (FC) are associated with order set use. Survey responses were analyzed using logistic regression.

Results The intention to use order sets for pain management was associated with PE to existing order sets, social influence (SI) by leadership and peers, and FC for electronic health record (EHR) training and function integration. Intention to use did not significantly differ by gender or clinician role. Moderate differences were observed in the perception of the effort of, and FC for, order set use across gender and roles of clinicians, particularly emergency medicine and internal medicine departments.

Conclusion This study attempts to identify barriers to the adoption of order sets for pain management and suggests future directions in designing and implementing CDS systems that can improve order sets adoption by clinicians. Study findings imply the importance of order set effectiveness, peer influence, and EHR integration in determining the acceptability of the order sets.

Keywords
- order sets
- electronic health records
- technology acceptance
- clinical decision support
- opioid

received
November 24, 2021
accepted
February 18, 2022

Georg Thieme Verlag KG,
Rüdigerstraße 14,
70469 Stuttgart, Germany

DOI https://doi.org/10.1055/s-0042-1745828.
ISSN 1869-0327.

Background and Significance

Clinical decision support (CDS) systems present clinicians, patients, and other stakeholders (including administrative staff and other members of the care team) with relevant clinical knowledge and patient information to improve health and health care delivery.[1] Examples of CDS include computerized alerts, diagnostic support, visualized summaries, and, in recent years, predictive analytics functions.[2–5] One key area of CDS is within the computerized provider order entry (CPOE) system. Adopted by over 95% of the U.S. non-federal acute hospitals,[6] CPOE plays a central role in the clinical workflow. Since many potential adverse drug events occur because of errors during order placement, an important role of CDS for CPOE is to reduce errors and support safe and efficient order placement.[7] A classic CDS for order entry in CPOE is an order set. Order sets present multiple orders for a particular clinical purpose as a set, with appropriate default settings, for clinicians to select.[8] Providing an alternative to placing standalone orders one by one, order sets often serve as an electronic health record (EHR)-embedded guideline for best practices. They are expected to result in improved safety, effectiveness, and efficiency while reducing care variations.[9–11] Thus, the creation of order sets has been widely accepted as a requirement for a successful CPOE implementation.[8,12,13]

Condition- or population-specific order sets have been associated with improved health care quality in the ambulatory setting,[14] surgical intensive care units,[15] chronic obstructive pulmonary disease units,[16] and emergency departments.[17,18] For instance, the adoption of standardized order sets in sepsis and septic shock has resulted in a significant reduction in morbidity, mortality, and use of health care resources[19] and led to improved antibiotic therapy and greater fluid administration.[20] A study conducted to evaluate the impact of the implementation of a standardized order set demonstrated that there was a statistically significant reduction in the length of stay and 100-day readmissions for pediatric asthma patients.[16] Particularly related to pain management, studies conducted in the emergency departments at two separate health systems by Delgado et al and Montoy et al concluded that default settings in the EHR order sets can influence prescription choices where a lower number of opioid tablet set in the default setting led to a lower number of actually prescribed pills.[21,22] Furthermore, a study conducted by Netley et al that evaluated the implementation of ALTO (alternative to opioids) order sets within an EHR found that they not only encouraged reduced prescription of opioids but also helped in optimizing dosing of nonopioid analgesics.[23] For better pain management, in addition to order sets, various tools, such as interactive pain management systems,[24] visual analytics for opioid documentation,[25] and pain information models,[26] have also been applied.

Despite order sets' common presence in CPOE and reported benefits, order set usage or acceptance reported by previous studies varies by clinical specialties, potentially limiting the improvement in patient care through CDS.[8,12,13,27] Asaro et al reported that while CPOE order sets were preferred by physicians over the paper version, the shortcomings in the operational activities of the system coupled with cultural and organizational challenges limited the effectiveness of the CPOE implementation.[28] Previous studies have reported that performance and peer influence were the most critical factors in determining the intention to use EHR or health care applications.[29,30] In particular, processes, training, and efficacy have been named as barriers to CPOE adoption.[31] Similarly, Vandenberg et al found that autonomy, familiarity, and learning curve were barriers in an order set designed to improve geriatric prescribing in the emergency department.[18]

We hypothesize that demonstrated benefits of order sets, and an environment that facilitate their use, may be associated with order sets' acceptability and intention to use by clinicians. To test our hypothesis, we used the Unified Theory of Acceptance and Use of Technology (UTAUT) framework.[32] UTAUT is a well-established and widely used theoretical framework for understanding technology acceptance and has been applied to explain CDS adoption.[33] Among the several theoretical models that have been used to assess the acceptability and intention to use of any new technological product, including theory of reasoned action (TRA), technology acceptance models (TAM), motivational model, theory of planned behavior (TPB), combined TAM and TPB, model of personal computer utilization, innovation diffusion theory, and social cognitive theory, UTAUT is one of the most well-established and validated frameworks in the health care domain.[32] In UTAUT, performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) are the key determining factors of behavioral intention (BI) and actual behavior. Gender, age, experience, and voluntariness/willingness to use serve as modifying factors affecting user behavior.[34] Related to PE and EE in UTAUT is the Physician Order Entry User Satisfaction and Usage Survey,[35] which was focused on an early effort of POE and found that satisfaction was correlated with its ability to improve productivity. The FC in UTAUT refers to environments and support systems that enable the technology use. The concept is also covered in the Computer Self-Efficacy Scale that assesses individual skills and knowledge related to using and learning computers.[36]

Objectives

To understand factors that affect the use of order sets by clinicians in an urban academic medical center, a cross-sectional survey based on UTAUT constructs was conducted among clinicians in two hospital campuses of an urban academic medical center, between October 2020 and April 2021. We particularly focused on the use of order sets for safe pain management. Opioid misuse is a national crisis that significantly affects public health and social welfare in the United States.[37] Opioid prescription in inpatient and emergency department settings is a common and yet less recognized gateway for opioid-naïve patients to develop dependence.[38–40] Recent studies have demonstrated the

potential of EHR-based interventions in the emergency department to mitigate opioid prescriptions by using default settings to nudge clinicians to limit prescriptions.[21] In addition, previous studies have reported that many care variations exist in opioid prescribing among clinicians.[41–43] Naturally, with the CDS functions of order sets through their controlled content and default settings, the use of order sets may play a role in facilitating safety and quality care in the context of opioid prescribing. However, few studies have examined clinician perception of order sets for opioid prescriptions.[44] This study investigates what factors may affect clinicians' decision to adopt the order sets into their clinical work, thus improving care safety and quality in pain management and opioid prescription. Our objective is to assess barriers and facilitators to the use of order sets by clinicians at a large urban academic medical center. We hypothesized that PE and FC as defined in the UTAUT framework might determine clinicians' intention of use.

Methods

Participants and Setting

We recruited clinicians including physicians, physician assistants, and nurse practitioners at two campuses of an academic medical center. There were two inclusion criteria. First, the participant had to have a clinical role to use the CPOE functions in the EHR, and second, the eligible participant had to have used, or tried to use, order sets to place an order at least once within a 1-year period before the survey. In the study site, order sets are built in the Epic EHR system, which was newly implemented, transitioning from Allscripts Sunrise EHR, one month prior to the survey initiation. Participants were recruited from emergency medicine, internal medicine, surgery, and other divisions in medicine. Recruitment venues included the listservs of departmental residents and faculty/staff. Participants received a $10 gift card as an incentive.

Study Design

The survey was a cross-sectional, online survey in English and accessible via a secure website. The survey was designed to take 5 to 10 minutes to complete. Surveys were created using survey software Qualtrics (Provo, Utah, United States) and distributed using an electronic link. All survey questions are listed in ►Table 1. The questions were designed to elicit responses demonstrating clinicians' characteristics and BI toward order sets in the EHR, particularly for pain management. Clinician characteristics included department affiliation, clinical role (physician, physician assistant, nurse practitioner, and other), levels of experience (attending physician and resident), and gender. The survey also included questions designed to capture EE (perceived ease of use), PE (perceived value of using order sets in terms of easing workload and providing CDS), SI, FC (level of IT training and literacy provided by the institution[45,46] and past experience in designing or modifying order sets), and BI (a user's intention to use new technology). We also asked about desired functions in the order set particularly related to pain management. Response options include multiple choices for characteristics questions and 7-point Likert scales for construct questions. ►Fig. 1 displays the questions and the constructs they represent based on UTAUT. This study

Table 1 Survey questions and constructs

Construct	Question	Number
PC	What is your department?	Q1
PC	How do you characterize yourself?	Q2
PC	If physician, are you an attending or resident?	Q3
PC	What is your length of time in practice? If resident:	Q4
PC	What is your length of time in practice? If attending:	Q5
PC	What is your gender?	Q6
EE1	The current EHR is easy to use.	Q8
EE2	It requires less work to use order sets compared with free-standing orders in the current EHR.	Q10
PE1	The current order sets in the EHR make order placement easier.	Q9
PE2	Current order sets help me practice safe pain management.	Q15
SI1	My institution encourages me to use order sets.	Q20
SI2	My current peers use order sets regularly for clinical decision support or convenience.	Q21
FC1	Did you receive sufficient EHR training at your current institution?	Q7
FC2	I know how to suggest changes to order sets at my current institution.	Q11
FC3	Order sets for pain management are well integrated with other functions in the EHR at my current institution.	Q14
BI	Would you be interested in having an order set for pain management?	Q16
BI	Would you be interested in having an order set, with decision support, for alternative pain management to opioids?	Q17
Other	I want reminders within the EHR for me to practice safe pain management.	Q12
Other	Do you have access to a pain management order set in your EHR?	Q13
Other	What other functions do you wish to have in the EHR to assist with pain management?	Q18
Other	Do you have any additional thoughts on opioids and EHR use?	Q19

Abbreviations: BI, behavioral intention; EE, effort expectancy; EHR, electronic health records; FC, facilitating conditions; PC, clinician characteristics; PE, performance expectancy; SI, social influence.

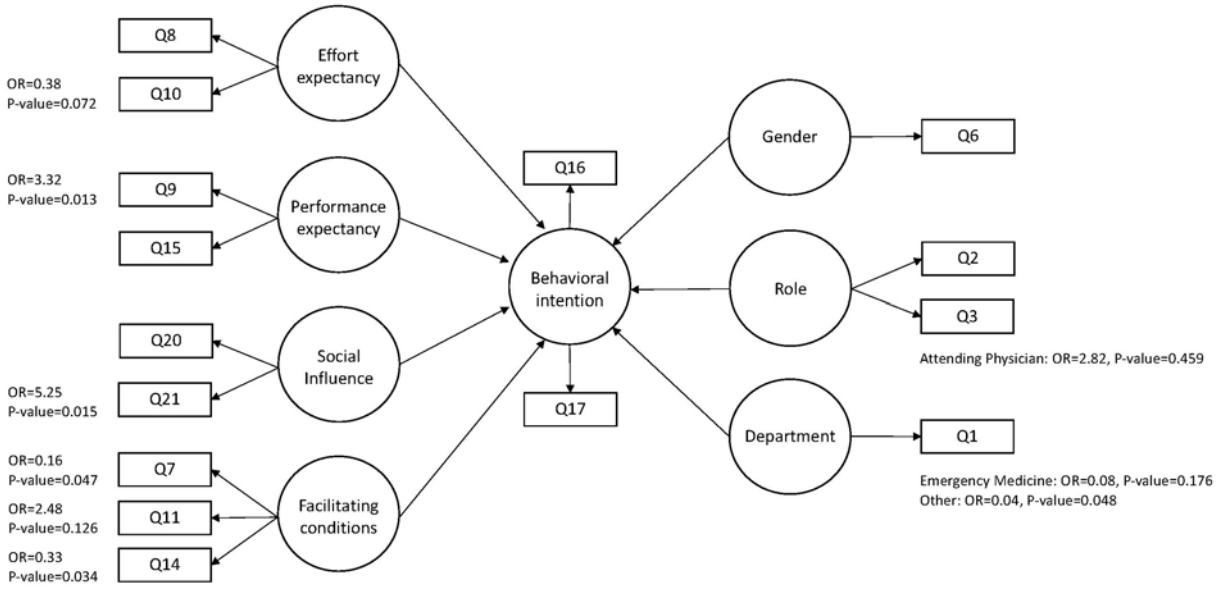

Fig. 1 UTAUT Model. UTAUT: Unified Theory of Acceptance and Use of Technology.

was approved by Weill Cornell Medicine Institutional Review Board, and all participants provided written informed consent.

Statistical Analyses

We computed descriptive statistics from the survey, including the count and percentage of each survey answer by constructs. For analysis, we categorized departments into three groups: emergency medicine, general internal medicine, and other groups. Participants in the other groups included surgery, obstetrics and gynecology, and other divisions in medicine. Responses with missing affiliation information were also included in the other groups. Participants' clinical roles were classified as attending physicians or non-attending clinicians that include residents, nurse practitioners, physician assistants, and other providers. Since responses to the UTAUT questions were in the 7-point Likert scales, we transformed descriptive responses to be numeric scores with the range of 1 to 7, namely setting 1 as "strongly disagree," 2 as "disagree," and 7 as "strongly agree." After generating the transformed score for each question, we averaged scores for all questions in each construct for each participant and used it as the construct's overall score for this participant. For each construct, to test clinician characteristics and other construct differences between participants with high and low construct score groups, we defined those with scores higher than 4 as the high construct score group and those no higher than 4 as the low construct score group. To compare participants' characteristics and construct scores for different groups of participants, we conducted Wilcoxon rank-sum tests for continuous variables and chi-square or Fisher's exact tests for categorical variables, at an α of 0.05.

Further, we converted answers to BI questions to be a binary BI variable, which is 1 (intend to use) if participants somewhat agreed/agreed/strongly agreed to either questions 16 or 17, and 0 (not intend to use) if otherwise. We also tested the differences in clinician characteristics and the four constructs between the binary BI variables, intend to use and not intend to use groups, with Wilcoxon rank-sum tests for continuous variables and chi-square or Fisher's exact tests for categorical variables, at a significant level of 0.05. To further test our hypothesis, we used the binary BI as the dependent variable, and answered questions given in ►Table 1 regarding clinicians' department, clinical roles, and UTAUT constructs as independent variables in a logistic regression model. Forward stepwise logistic regression was used to choose the final model. All analyses were conducted using R 3.6.0.

Results

The survey was distributed to two listservs of at least 630 clinicians through emails containing web links to the survey. Out of 127 surveys started, 124 (97.6%) finished the survey, and eight surveys were removed from the analysis because more than 50% of their answers were missing. Among the 116 remaining respondents, the gender distribution was 54 (46.6%) males versus 62 (53.4%) females and 37 (31.9%) attending physicians versus 79 (68.1%) non-attending clinicians. Participants from internal medicine, emergency medicine, and other departments accounted for 45.7% ($N = 53$), 44.0% ($N = 51$), and 10.3% ($N = 12$), respectively.

►Table 2 shows the descriptive statistics for UTAUT constructs. Most respondents agreed that they had received sufficient training for the use of the EHR at their current institution (94.8%), felt that the current EHR was easy to use (90.5%), and agreed that the order sets in the EHR enabled the easier placement of orders (88.8%). The majority were interested in having an order set for pain management (88.8%) and were interested in using an order set with CDS functions for alternative pain management to opioids (90.5%). However, only 40.5% of the respondents were aware of how to

Table 2 Summary of answers to question related to UTAUT

Construct	Question	*N* (%) answered agree/yes[a]
EE1	Q8: The current EHR is easy to use.	105 (90.5%)
EE2	Q10: It requires less work to use order sets compared with free-standing orders in the current EHR.	64 (55.2%)
PE1	Q9: The current order sets in the EHR make order placement easier.	103 (88.8%)
PE2	Q15: Current order sets help me practice safe pain management.	32 (27.6%)
SI1	Q20: My institution encourages me to use order sets.	93 (80.2%)
SI2	Q21: My current peers use order sets regularly for clinical decision support or convenience.	88 (75.9%)
FC1	Q7: Did you receive sufficient EHR training at your current institution?	110 (94.8%)
FC2	Q11: I know how to suggest changes to order sets at my current institution.	47 (40.5%)
FC3	Q14: Order sets for pain management are well integrated with other functions in the EHR at my current institution.	25 (21.6%)
BI	Q16: Would you be interested in having an order set for pain management?	103 (88.8%)
BI	Q17: Would you be interested in having an order set, with decision support, for alternative pain management to opioids?	105 (90.5%)
Other	Q12: I want reminders within the EHR for me to practice safe pain management.	74 (63.8%)
Other	Q13: Do you have access to a pain management order set in your EHR?	18 (15.5%)

Abbreviations: BI, behavioral intention; EE, effort expectancy; EHR, electronic health records; FC, facilitating conditions; PE, performance expectancy; SI, social influence; UTAUT, Unified Theory of Acceptance and Use of Technology.
[a]All the questions counted the number of respondents agreeing (somewhat agreed/ agreed/ strongly agreed) to the question except for Q13 that counted the number of respondents answering yes.

suggest changes to order sets at their current institution, which may be related to the new EHR implementation but underscored the need to communicate these processes to front-line staff. Only 15.5% answered yes when asked whether order sets exist for pain management in the institution.

►**Supplementary Table S1** (available in the online version) shows Spearman's rank correlation among all UTAUT constructs. BI was positively correlated with SI construct 1 and 2, FC construct 2, and EE construct 1. ►**Supplementary Tables S1** to **S5** (available in the online version) present the descriptive statistics and statistical analysis by four constructs, EE, PE, SI, and FC.

Effort Expectancy

►**Supplementary Table S2** (available in the online version) shows that most of the respondents' EE scores were higher than 4 ($N = 97$, 83.6%) or in the high EE score group. More than half (50.5%) of the respondents in the high EE score group were males, while only a little more than one-quarter (26.3%) of the respondents in the low EE score group were males; however, there were more females in the low EE score group than those in the high EE score group. Among three department categories, internal medicine respondents (63.2%) were the largest sub-group in the low EE group and emergency medicine respondents (46.4%) were the largest sub-group in the high EE group. The PE, SI, and FC scores in the low EE score group were lower than those in the high EE score group, and particularly, the difference in PE was statistically significant (p-value = 0.041).

Performance Expectancy

As shown in ►**Supplementary Table S3** (available in the online version), there were more ($N = 93$, 80.2%) respondents in the high PE score group than those in the low PE score group ($N = 23$, 19.8%). Both in the low PE score group and high PE score group, there were more females than males, with 52.2% females in the low PE score group and 53.8% females in the high PE score group. Among the three departments, internal medicine respondents held the highest proportion in the low PE score group (65.2%) and emergency medicine respondents held the highest proportion in the high PE group (47.3%). Similar to EE, non-attending clinicians represented a higher proportion than attending physicians in both the low PE score group and the high PE score group, 82.6 and 64.5%, respectively. For other construct scores, similar to the statistics by EE score, respondents in the low PE score group had lower EE, SI, and FC scores than those in the high PE score group. The differences in SI and FC constructs were statistically significant (p-values < 0.001).

Social Influence

As in ►**Supplementary Table S4** (available in the online version), there were more respondents in the high SI score group ($N = 100$, 86.2%) than those in the low SI score group ($N = 16$, 13.8%). Similar to the PE score group, there were more females than males in both the low SI score group and the high SI score group. There was a statistically significant difference in the department distribution between low and high SI score groups (p-value = 0.002) among the emergency

Table 3 Clinician characteristics and construct scores by binary BI construct

	Not Intend to use ($N = 9$)	Intend to use ($N = 107$)	Overall ($N = 116$)	*p*-Value
Gender (%)				0.732
Males	5 (55.6)	49 (45.8)	54 (46.6)	
Females	4 (44.4)	58 (54.2)	62 (53.4)	
Department (%)				0.402
Emergency medicine	3 (33.3)	48 (44.9)	51 (44.0)	
Internal medicine	4 (44.4)	49 (45.8)	53 (45.7)	
Other	2 (22.2)	10 (9.3)	12 (10.3)	
Role (%)				1.000
Attending physician	3 (33.3)	34 (31.8)	37 (31.9)	
Non-attending clinician	6 (66.7)	73 (68.2)	79 (68.1)	
EE score (mean [SD])	5.06 (0.58)	5.08 (1.02)	5.08 (0.99)	0.798
PE score (mean [SD])	4.22 (1.52)	4.91 (0.92)	4.85 (0.99)	0.235
SI score (mean [SD])	4.61 (0.70)	5.45 (1.09)	5.38 (1.08)	0.004[a]
FC score (mean [SD])	4.04 (0.61)	4.52 (1.06)	4.49 (1.04)	0.124

Abbreviations: BI, behavioral intention; EE, effort expectancy; FC, facilitating conditions; PE, performance expectancy; SI, social influence; SD, standard deviation.
[a]*p*-Value < 0.01.

medicine, internal medicine, and other departments, with internal medicine having the largest proportion in the low SI score group and emergency medicine the largest proportion in the high SI score group. Regarding the respondents' clinical roles, similar to PE, more non-attending clinicians were in the low and high SI score groups (87.5 and 65.0%). The high SI score group had statistically higher EE, PE, and FC construct scores than the low SI group (*p*-values $= 0.005, < 0.001$, and < 0.001, respectively).

Facilitating Conditions

As shown in ►**Supplementary Table S5** (available in the online version), although 60.3% of the respondents ($N = 70$) were in the high FC score group, this percentage was lower than that of high EE, PE, and SI score groups. There were more females in the low FC score group (60.9%) but more males in the high FC group (51.4%). Within the low FC score group, internal medicine had the highest percentage of respondents (73.9%), and within the high FC score group, emergency medicine had the highest percentage of respondents (64.3%). Statistically, the difference among department distributions between the two groups was significant (*p*-value < 0.001). Furthermore, non-attending clinicians had a statistically higher percentage than the attending physicians in the low FC score group than in the high FC score group (*p*-value < 0.001). Respondents who were in the high FC group were more likely to be in high EE, PE, and SI score groups as well, and statistically significant differences were observed in PE and SI constructs (*p*-values < 0.001).

Logistic Regression Model

The outcome for the logistic regression model was defined using the binary BI variable into intend to use group versus not intend to use group. We tested the differences in clinician characteristics and construct scores as shown in ►**Table 3**. The majority (92.2%, $N = 107$) of respondents were in the intend to use group, showing an interest in having an order set for pain management or having an order set with decision support for alternative pain management to opioids. In the not intend to use group, there were more males than females, 55.6 versus 44.4%, while in the intend to use group, there were more females than males, 54.2 versus 45.8%. Within either group, respondents in internal medicine took up a higher percentage (44.4 and 45.8%) than those in emergency medicine (33.3 and 44.9%) or other (22.2 and 9.3%) departments. The respondents' average EE, PE, SI, and FC construct scores were all higher in the intend to use group than those in the not intend to use group, but the only difference in SI score was statistically significant (*p*-value $= 0.004$).

The results of the logistic regression model are displayed in ►**Table 4**. Questions related to PE (*p*-value $= 0.013$), SI (*p*-value $= 0.015$), and FC (*p*-values $= 0.047$ and 0.034) had statistically significant impacts on the binary BI variable, controlling for departments, and clinical roles. A point increase in the PE construct 1, a question about the performance of the current order sets in EHR (Q9), increased the odds of BI by a factor of 3.32. A point increase in the SI construct 2, a question regarding peers' use of order sets (Q21), increased the odds of BI by a factor of 5.25. A point increase in the FC construct 1, a question related to EHR training (Q7), and a point increase in the FC construct 3, a question on the integration of pain management (Q14), decreased the odds of BI by a factor of 0.16 and 0.33, respectively. In terms of departments, the odds ratios of BI from emergency medicine and other departments over internal medicine were 0.08 and 0.04, respectively, relatively

Table 4 Logistic regression model

Variable	Odds ratio (CI)	*p*-Value
Emergency medicine department[a]	0.08 (0.00, 2.17)	0.176
Other department[a]	0.04 (0.00, 0.82)	0.048[c]
Attending physician[b]	2.82 (0.19, 68.93)	0.459
EE2	0.38 (0.11, 0.94)	0.072
PE1	3.32 (1.51, 11.12)	0.013[c]
SI2	5.25 (1.71, 28.59)	0.015[c]
FC1	0.16 (0.02, 0.68)	0.047[c]
FC2	2.48 (1.02, 12.41)	0.126
FC3	0.33 (0.09, 0.81)	0.034[c]

Abbreviations: CI, confidence interval; EE, effort expectancy; FC, facilitating conditions; PE, performance expectancy; SI, social influence.
[a]For department categorical variable, the reference group is internal medicine.
[b]For attending physician group, the reference group is non-attending clinician group.
[c]*p*-Value < 0.05.

small, which indicated that compared with clinicians in internal medicine, clinicians in these departments were likely to have much lower intention to use order sets. Variance inflation factors between variable pairs were all less than 10, removing concerns for multicollinearity among variables in the model.

Discussion

Findings

Based on our survey result, the clinicians at two campuses of an urban academic medical center had a strong interest in order sets for pain management. A majority (88.8%) were interested in having an order set for pain management; 90.5% were interested in using an order set with CDS functions for alternative pain management to opioids. In total, 88.8% agreed that order sets make order placement easier, and over half (55.2%) of clinicians agreed that it requires less work to use order sets compared with standalone orders in the current EHR. While the former is based on PE, the latter is based on EE.

Three out of four major constructs, PE, SI, and FC, have statistically significant impacts on clinicians' adoption intention, which are consistent with previous studies on factors impacting clinicians' technology adoption intention by using the UTAUT framework.[34,47–49] Our study found that SI had the strongest impact (odds ratio = 5.25, *p*-value = 0.015) on clinicians' intention to use order sets in EHR among the four constructs in our UTAUT model. SI has been found to be a strong factor that impacts physicians' EHR adoption in extant research via various research methods,[29,34,50–52] although the impact level varied across studies. Some studies found that SI was less impactful than PE, EE, and FC,[47] which is different from our results. This study showed that the PE, order sets make order placement easier, has the second strongest impact on clinicians' intention to use the order sets (odds ratio = 3.32, *p*-value = 0.013). On the contrary to previous studies, we found that the EE does not have a statistically significant impact on clinicians' intention to use the order sets. This may suggest that high-performing order sets would be more acceptable, which should be considered in the design of the future order sets in EHRs. Contrary to our expectation, the FC, FC1, and FC3, were negatively associated with intention to use, particularly FC3 that is related to EHR training. Since the question was asked about order sets, it is possible that those who were more experienced with the EHR had other preferences such as quick-lists or order panels (i.e., answered based on HER-specific nomenclature but still might or might not prefer content that could provide CDS), although we are not able to verify these preferences. It is also possible that some unavailable controlled variables or a limited sample size may have biased our model result. We also found trends across gender and clinician types. While not statistically significant, female clinicians were consistently more likely to be in the lower UTAUT construct groups (EE, SI, and FC). On the contrary, more female clinicians answered positively to intention to use. Similar trends were observed with non-attending clinicians, who were more likely to report low PE, FC, and SI.

Limitations

Our study has several limitations. The primary one is that the majority of survey respondents were clinicians concentrated in internal medicine or emergency medicine in two urban hospitals in one urban area. Reduced sample size for analysis due to missing values, moreover, limited the number of respondents from other departments such as surgery. In addition, only hospital sites in an academic medical center were studied, which might limit generalizability to other sorts of medical organizations. Further survey distribution to other settings or specialties, such as non-academic centers and surgery department, is needed to be representative of the general clinician population. The newly implemented EHR at the time of survey initiation may have also caused difficulty in assessing whether perceptions assessed in the survey were formed from the legacy EHR or the new EHR system. While we considered broad factors in developing our research questions and questionnaires, future studies could assess respondents' attitudes in terms of their specific user preferences as well as their perceptions on having educational initiatives for the same. Qualitative analysis on open-ended free-text responses could provide additional insights.

Conclusion

The present study findings highlight the importance of health system performance and the technological culture in understanding the barriers to order set acceptance. Under the UTAUT framework, we find that the acceptance of order set use for pain management may be steered by its ease to use as a CDS, peer usage, organizational endorsement, and better integration with other functions in EHR, ensuring that

order set design is configured to improve quality metrics and having organizational leadership support to raise awareness may increase acceptance. We further found that perceptions differed across gender and clinician types although not with statistical significance. Ensuring that clinicians across experience levels receive the same EHR training and similar clinical working environment may provide more support to order set use. Future work may also investigate detailed clinician characteristics to determine acceptance.

Clinical Relevance Statement

The study sheds light on factors to be considered when incorporating order sets, a CDS tool in the EHR, specifically for pain management. Identified factors represented the importance of PE, SI, and FC in using order sets. Insights into barriers of order set use are crucial to understand in implementing system-level changes to ensure its efficacy in patient care.

Multiple Choice Questions

1. When implementing order sets, which of the following did the survey find to useful to pay attention to?
   a. Patient characteristics
   b. Hospital size
   c. EHR vendor communication
   d. Social influence

   Correct Answer: The correct answer is option d. The results showed that clinicians' intention to use order sets was associated with social influence by leadership and peers.

2. What technology acceptance framework may one consider in studying the perceptions of order sets as a form of clinical decision support?
   a. Unified Theory of Acceptance and Use of Technology
   b. Theory of reasoned action
   c. Theory of planned behavior
   d. All of the above

   Correct Answer: The correct answer is option a. Unified Theory of Acceptance and Use of Technology framework is a well-established, validated theoretical framework for understanding technology acceptance in the health care domain.[32]

Protection of Human and Animal Subjects

An IRB approval was obtained from Weill Cornell Medicine IRB to conduct this project.

Funding

This study was funded by U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality (R03 HS26266).

Conflict of Interest

None declared.

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