# Improved Patient Flow and Provider Efficiency After the Implementation of an Electronic Health Record

Lesley Pyron, DNP, APRN, FNP-BC, Heather Carter-Templeton, PhD, RN-BC

Electronic health records are used widely across the nation in many different types of healthcare facilities. Electronic health record systems can provide more accurate and complete information about a patient's health, improve patient safety, and improve patient care. The purpose of this project is to evaluate a provider efficiency and workflow program at a hospital-owned, freestanding urgent care system after implementation of an electronic health record. A retrospective, longitudinal approach was used to evaluate the implementation of an electronic health record system among six freestanding urgent care clinics. The logic model was used as a guiding framework to determine whether provider efficiency and patient flow were improved. Data were collected from participants via an online survey, electronic health record data review, paper chart review, and direct observation of providers. An evaluation of a provider efficiency program using door-to-triage, door-to-provider, door-to-discharge, and average length of stay at each urgent care clinic was collected. The results indicate improvement in all areas after implementation of the electronic health record in all six urgent care settings. The average length of stay decreased from 109 minutes in 2014 to 73 minutes in 2016.

**KEY WORDS:** Electronic medical record, Program evaluation, Urgent care

ccording to the Urgent Care Association of America, the average urgent care patient visits per year are approximately 71 to 160 million, with an average wait time of 60 to 120 minutes. Increased patient volume, decreased numbers of primary care providers, increased numbers of primary care appointments, and long emergency wait times have resulted in overcrowding in freestanding urgent care settings.<sup>1</sup> Overcrowding, a concern for patient safety, is one of the six dimensions of quality recognized by the Institute of Medicine.<sup>2</sup> The cost of overcrowding in the emergency department

Author Affiliations: Capstone College of Nursing, The University of Alabama, Tuscaloosa

Copyright © 2019 Wolters Kluwer Health, Inc. All rights reserved. DOI: 10.1097/CIN.000000000000553 (ED) in 2007 was estimated to be approximately \$3.9 million to \$9.8 million lost revenue.<sup>3</sup> Overcrowding causes increased lengths of stay in the ED, especially with admitted patients, which can lead to millions of dollars of lost revenue. Admitted patients held in the ED, on average, have longer stays than those who are discharged from the ED. Increased lengths of stay are due to longer boarding times (admission) times, nurse or provider hand-off to admitting team and floor nurses, and long wait times for laboratory and x-ray test results.<sup>4</sup>

The electronic health record (EHR) has several impacts on healthcare: improved patient care, increased patient participation, improved care coordination, improved diagnostic and patient outcomes, and improved practice efficiencies, workflow, and cost savings.<sup>5</sup> Historically, paper charts have been criticized for illegibility and absent data. Electronic health records and other information technology (IT) implementation due to the American Recovery and Reinvestment Act of 2009 provided approximately \$19 billion toward incentives to providers for the addition of EHRs.<sup>6</sup> Gathering information from practices who have adopted an EHR is relevant, and the data provide information on productivity, volume, and staffing after implementation.<sup>7</sup> Community expectations of urgent care wait times and the addition of EHRs and IT programs have prompted a drive for improved efficiency and workflow process in the urgent care systems. The need to understand the context of each healthcare organization (ie, workflow, information requirements, patient mix) prior to EHR implementation is essential to increase positive outcomes such as cost reductions and quality of care improvements.<sup>6</sup>

The purpose of this project was to evaluate how provider efficiency and patient flow improved after the implementation of an EHR. Prior to the EHR implementation, tracking provider efficiency was based on data collected from the billing program and manual calculations using paper charts, which was inconsistent. The logic model was used as a systematic and ongoing guiding framework to assist in the evaluation of provider efficiency and a workflow redesign program.<sup>8</sup> The logic model represents a good addition to systematic reviews because it details evidence and assumptions, which are the foundation of a complex pathway.<sup>9</sup> Logic models provide a roadmap for exploring complex relationships using diagrams or flowcharts to convey differences and similarities between contextual factors, inputs, processes, and outcomes<sup>10</sup>

The authors have disclosed they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Corresponding author: Lesley Pyron, DNP, APRN, FNP-BC, Capstone College of Nursing, The University of Alabama, 650 University Boulevard East, Box 870358, Tuscaloosa, AL 35487 (lesm2np@gmail.com).

(Figure 1). This study is novel in that an EHR evaluation within the context of the urgent care had not been performed previously.

#### LITERATURE REVIEW

Publications describing research conducted in urgent care settings are often absent from nursing literature. A review of the literature revealed that EHR efficiency and workflow issues are focused on ambulatory/outpatient care, ED, and hospital settings. No articles specific to urgent care settings were found. The search phrases used included "EHR and workflow process," "EHR and provider efficiency," "improving patient flow," and "logic model evaluation." The key question, "Does the addition of an EHR improve efficiency and patient flow in an urgent care environment?" guided the literature search for existing evidence-based literature. Key search terms mentioned previously were used to find articles in MEDLINE and CINAHL. A search of these databases yielded approximately 508 articles for review. Articles were narrowed down to 13 for use based on the following criteria: date of publication, use of the logic model, evidence level, and outcomes that focused on efficiency and patient flow.

Articles in this literature review ranged in level of evidence from cohort study to meta-analysis. Contexts of studies varied from small outpatient settings to large hospital-based settings. All studies that concerned outcomes based on workflow used a workflow redesign as one of their variables. Review studies that concern the logic model were focused on an overall evaluation of a program and whether the program succeeded or failed to meet the outcomes. The studies used a variety of statistical methods for data analysis.

Overall, the research suggests that efficiency after EHR implementation is sluggish.<sup>11</sup> Several articles discussed how new technologies are most often designed for administrative purposes rather than daily practice routines.<sup>6,11–13</sup> Some evidence suggests that a change in workflow process does improve patient flow.<sup>4,6,14</sup>

Based on the literature review, the use of EHR does improve efficiency and patient flow.<sup>4,6,14</sup> One of the main

themes is changing the workflow design to improve patient flow, patient outcomes, patient lengths of stay, and provider and staff efficiency. Second, the logic model is an effective tool in evaluating a program based on efficiency and workflow design.

The implications of improved efficiency, patient flow, and a workflow redesign are supported by sound research. The studies that were analyzed were all at or above the level of cohort studies, including systematic reviews and metaanalysis.<sup>15–17</sup> The logic model evaluation studies were all based on known programs and outcomes.<sup>18–20</sup>

#### **Institutional Review Board**

The study was approved after expedited review under two institutional review boards.

#### **IMPLEMENTATION**

Mandatory EHR implementation for the urgent care settings began in July 2014. The workflow redesign began in December 2015 and included staffing changes, provider efficiency changes, and a new intake process. Staffing in the urgent care settings changed to allow nurse practitioners (NPs) and physician assistants (PAs) to work solo shifts or shifts with no physicians (MDs) present but available if needed. The number of RNs per urgent care setting decreased, and LPNs and emergency room technicians were brought in to reduce cost at the urgent care settings. At least one RN was present for medication administration and supervisory roles. To standardize the expectations of providers, management implemented a door-to-provider time of 30 minutes or less (adopted from the ED); several shortcuts within the system, such as diagnosis-specific templates that providers could save for upper respiratory tract infection, strep throat, pneumonia, urinary tract infection, otitis media, or orthopedic injuries, which could be edited for each specific patient; and a new intake process to keep the patient flow consistent. The use of voice-activated software to dictate the provider note was used to improve efficiency. Also, macros, which are symbols, names, or keys that represent



FIGURE 1. Logic model.

a list of commands, actions, keystrokes, or blocks of text that the system uses to carry out a command, were used. Macros save time and help improve efficiency.<sup>21</sup> Individual providers added commonly used phrases, such as "I have reviewed past medical history" and "Abdomen soft, nontender," which were saved and could be accessed using one key for quicker documentation.

The new intake process involved all staff. The expectation of the nursing staff and emergency room technicians was to perform the intake immediately or within 15 minutes of the patient's arrival to the urgent care setting. If the intake process was more than 15 minutes, the provider could enter the room and listen while the intake was performed or start the assessment of the patient without the completed intake process. This allowed the provider to enter orders and initiate patient care quicker. A surge plan was developed to expedite patients being evaluated during peak times, which differed per urgent care setting, when more than five patients were waiting, or when the patient wait times were approaching 30 minutes. At the beginning of the shift, the provider(s) would discuss with the staff how a surge of patients would be handled. The provider would initiate care and perform a brief exam on two patients. The providers would discuss among themselves how to execute this. For example, if there were five patients waiting to be seen, the MD might establish care with a brief medical screening exam on two

patients, while the NP/PA initiated care for two patients. The determination was made by the providers collectively to ensure quality, timely care.

#### **METHODS**

The project was undertaken to evaluate patient flow and provider efficiency after the implementation of an EHR. The logic model, an effective tool for program evaluation, was used as the guiding framework (Figure 2). Data used for evaluation purposes were collected from a number of sources including the billing system (relative value unit [RVU] calculations), participants (end-user surveys and direct observation), and charts (preimplementation and postimplementation).

#### **Setting and Participants**

The setting for the project was six freestanding urgent care settings affiliated with a hospital in the southwest. All staff from these settings including MDs (n = 26), NPs (n = 9), PAs (n = 4), RNs (n = 21), LPNs (n = 5), emergency room technicians (n = 6), x-ray technicians (n = 12), laboratory technicians (n = 12), and registration staff (n = 16) were recruited in this study based on data collection from the EHR and the workflow design only. The goals of the evaluation were to provide data for discussion and comparison of the program goals of improving patient flow and provider



FIGURE 2. Average time spent in patient care phase (in minutes) per urgent care.

efficiency and to make recommendations for future improvements. No compensation was offered, and all participation was voluntary for the survey.

#### **Data Collection**

Using a retrospective, longitudinal approach, data were collected using EHR data reports, direct observation, chart review, and an end-user survey of those participating among the six urgent care settings. An evaluation of a provider efficiency program using door-to-triage, door-to-provider, doorto-discharge, and average length of stay at each urgent care was conducted. Electronic health record-derived quality reports containing data were collected and saved on a password-protected secure server. Direct observation of 15 providers (five MDs, five NPs, five PAs) was completed by observing how many screens and actions were required to enter data in one patient chart from beginning to end of the encounter. The number of screens visited to complete provider documentation, number of screens visited to complete discharge, number of screens visited to complete e-prescribing, medication interaction when e-prescribing, and allergy check when e-prescribing were all evaluated per provider. Direct observation helped to provide insight into the complexity of use of the EHR system, and it was concluded that all providers used approximately the same number of screens whether they completed the check boxes or dictated via voice-activated software.

A chart review was performed using data collected prior to EHR implementation. Paper charts were randomly selected prior to July 2014 (10 charts per month between January 1, 2014, and May 31, 2014), and a total of 50 charts were selected for this review based only on different months, no specific urgent care settings. The number of charts chosen for review was based on the sample size and study size. No specific number of charts to review was recommended in the literature.<sup>22</sup> The purpose of reviewing the charts was to provide a comparison to the EHR charting system to determine whether charting times and efficiency had improved. Paper charts were reviewed specifically for door-to-triage, door-to-provider, door-to-discharge, and average length of stay at each urgent care setting. No identifiers were collected, and the data were deidentified. It is important to note that these phases of the patient care experience are not mutually exclusive. Therefore, the total average length of stay did not equal the total of the three other phases reported in this study. These phases were identified as distinct periods where efficiency (or lack thereof) may be captured and monitored.

The Urgent Care End-User Survey was administered through Qualtrics survey software (Qualtrics, Provo, UT) and was password protected. No identifiers were collected, and the data were deidentified. Reliability and validity were determined through a literature search that yielded 23 articles presenting validated survey measures of IT implementation.<sup>11</sup> The survey included questions that are specific to all aspects of the urgent care setting.

The RVU is a measure used by facilities to determine reimbursement and provider productivity, which could result in bonuses. This was important to evaluate efficiency of the providers based on their productivity. The RVU is based on three components: provider work, practice expense, and malpractice expense. The provider work RVUs are determined by the amount of time, technical skill, and equipment used during the visit. The RVU total is multiplied by a conversion factor to determine productivity and bonus potential and varies among facilities.<sup>23</sup>

#### Instruments

Participants were asked to complete an anonymous survey to evaluate the EHR and workflow process from point of implementation, including how staff perceived the use of the EHR in daily activities, as well as effectiveness and efficiency in the urgent care settings. The survey was based on the Primary Care Information Project Post-Electronic Health Record Implementation: Survey for Providers, developed and administered by the New York City Department of Health and Mental Hygiene. The goal of the survey was to advance population health through supporting and promoting highquality primary care and prevention, while assisting medical practices in using EHRs to increase the delivery of evidencebased preventive care services.<sup>24</sup> Permission was obtained to use and modify the original survey, which was based on primary care practices. Questions were omitted or altered in our modified survey, renamed Urgent Cares End-User Survey, to correlate with the urgent care setting in which it was administered. Also, some questions were added to include ancillary staff such as x-ray technicians, laboratory technicians, and registration staff. Survey questions were organized into 14 categories based on accuracy and timeliness of EHR information, efficiency and effectiveness of the EHR in completing daily tasks, availability of technical support for EHR issues, the staff's level of comfort with technology use, and the amount of training each staff member received. The survey was administered between May 1, 2017, and June 1, 2017.

A paper chart review was performed using data prior to July 2014 to evaluate the efficiency after implementation of an EHR. A total of 50 charts were reviewed for four distinct time periods (door-to-provider times, door-to-triage times, door-to-discharge times, and average length of stay) in the patient care experience. Again, these phases were identified as distinct periods where efficiency could be captured and monitored. The charts were stored in a central location not designated by specific urgent care settings; however, 10 charts from each month between January 1, 2014, and May 31, 2014, were randomly chosen for evaluation. The comparison of paper charts to EHR reports was completed, and it was determined that many inconsistencies in documentation times were eliminated.

The RVU per provider and the number of patients seen per day per urgent care setting can be evaluated by using reports generated from the billing system. The RVU data were collected using seven quarterly RVU reports from July 2014 to July 2016. The RVU is a valuable tool in determining productivity but, if used alone, may not fully represent the provider's overall productivity. Other factors such as doorto-triage times, door-to-provider times, door-to-discharge times, and average length of stay per urgent care setting based on daily census and staffing can also be important.

#### **RESULTS**

#### **Proficiency Results**

Yearly data collected from each urgent care setting showed continued improvement in times spent in all areas over a multiyear span after EHR implementation, staffing changes, and new processes. In fact, each of the six urgent care settings experienced improvements in average times including doorto-triage, door-to-provider, door-to-discharge, and provider discharge–to–nurse discharge times. Furthermore, all but one urgent care setting (urgent care 1) met the benchmark of less than 30 minutes for door-to-provider time established by management. Also, all six urgent care settings met the benchmark of less than 15 minutes for door-to-triage time (Figure 2). The data suggest that staff members adapted to the EHR and continued to improve efficiency in the urgent care settings that met the outcome expectations evaluation guided by the logic model.

#### **Relative Value Unit Data**

Data obtained from the billing system RVU reports showed many of the providers exceeded the minimum threshold for productivity, which resulted in bonuses. Relative value unit data are helpful in determining productivity; however, many inconsistencies were noted such as providers leaving the group, change from full-time to part-time status, vacation time, and summer leave. While these data may be useful for an organization to ascertain productivity, many inconsistencies were noted, and provider productivity could be evaluated more concisely using the EHR reports.

#### **Paper Chart Data**

The paper charts were missing several times by both the providers and the nursing staff. Missing times were, most likely, due to human error. The missing times were marked as zero, and the mean was determined using only documented times for analysis. Of the 50 charts reviewed, only 21 were not missing any times most likely due to human error, and 15 charts had two or more missing times including missing provider-to-room times, discharge times, and nurse/provider discharge times (Table 1).

Mixed results were evident in the analyses concerning means of length of stay per specific patient care phases (door-to-triage, door-to-provider) of patient care pre- and post-EHR implementation. A number of improvements were made with regard to the time patients spent in certain phases during the urgent care experience. An independent-samples t test was conducted to compare results between the means of length of stay of each patient phase experience prior to the EHR implementation and post-EHR implementation scores (Table 2). The most noticeable finding concerned the complete patient care experience found in the "door-to-discharge" length of stay times. Three urgent care settings (urgent care 1, urgent care 5, and urgent care 6) experienced decreases in the time patients spend from door to discharge. Of the three urgent care settings that experienced more efficient (decreased time in minutes) patient experiences, only one (urgent care 1) was statistically significant. However, the other three experienced increases in patient time spent from entering the care to being discharged. Urgent care 4 was most significant with regard to increasing the amount of time for patients from door to discharge.

Once the EHR was implemented among the six urgent care settings, efficiency increased. Overall, every urgent care setting experienced a decrease in average times after implementation of the EHR across the four metrics. For example, urgent care 5 saw the greatest reduction in door-to-discharge time averages, from 96 minutes (2014) to 72 minutes (2016) (Figure 2).

#### **Direct Observation Data**

Results were rounded to whole numbers for the following statistics. Physicians visited seven screens during documentation, whereas PAs and NPs visited six. For discharge, MDs visited four screens, whereas PAs and NPs visited five; for e-prescribing, all personnel visited three screens. No providers were able to verify medication interactions when

Table	<b>1.</b> Average	Length of Sta	y Data (	in Minutes	) Pre-EHR Im	plementation	Per Provider	Type

Title	Door-to-Triage Time	Door-to-Provider Time	Provider Discharge-to-Nurse Discharge Time	Door-to-Discharge Time
MD (n = 19)	13	27	12	75
NP (n = 16)	13	13	12	75
PA (n = 15)	16	25	5	70

 Table 2. Independent-Samples t Test of Pre-EHR Implementation Patient Length of Stay Times Versus Post-EHR

 Implementation Patient Length of Stay Times

	Door to Triage	Door to Provider	Provider Discharge to Nurse Discharge	Door to Discharge	
	n = 50	n = 34	n = 33	n=45	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
	16.9 (14.5)	30.9 (16.8)	6.8 (7.4)	75.1 (35.6)	
Urgent care 1	1.233	-4.48	-8.182ª	-12.533 <sup>b</sup>	
Urgent care 2	4.567 <sup>b</sup>	4.186	-1.848	3.133	
Urgent care 3	5.9 <sup>c</sup>	3.186	-4.515 <sup>c</sup>	1.133	
Urgent care 4	10.9 <sup>a</sup>	5.853	-0.515	12.133 <sup>b</sup>	
Urgent care 5	-0.1	-3.147	-5.515ª	-7.533	
Urgent care 6	5.233 <sup>b</sup>	1.52	-4.515 <sup>c</sup>	-1.2	
$^{a}P < .001$					

 $<sup>{}^{\</sup>rm b}P < .05.$ 

 $^{c}P < .01.$ 

e-prescribing due to the function not properly working with EHR; however, providers could check interactions using a pharmacist or an electronic medication checker, and all providers who e-prescribed were able to check the patient's allergies through the EHR before electronically sending the medication.

#### **Urgent Care Settings' End-User Survey Data**

A voluntary survey was conducted using Qualtrics software on a secure site that was password protected. Employees received an email invitation. A total of 108 emails were sent and 57 responded, which resulted in a 53% response rate. All data collected were downloaded from the online survey system and then analyzed using IBM SPSS Statistics version 24.0 (IBM, Armonk, NY). The focus of the survey included role versus training, role versus EHR functionality, and role versus productivity.

#### Role Versus Training

Participants were asked how much training they received on the EHR system and if using the EHR helped them accomplish tasks quickly. Only RNs (n = 17 [53%]) indicated that the EHR did not help them accomplish their tasks quickly, while the rest of the staff was fairly satisfied with the EHR. The data also indicate that most participants (n = 56 [98%]) received some type of formal training, although some did receive informal, on-the-job training.

#### Role Versus Electronic Health Record Functionality

Focusing on the functionality of the EHR, participants, excluding registration, laboratory, and radiology staff, were asked if they felt they worked longer to see the patients, if using the EHR made their jobs easier, if the EHR was useful in their job, and if the EHR did what they wanted it to do. The data indicate that while MDs (n = 11 [55%]) stated they worked longer to see patients, thought the EHR made their

jobs easier (n = 11 [55%]), and the EHR did what they wanted (n = 11 [55%]), they did not report that the EHR was useful (n = 11 [45%]). Nurse practitioners reported the EHR made them work longer to see patients half the time (n = 8 [50%]) and felt the EHR made their jobs easier (n = 8 [63%]), was useful (n = 8 [75%]), and did what they wanted (n = 8 [63%]). Physician assistants (n = 2 [50%]) were evenly split between whether they worked longer to see patients (n = 2 [50%]), felt the EHR made their jobs easier (n = 2 [50%]), was useful (n = 2 [50%]), and did what they wanted (n = 2 [50%]). Nurses (n = 17 [65%]) stated they may work slightly longer to see patients and they did not report that the EHR made their jobs easier (n = 17[35%]) or was useful (n = 17 [35%]); however, they did feel the EHR did what they wanted (n = 17 [65%]). Emergency room technicians were evenly split on whether they worked longer to see patients (n = 4 [50%]), whether the EHR made their jobs easier (n = 4 [50%]), whether the EHR was useful (n = 4 [50%]), and whether they felt the EHR did what they wanted it to do (n = 4 [50%]). While approximately half of the staff (55% of MDs, 50% of NPs, 50% of PAs, and 65% of nurses) felt there were inefficiencies, the data actually showed widespread throughput improvements across every urgent care setting over the time of the study.

#### Role Versus Productivity

Productivity is one of the main factors of using an EHR system. Staff members, excluding registration staff and laboratory/x-ray staff, were asked if the EHR decreased the time they spent with patients, if the EHR caused disruption in the workflow, if the EHR improved patient flow, and if the EHR improved their ability to make decisions about patient care. Physicians were split on whether the EHR decreased time with patients (n = 11 [45%] agreed and disagreed with one don't know); however, there was no disruption in

workflow (n = 11 [64%]), and they indicated improved patient flow (n = 11 [55%]) and patient care decisions (n = 11 [73%]). Nurse practitioners suggested the EHR decreased the time spent with patients (n = 8 [75%]), caused disruptions in their workflow (n = 8 [63%]), and was not helpful with patient care decisions (n = 8 [63%]). However, improved patient flow was noted (n = 8 [88%]). Physician assistants indicated the EHR increased the time they spent with patients (n = 2[100%]), were split on whether the EHR disrupted their workflow and improved patient flow (n = 2 [50%]), and denied helpfulness with patient care decisions (n = 2 [0%]). Nurse responses indicated they had decreased time with the patients (n = 17 [71%]), disruptions in workflow (n = 17[53%]), and improved patient flow (n = 17 [53%]), but were somewhat doubtful about whether the EHR improved patient care decisions (n = 17 [47%]). Emergency room technicians stated they had decreased time with the patients (n = 4[100%]) and disruption of workflow (n = 4 [75%]), but recognized improved patient flow (n = 4 [100%]), with half stating improvement in making patient care decisions (n = 4 [50%]).

#### DISCUSSION

In this program evaluation, impacts were determined by evaluation of the EHR versus paper charting, as well as the implementation of process changes within the urgent care system as they relate to productivity. Productivity can be measured using RVUs and EHR reports. A study on EHR versus paper charting concluded that the EHR allowed simultaneous chart accessibility, which allowed staff to finish charting without waiting for the provider to finish their charting, therefore improving productivity.<sup>14</sup>

Furthermore, it is evident that the EHR allows for systematic data collection pertaining to the time patients spend in each phase of their experience. This offers a more consistent way to track productivity and identify delays. In addition, to ensure that safety measures are followed, a time stamp is useful for tracking and accuracy.

The evaluation, guided by the logic model, led to recommendations for improvements to the RVU system and tracking provider productivity. Productivity may be analyzed using the RVU system, which provides information on whether the minimum required number is met. Although this is a good tool for organizations, many inconsistencies may arise depending on how the system filters certain information that may not show a provider's actual productivity. Recommendations for improvement included filters within the system to account for such factors as vacations, summer leave option, changing employment status, and leaving or returning to the company. The system used for RVU documentation is not linked to the EHR and is based on providers entering billing information correctly. Although the hospital has a billing department that reviews a portion of the billing, the providers are responsible for entering the proper billing and procedure codes. A second recommendation would be to improve the accuracy of the billing system within the EHR system to reduce the risk of human error with manual entry.

Productivity may also be measured by volume.<sup>14</sup> Recommendations for provider productivity included a mix of RVUs, volume, and overall productivity. There is no single accurate way to measure provider productivity because many variables exist. Therefore, a combination of several measures should be used to determine whether a provider meets efficiency expectations. Electronic health record reports can show how many patients per day, per urgent care, per provider were seen. This may be a better indication of productivity than the RVU system, although the RVU system provides a bonus to providers based on the numbers calculated in the billing department quarterly on completed charts. Volume can vary depending on location, time of day, and time of year; however, a base average can be calculated for these conditions by factoring in each element. The analysis of several aspects of the urgent care system both before implementation of the EHR and before a process change indicated productivity was improved overall between July 2014 and July 2016.

The evaluation has led to recommendations to improve patient flow. First, patient flow can be improved by requesting that patients fill out questionnaires in the lobby, which includes medical history, allergies, medications, and the reason for the visit, while they are waiting to be seen by a provider. This can decrease the overall length of stay and improve patient flow in the urgent care system.

Second, improving the registration process can improve patient flow. The system used for registration is linked to the EHR; however, the system has several steps to complete the registration process. A shortened version of the registration process in the urgent care system would decrease length of stay and improve patient flow by allowing intake staff earlier access to the patient. One way to shorten the registration process would be for staff to start the process in the registration area, place the patient's name on the tracking board, and finish the registration process after the patient has been assigned a room and seen by the intake staff and the provider. Another suggestion for registration would be to add a kiosk in each urgent care setting that would allow patients to enter their information prior to registration to increase the efficiency of the registration staff. Finally, allowing patients to enter their registration information online using a patient portal would also decrease the length of stay and improve efficiency of the urgent care system.

The limitations to this study are as follows. A convenience sample was used because the data were collected based on the availability of staff members willing to participate; therefore, the study does not have full representation of all employees, and the results may not adequately reflect the overall productivity

and EHR acceptance of the entire urgent care system (six urgent care settings). The next limitation was that only one urgent care system consisting of six urgent care settings using an EHR was evaluated for productivity, which may not allow generalization of productivity measurements in all urgent care systems. Therefore, the evaluation of the EHR was specific to this urgent care system and does not reflect the overall functions of all urgent care systems using EHRs. The final limitation was that a program evaluation specifically targets a program in process to determine an outcome. Therefore, the EHR program evaluation for productivity is evolving and continuously changing, which will require further study. Ongoing efforts such as improved workflow processes, staffing changes, and system changes, additions, and deletions would generate new processes, which would require a new program evaluation.

#### **CONCLUSION**

The implementation of the EHR in the urgent care system has, for the most part, improved productivity and efficiency. This study provides evidence that EHR documentation has a great impact on many aspects of healthcare including productivity, efficiency, patient safety, quality control measures, patient flow, and workflow. The combination of implementing the EHR and changing the workflow process resulted in improved productivity and efficiency in the urgent care settings. The workflow redesign did take time and occurred 1<sup>1</sup>/<sub>2</sub> years after the implementation of the EHR, and the data collected after the redesign included only 6 months of data; therefore, for this study, the EHR is the significant factor in the improvement of productivity and efficiency. The significance of this study is that it provides information that will benefit staff, administration, and the community and may suggest new or alternative suggestions for efficiency.

As the needs of the urgent care system increase, the need for new interventions and outcomes will present and be used by a new team to evaluate productivity and patient flow. Future research is necessary to evaluate continued productivity and efficiency of the EHR as technology advances and there are increased demands on the healthcare system. In addition, research studies should include evaluation of how the capacity of the EHR to improve the overall care delivery process of patients relates to provider efficiency and effectiveness.<sup>17</sup> Furthermore, future studies should include data from multiple urgent care systems using EHRs across the region, which would assist in generalizing the most effective use of the EHR in the urgent care setting.

#### References

- Urgent Care Association of America. The case for urgent care. 2011. http:// c.ymcdn.com/sites/www.ucaoa.org/resource/resmgr/Files/WhitePaper TheCaseforUrgentCa.pdf. Accessed August 25, 2016
- McHugh M, Van Dyke K, McClelland M, Moss D. Improving patient flow and reducing emergency department crowding. AHRQ Publication. 2011;11(12): 1–48.

- Foley M, Kifaieh N, Mallon WK. Financial impact of emergency room overcrowding. The Western Journal of Emergency Medicine. 2011;12(2): 192–197.
- Sayah A, Rogers L, Devarajan K, Kingsley-Rocker L, Lobon L. Minimizing ED wait times and improving patient flow and experience of care. *Emergency Medicine International*. 2014;2014: 1–8.
- Benefits of EHRs. HealthIT.gov. https://www.healthit.gov/topic/health-itbasics/benefits-ehrs. Accessed February 5, 2018.
- McGeorge NM, Hegde S, Guarrera TK, et al. Studying the impact of interoperable electronic health records on workflow in ambulatory care. International Journal of Industrial Ergonomics. 2015;49: 144–155.
- Fleming NS, Becker ER, Culler SD, et al. The impact of electronic health records on workflow and financial measures in primary care practices. *Health* Services Research. 2014;49(1 pt 2): 405–420.
- Kellogg WK. Kellogg Foundation Logic Model Development Guide. 2006. www.wkkf.org/resource-directory/resource/2006/02/wk-kelloggfoundation-logic-model-development-guide. Accessed July 9, 2016
- Baxter SK, Blank L, Woods HB, Payne N, Melanie R, Elizabeth G. Using logic model methods in systematic review synthesis: describing complex pathways in referral management interventions. *BMC Medical Research Methodology*. 2014;14(62): 14–62.
- Harris R, Mosedale S, Garner J, Perkins E. What factors influence the use of contracts in the context of NHS dental practice? A systematic review of theory and logic model. Social Science & Medicine. 2014;108(2014): 54–59.
- Messeri P, Khan S, Millery M, et al. An information systems model of the determinants of electronic health record use. *Applied Clinical Informatics*. 2013;4(2): 185–200.
- Wu SW, Chen T, Wu M, et al. Management of medical technology under the new medical policy background in China. *Chinese Medical Journal*. 2016;129(22): 2745–2748.
- Djalali S, Ursprung N, Rosemann T, Senn O, Tandjung R. Undirected health IT implementation in ambulatory care favors paper-based workarounds and limits health data exchange. *International Journal of Medical Informatics*. 2015;84(11): 920–932.
- Howard J, Clark EC, Friedman A, et al. Electronic health record impact on work burden in small, unaffiliated, community-based primary care practices. *Journal of General Internal Medicine*. 2013;28(1): 107–113.
- Bullard MJ, Villa-Roel C, Guo X, et al. The role of a rapid assessment zone/pod on reducing overcrowding in emergency departments: a systematic review. *Emergency Medicine Journal*. 2012;29(5): 372–378.
- Jones P, Schimanski K. The four hour target to reduce emergency department 'waiting time': a systematic review of clinical outcomes. *Emergency Medicine Australasia*. 2010;22(5): 391–398.
- Poissant L, Pereira J, Tamblyn R, Kawasumi Y. The impact of electronic health records on time efficiency of physicians and nurses: a systematic review. *Journal* of the American Medical Informatics Association. 2005;12(5): 505–516.
- Scalon DP, Beich J, Alexander JA, et al. The Aligning Forces for Quality initiative: background and evolution from 2005 to 2012. *The American Journal of Managed Care*. 2012;18(6): S115–S125.
- McHugh M, Joshi M. Improving evaluations of value-based purchasing programs. *Health Services Research*. 2010;45(5 pt 2): 1559–1569.
- Rein A, Kennedy H, DeCoudres B, Singer Cohen R, Sabharwal R, Fairbrother G. Evaluation design and technical assistance opportunities: early findings from the Beacon community program evaluation teams. *Commonwealth Fund*. 2012;1576(1): 1–21.
- Glossary and acronyms of EMR/EHR terminology. EHR Consultant. 2018. http://www.emrconsultant.com/glossary-and-acronyms-of-emr-ehrterminology/. Accessed March 7, 2018
- Vasser M, Holzmann M. The retrospective chart review: important methodological considerations. *Journal of Educational Evaluation for Health Professions*. 2013;10: 12.
- Bendix J. RVUs: a valuable tool for aiding practice management. Medical Economics. http://www.medicaleconomics.com/health-law-policy/rvusvaluable-tool-aiding-practicemanagement. Accessed April 24, 2018.
- Primary care information project. New York City Department of Health and Mental Hygiene. 2018. http://www1.nyc.gov/site/doh/providers/resources/ primary-care-information-project.page. Accessed August 23, 2017

# For more than 72 additional continuing education articles related to electronic information in nursing, go to NursingCenter.com.

### Instructions for Taking the CE Test Online Improved Patient Flow and Provider Efficiency After the Implementation of an Electronic Health Record

- Read the article. The test for this CE activity can be taken online at www.NursingCenter.com. Tests can no longer be mailed or faxed.
- You will need to create a free login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Professional Development online CE activities for you.
- There is only one correct answer for each question. A
  passing score for this test is 13 correct answers. If you
  pass, you can print your certificate of earned contact
  hours and the answer key. If you fail, you have the
  option of taking the test again at no additional cost.
- For questions, contact Lippincott Professional Development: 1-800-787-8985.

Registration Deadline: September 3, 2021

**Disclosure Statement:** 

The authors and planners have disclosed that they have no financial relationships related to this article.

Provider Accreditation:

Lippincott Professional Development will award 1.5 contact hours for this continuing nursing education activity.

Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Florida, Georgia, West Virginia, New Mexico, South Carolina, #50-1223.

Your certificate is valid in all states.

#### Payment:

• The registration fee for this test is \$17.95