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Impact on Length of Stay After Introduction of Emergency Department Information System

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Objective: An electronic emergency department information system (EDIS) can monitor the progress of a patient visit, facilitate computerized physician order entry, display test results and generate an electronic medical record. Ideally, use of an EDIS will increase overall emergency department (ED) efficiency. However, in academic settings where new interns rotate through the ED monthly, the “learning curve” experienced by the new EDIS user may slow down patient care. In this study, we measured the impact of the “intern learning curve” on patient length of stay (LOS).

Methods: We retrospectively analyzed one year of patient care data, generated by a comprehensive EDIS in a single, urban, university-affiliated ED. Intern rotations began on the 23rd of each month and ended on the 22nd of the next month. Interns received a 1.5-hour orientation to the EDIS prior to starting their rotation; none had prior experience using the electronic system. Mean LOS (\pm standard error of the mean) for all patients treated by an intern were calculated for each day of the month. Values for similar numerical days from each month were combined and averaged over the year resulting in 31 discrete mean LOS values. The mean LOS on the first day of the intern rotation was compared with the mean LOS on the last day, using Student’s t-test.

Results: During the study period 9,780 patients were cared for by interns; of these, 7,616 (78%) were discharged from the ED and 2,164 (22%) were admitted to the hospital. The mean LOS for all patients on all days was 267 ± 1.8 minutes. There was no difference between the LOS on the first day of the rotation (263 ± 9 minutes) and the last day of the rotation (276 ± 11 minutes, $p > 0.9$). In a multiple linear regression model, the day of the intern rotation was not associated with patient LOS, even after adjusting for the number of patients treated by interns and total ED census ($\beta = -0.34$, $p = 0.11$).

Conclusion: In this academic ED, where there is complete intern “turnover” every month, there was no discernible impact of the EDIS “learning curve” on patient LOS. [West J Emerg Med. 2010; 11(4): 329-332.]

INTRODUCTION

A computer-based emergency department information system (EDIS) can monitor the progress of a patient visit, facilitate computerized physician order entry, display test results, and generate an electronic medical record. Ideally, EDIS use will increase emergency department (ED) efficiency, enhance communication among members of the healthcare team, minimize charting time, eliminate illegible notes and

missing charts, improve patient safety, and ensure proper coding for reimbursement. Indeed, in 2006 the Institute of Medicine report on the future of emergency care suggested that electronic information systems could improve ED efficiency and overall patient care.¹

Little is known about the impact of an electronic patient information system on patient length of stay (LOS). LOS is the result of many complex and interrelated facility, provider,

patient, system and resource-related variables.²⁻⁴ It is not clear if the methods of patient charting, whether hand-written or electronic, play a significant role in determining ED patient LOS since few studies have examined this issue.^{5,6}

Comprehensive electronic patient charting and information systems are of special interest. On one hand, they promise greater accuracy and efficiency in documenting the reasons for a patient's visit and the results of his or her care in the ED. On the other hand, successful implementation of an EDIS requires physician and staff training, experience, and fluency with the specific electronic application.

In academic settings where new interns from multiple clinical services rotate through the ED monthly, there is concern that the "learning curve" experienced by new EDIS users may slow down patient care. In this study conducted in an academic, teaching hospital-based ED, we sought to measure the impact of the interns' EDIS "learning curve" on patient LOS.

METHODS

In this retrospective study, we examined the LOS for all ED patients seen by rotating interns over a one year period. To assess the impact of learning to use the EDIS, we compared the LOS for patients seen by interns on the first day of their one-month ED rotation with the LOS for patients seen on the last day of their rotation. This study was approved by the institutional review board.

We analyzed one year of patient care data generated by our EDIS (PICIS PulseCheck, Wakefield, MA). The study was conducted in an urban, university-affiliated ED with an annual volume of 36,000 patients. The hospital is a Level II trauma center with a 24-hour cardiac catheterization lab, regional burn center, multiple transplant services and other regional specialty centers. Data were gathered from March 1, 2005 to February 28, 2006.

Intern rotations began on the 23rd of each month and ended on the 22nd of the next month. These first year house officers were from emergency medicine, internal medicine, family medicine and surgery residency programs associated with the University of Colorado Denver School of Medicine and the Denver Health Residency in Emergency Medicine. On average there were five interns per 24-hour day who worked 10 hour shifts with an equal distribution of days, evenings, nights and weekends.

Interns received a 1.5-hour training session in the use of the EDIS prior to starting their ED rotation. None had prior experience using the EDIS. No interns repeated rotations in the ED during the study period. All orientations were taught by one of two emergency medicine faculty members and were unchanged in content or format during the course of the year. Both worked from the same orientation outline to ensure all relevant material was covered. Training included both didactic and hands-on practice using the EDIS; interns were taught to navigate the patient locator screens, generate orders (including

medications, diagnostic studies and nursing and admission orders), document the medical evaluation and treatment for the patient visit, and produce discharge prescriptions and instructions. In general, the first 15 minutes of each orientation session was dedicated to navigation of the patient tracking screen; the next 45 minutes focused on order entry and charting the history and physical examination and procedures performed; and the final 30 minutes was devoted to hands-on practice in charting, order entry, and writing prescriptions and discharge instructions.

LOS was defined as the time from patient arrival to discharge from the ED, when the patient's name was removed from the patient-tracking screen. LOS data for all ED patients who were cared for by interns and who completed visits to discharge from the ED were included. Excluded from data analysis were patients who left without being seen, left before their visit was complete, or were triaged to other areas of the hospital, such as the obstetrics labor and delivery area. An attending physician supervised all care provided by interns.

Total numbers of patient visits (ED census), numbers of patients seen by interns (intern census) and mean LOS (\pm standard error of the mean) for all patients treated by interns were calculated for each day of the month. Values for similar numerical days from each month were combined, resulting in 31 discrete LOS, ED census and intern census values. The mean daily patient LOS on the first day of the intern rotation (23rd) was compared with the last day of the rotation (22nd) using Student's t-test. A linear regression analysis to determine whether the day of the month was associated with LOS after adjusting for the effects of intern census and total ED census for that day of the month.

RESULTS

During the study period 30,357 patients were included in the data analysis; interns provided care to 9,780 patients. Of these patients 7,616 (78%) were discharged from the ED and 2,164 (22%) were admitted to the hospital. The mean LOS for all patients treated by interns on all days was 267 ± 1.8 minutes. There was no significant difference in LOS between the first day of the rotation (the 23rd) and the last day of the rotation (22nd) (263 ± 9 minutes vs. 276 ± 11 minutes, $p > 0.9$). Among all ED patients treated by interns, the shortest LOS occurred on the 24th day of the month (236 ± 8 minutes), the second day of the interns' rotation; the longest LOS (300 ± 11 minutes) occurred on the seventh of the month, midway through the rotation. In the multiple linear regression model, the day of the month was not associated with intern patient LOS, even after adjusting for intern census and total ED census ($\beta = -0.34$, $p = 0.11$).

DISCUSSION

In this academic ED where there is complete intern turnover every month, the EDIS learning curve had no discernable impact on patient LOS. Our results include more

than 9,000 patient visits over a one-year period. Following a brief orientation, practice and skill session, new interns were able to use the EDIS to track patients, order tests and medications, retrieve test results, complete the electronic medical record and issue discharge prescriptions and instructions without a measurable effect on patient LOS. The number of patients seen per day by interns was not significantly different on most days of the month and was not related to time elapsed since EDIS training.

While much has been written about the advantages and potential costs and hazards of electronic medical records and patient information systems,⁷⁻¹¹ there is scant information regarding the impact of these systems in academic settings and none that specifically assesses academic EDs. Retchin and Wenzel recognized several years ago that “training programs of academic health centers are optimal environments for testing and implementing EMR [electronic medical record] systems. Academic health centers have the expertise to resolve remaining software issues, the components necessary for integrated delivery, a culture for innovation in clinical practice, and a generation of future providers that can be acclimated to the requisites for computerized records.”¹²

LOS is an important measure of the efficiency of ED care and a determinant of patient satisfaction.¹³⁻¹⁵ Hospital administrators, physicians, nurses and patient care advocates may be encouraged by the finding in this study that LOS did not rise when new users were asked to learn and use a complex, comprehensive computer-based electronic information system.

There are several limitations to the current study. First, our interns were generally web and software savvy and seemed to learn EDIS skills easily. Our results may not be transferable to new users who do not have a high comfort level with web-based software. Second, our LOS were quite high (mean LOS 267 ± 1.8 minutes), and the effect of the EDIS might be different in EDs with much shorter or much longer LOS. Third, efficient use of the EDIS depends on “on the job training.” Our physician and nursing staff were frequently called upon to help the new clinicians learn the subtleties of software navigation and advanced techniques to enhance speed and accuracy. In this investigation, we did not attempt to standardize or analyze the individual components of the intern “learning curve.” We recognize that proficiency depends on many aspects of learning, including the orientation program, independent practice and experience with similar applications. Fourth, we did not study LOS for patients cared for by other trainees, including medical students or higher level residents.

There are two additional important limitations. We tested for an association between the day of the intern rotation and patient LOS. However, we did not attempt to measure the quality or content of charting performed by interns. Finally, we did not study a number of other important covariates that may affect patient LOS. Our results were unchanged when we

controlled for individual intern patient load and overall ED patient volume; however, we did not consider intern specialty, their progress in learning clinical or procedural skills, supervising physician efficiency, ED staffing, patient severity of illness, test ordering behaviors, laboratory turnaround time, inpatient bed availability, waiting room volumes or other factors that affect LOS.^{2, 16-20} At the same time, one of the strengths of our study design is the comparison of LOS across days of the month. It is unlikely that any of the above factors will vary systematically by day of the month, except for interns’ experience in the ED. Future studies are needed to reach a more comprehensive understanding of the impact of the EDIS on patient “throughput,” quality of care and the practice of emergency medicine.

CONCLUSION

In this academic ED where there is complete intern turnover every month, the EDIS “learning curve” had no discernable impact on patient LOS.

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