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Improving Student EHR Accuracy: An Analysis of Training Methods to Better Prepare Students to Volunteer at Student-Run Clinics

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Abstract

Background: As many students do not have previous experience with electronic health records (EHRs), the Comprehensive Medical Care Outreach Team at the University of Central Florida repeatedly struggled to maintain an accurate and consistent record of patient visits, despite all volunteers attending a lecture-based training session prior to clinic day. This study evaluated changes in student EHR accuracy at this student-run clinic using alternative training methods. We hypothesized that small-group interactive learning would result in higher EHR accuracy than lecture-style learning.
Methods: This study examined EHR accuracy through one year (2019) of data over four clinic sessions. EHR accuracy was defined as completion and correctness of various EHR parameters, consisting of electronically signing notes, medications, allergies, diagnoses, vital signs triage, and subjective, objective, assessment, and plan notes. For the first two clinics, students were trained using large group lecture-style learning, with a lecturer to volunteer ratio of 1:70. For the latter two clinics, students were trained in small-groups based on clinic role, in rooms with an average lecturer to volunteer ratio of 1:8. In these sessions, students then actively utilized the EHR by annotating a standardized patient case before the clinic.
Results: Data shows significant differences ($p<0.05$) in EHR accuracy of large-group versus small-group training for 11 of 18 parameters, with all parameters demonstrating an increase in accuracy in the experimental groups.
Conclusions: These results indicate that small-group, interactive learning affords greater EHR accuracy than large group lecture-style learning, suggesting more efficient ways to perform EHR training.

Introduction

The electronic health record (EHR) has improved patient care by easing the transition between providers, facilitating communication among teams, and decreasing medical errors.[1-4] Free clinics, including student-run free clinics, utilize EHRs as a longitudinal record of care for their patients. As with any tool, training is usually required for correct usage. Enhanced training with a hands-on approach and closely supported clinical use is beneficial to the understanding and the application of EHRs.[4-6] Additionally, patient-simulated encounters with hands-on computer system use have the highest success in terms of EHR use and user satisfaction.[7-9] Such time-consuming training sessions are challenging for the coordination of volunteer health professional students, who often are limited on time and have variable previous experience in EHR systems.

The Comprehensive Medical Care Outreach Team (CoMCOT) at the University of Central Florida (UCF) provides free care at a quarterly multidisciplinary clinic for farmworkers. The clinic setting is an office building repurposed as a clinic that serves approximately 100 patients every

event, with over 100 volunteers from various disciplines. Working with their faculty advisor and information technology support, a core group of second-year medical student members of UCF's global health interest group maintain the EHR and develop all training sessions each clinic year. Due to varying availability and interest, student volunteers are different at each clinic, with a returning volunteer rate varying anywhere from 15-50% between clinics. Volunteers are responsible for EHR documentation, laboratory and medication orders, and communication between providers (while under professional supervision). Due to both variability in clinic volunteers and an annual turnover of leaders, it is challenging to keep EHR training standardized and efficient.

The multidisciplinary student-run clinic utilizes a free, open-source EHR. As a result, the system lacks widespread technical support and training afforded with other paid EHR services. Many healthcare providers in the free clinic are not well-versed with the system, as it is not used at their place of employment. To overcome these issues, a mandatory volunteer training session is held the day before the clinic. The session broadly includes the following skills: entering patient information, electronically signing notes, and communicating between various clinic disciplines. However, even with this training session in place and the additional safeguard of having an EHR Director available to answer questions, CoMCOT still experienced documentation errors. These errors included missing data such as patient demographics, vital signs, diagnoses, medications and doses, allergies, and supervising provider information as well as missing signatures of the care team and supervising provider. Proper documentation allows for accurate patient follow-up and responsibility for care.

This study was designed to evaluate changes in student EHR accuracy at our student-run clinic using different training methods: large-group, lecture-style learning (LGLSL) with didactics, and small-group, role-specific learning (SGRSL) with hands-on, interactive training. Given previous studies related to EHR training, as well as a working understanding of human learning and memory,[6] it was hypothesized that the small group, role-specific training would demonstrate greater success in EHR documentation.

Methods

This study examined the effect of EHR training style on EHR accuracy at a student-run clinic through four clinic sessions in 2019. This study was approved as an exemption by the institutional review board at UCF.

Training Methods

To investigate the efficacy of EHR training methods, two different implementations of EHR training were employed over four clinic sessions. The first two clinics utilized LGLSL, and the latter two clinics utilized SGRSL.

The day before the clinic, all student volunteers were required to attend a training where they were educated on patient population, clinic flow, and usage of the EHR; they were additionally encouraged to view instructional videos and slide deck presentations prior to training. These videos and presentations were developed by CoMCOT student leaders.

LGLSL methods consisted of training in a lecture hall with a student instructor to volunteer ratio of 1:70. All volunteers were present through training for all clinic roles, regardless of which station they were assigned. During this session, the volunteers were presented a slide deck presentation of screenshots detailing the use of the EHR for all individual roles at the clinic.

Students in the SGRSL training group were taught role-specific charting in small groups with an instructor to volunteer ratio of 1:8. Roles for each clinic, and thus each training session, were randomly assigned. For example, students at triage only learned how to complete triage notes, as opposed to learning the entire EHR system (as in LGLSL). A sandbox (or practice version) EHR was developed to simulate the clinic EHR, allowing for students to receive hands-on experience prior to clinic. Additionally, students were given the opportunity to log on to the sandbox system prior to clinic if they wanted to become more familiar with the system. The SGRSL groups used this interactive sandbox EHR during the training sessions to teach students how to log on and familiarize them with the system. Then, their learning was reinforced via a simulated standardized patient activity for their specific clinic role.

OpenEMR

OpenEMR[10] is a secure, portable, open-source EHR utilizing a local host and network to ensure security and reliable connectivity. The CoMCOT student-run clinic has used OpenEMR since February 2019 and has been making iterative changes to improve clinic flow and data accuracy. This system allows clinic leaders to collect patient demographics, notes, lab results, and prescriptions. However, the utility of this information depends on its accuracy, thus emphasizing the importance of proper charting. The sandbox version was developed using Amazon Web Services.[11,12]

Data Collection

Researchers conducted a manual chart review across several data collection sessions, during which the EHR was deployed on the local host and the research team logged on the system to extract the relevant data. Each patient chart entered in 2019 was included in the analysis.

EHR Accuracy

EHR accuracy was defined as the correctness and completion of the following training session goals: electronically signing (e-signing) notes, medications, allergies, diagnoses, vital signs, triage, and subjective, objective, assessment, and plan (SOAP) notes (Table 1). One point was given for the completion and one point for the correctness of each parameter; thus, the maximum number of points awarded to each chart was 18. A parameter was considered complete if all the fields were filled out, either correctly or incorrectly, and a parameter was considered correct if it was completed in the exact manner instructed during the training. Six independent investigators evaluated for EHR accuracy accordingly, and each chart required consensus by all investigators to be defined as complete and/or correct.

Statistical Analysis

The primary outcomes of interest were "completion" and "accuracy" of e-signatures, medications, allergies, diagnoses, vital signs, triage, and SOAP notes. The frequency of completion and correctness for all nine EHR parameters was divided by the total number of entries to obtain percentages. The normal distribution of our samples was confirmed via the Shapiro-Wilk and Kolmogorov-Smirnov tests. These tests for normality were determined to be ideal based on sample size. Independent samples t-test was conducted to analyze the difference in outcomes between LGLSL and SGRSL learning methods. Statistical analysis was conducted utilizing IBM SPSS Statistics 25,[13] with statistical significance defined as $p<0.05$ for all analyses.

Results

In total, 189 health professional students were trained on the EHR using LGLSL, and 221 were trained using SGRSL. Across all parameters, charts completed by students in the SGRSL training (n=171) demonstrated a higher percentage of accuracy than charts completed by students in the LGLSL training group (n=190) (Table 2).

The differences in accuracy between the LGLSL and SGRSL learners were statistically significant for the following EHR accuracy parameters: correctness of triage note format (p=0.038), correctness of triage note signature (p=0.004), completion of vital signs (p=0.012), completion of vital signs signature (p=0.005), completion (p=0.001) and correctness (p=0.001) of medications, and completion (p=0.001) and correctness (p=0.001) of diagnosis. There was no statistically significant difference between SGRSL and LGLSL for completion and correctness of allergies, completion of triage note signature, completion of triage note, correctness of vital signs signature, completion and correctness of SOAP note, and completion and correctness of SOAP note signature (Figure 1).

Discussion

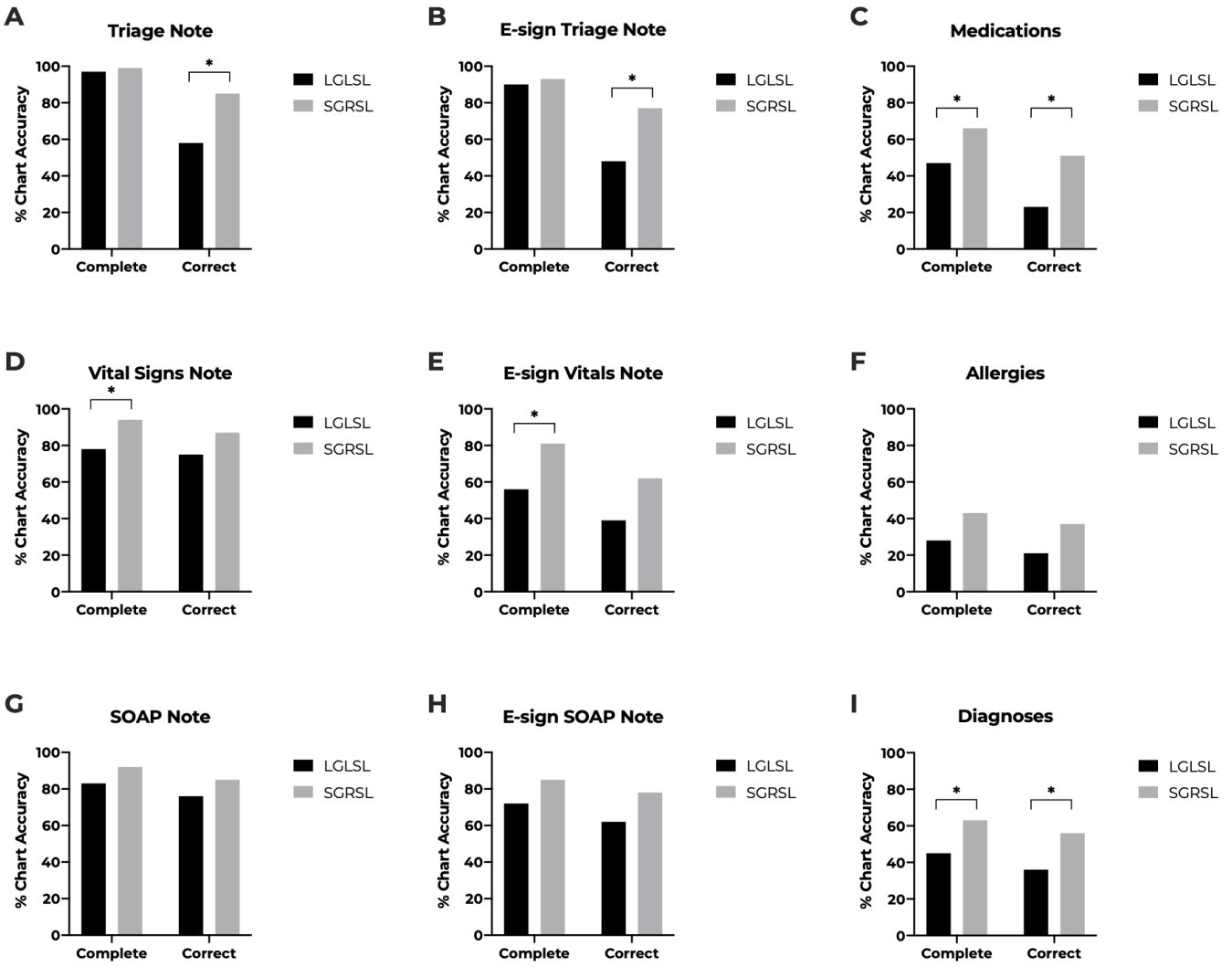
Our multidisciplinary, quarterly clinic for farmworkers has struggled with inconsistencies in EHR entries. While practice and repetition would allow for building familiarity with the EHR system and potentially result in improved EHR accuracy, our clinic, like many student-run free clinics, sees an annual leadership turnover and new volunteers every clinic. In fact, our volunteer cohort for the four clinics in 2019 showed only a 40% retention rate of volunteers. The majority of the volunteers are new; thus, an effective training system is necessary. Few healthcare systems have

Table 1. EHR accuracy parameter definitions and examples

Parameter	Complete	Correct	Example
Triage Note	Entered and submitted in some form	Contains a complete summary of the patient and their presenting information	66YO F c/o epigastric abd pain onset 3 wks ago....
E-signing Triage Note	The note was signed and locked	First and last name scribe, first and last name other triage staff, first and last name provider with credentials	John Smith, Joey Smith, Judy Smith, Dr. Janice Smith, M.D.
Vital Signs Note	Documented at least one of the following: height, weight, heart rate, blood pressure, temperature, oxygen saturation, and respiratory rate	Completed in full with no missing vital signs	Ht – 5'6" Wt – 147lbs HR – 78bpm BP – 128/67mmHg Temp – 98.6F SaO2 – 98% room air RR – 13/min
E-signing Vital Signs Note	The note was signed and locked	First and last name scribe, first and last name other vital signs staff, first and last name triage provider with credentials	John Smith, Joey Smith, Judy Smith, Dr. Janice Smith, M.D.
Medications	Entry present under medication tab	Drug name, dosage, the frequency for [disease]	Omeprazole 40mg 1 pill before each meal for GERD
Allergies	Entry present under allergy tab	Allergy, reaction, severity	Penicillin, hives/urticaria, 6/10
Diagnoses	Entry present under-diagnosis tab	Includes all medical diagnoses	HTN, T2DM, GERD
Patient Room (SOAP) Note	Note was entered and submitted in some form	Contained complete subjective, objective, assessment, and plan entries	**Subjective**: 66YO F c/o of abd pain of 3 wks... **Objective**: Well-dressed and in no apparent distress, AAOx3... **Assessment**: 66YO F w/ epigastric abd pain highly concerning of GERD **Plan**: Omeprazole 40mg before meals
E-signing Patient Room (SOAP) Note	Note was signed and locked	First and last name scribe, first and last name other patient room staff, first and last name provider with credentials	John Smith, Joey Smith, Judy Smith, Dr. Janice Smith, M.D.

E-signing: electronically signing; SOAP: subjective, objective, assessment, and plan

Figure 1. Comparison of EHR accuracy among learning groups



LGLSL: large-group, lecture-style learning; SGRSL: small-group, role-specific learning; E-sign: electronically sign; SOAP: subjective, objective, assessment, and plan

Percentage (%) of EHR accuracy was obtained by dividing the frequency of completion or correction by the total number of chart entries (LGLSL n=190, SGRSL n=171)

**p<0.05; A: The correctness of triage note format was significant (p=0.038); B: The correctness of the triage note signature was significant (p=.004); C: Both completion (p=0.001) and correctness (p=0.001) of medications were significant; D: The completion of vital signs was significant (p=0.012); E: The completion of vital signs signature was significant (p=0.005); F-H: Completion and correctness of allergies, SOAP note entry, and electronic signature of SOAP note were not significant; I: Both completion (p=0.001) and correctness (p=0.001) of diagnosis were significant*

analyzed EHR training modalities, and as such, little evidence exists for teaching students in the setting of a student-run free clinic. This study serves as a stepping-stone for medical education to improve recordkeeping in the student-run free clinic environment.

Implications for Practice

The results support small group training to significantly improve EHR accuracy when compared to large group lecture-style training sessions. These results are in accordance with the difficulties that come with a large group training modality: students can easily get distracted, are not held accountable for listening, and if much of what they are learning does not directly apply to their role, it may lead to a lack of interest in the session. By creating smaller groups and focusing

on specific roles, participation increases and more information is absorbed, thus leading to improved training results.

Though every chart parameter saw an increase in accuracy, the data suggest that volunteers still struggle with correctly recording medications, e-signatures, allergies, and diagnoses, which highlights the need for further training improvements. Clinic leadership is responsible for making changes to training that focus on emphasizing the importance of these parameters. By improving EHR training for student volunteers, we can improve patient care and optimize the value of student-run free-clinics in supplementing formal medical education. Accurate and timely EHR data has an impact on both patient outcomes and satisfaction with care.[14,15]

Limitations

One limitation of this study is the lack of demographic data on volunteers completing the documentation. Specifically, students were not separated by school discipline, year in training, or prior EHR experience. These variables could have accounted for some differences among the groups. As we did not record which volunteer completed each chart at the time of data collection, we are unable to tell whether just a few students were responsible for incorrectly completing all the fields, or all students were making mistakes more infrequently. In either case, small groups would better identify struggling users.

The timing of the training groups could also be a limitation: LGLSL was completed earlier in 2019, and SGRSL was completed towards the end of the year. This means that students attending multiple clinics would have been at different points in their learning during each of the clinics. As such, though no formal EHR training is done for medical students, students with more clinical exposure outside of the student-run clinic may be more comfortable handling an EHR and less likely to miss a required field.

The binary measurement of each parameter is also a potential limitation. Instead of assessing the degree of accuracy, EHR accuracy was determined by measurements according to defined parameters. However, this strategy has been performed by some large healthcare systems, including Kaiser Permanente Southern California.[2] Additionally, future studies can be performed to examine the degree of accuracy among parameters, as opposed to binary measurements. It may be useful to provide information about what aspects of each parameter were most performed incorrectly.

Finally, when deploying the sandbox for SGRSL training, technical difficulties were experienced by some of the groups. This could negatively affect the results, such that though the idea for interactive learning was enforced, it was unable to be fully executed in a standardized manner across all groups due to technical problems with the sandbox EHR.

Future Directions

To improve the study and accurately reflect the nature of a multidisciplinary team and variety of students at the clinic, volunteer participants should be matched between SGRSL and LGLSL by discipline, year in program, and prior experience. Additionally, as there is a natural variance in student ability throughout each school year, the results can be strengthened by comparing the results of SGRSL and LGLSL directly at the same clinic session. This addition can better account for differences in student experience, varying diagnoses, and time-of-year case presentations. Future quality improvement measures should focus on optimizing the SGRSL training method to further improve EHR accuracy and comparing it to other training modalities in a small group setting.

Conclusion

Many student-run free clinics rely on the students' accuracy with the EHR to provide quality, long-term care to their patients. The results of this study demonstrate the value of smaller-group sessions and hands-on learning over lectures in the setting of student volunteer training. This training regimen could provide a model for peer-taught EHR utilization to improve quality of care and enhance EHR learning experiences for medical students.

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Disclosures

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