

Keyboard Data Entry Use Among Osteopathic Medical Students and Residents

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Context: Candidates taking the Comprehensive Osteopathic Medical Licensing Examination-USA Level 2-Performance Evaluation (COMLEX-USA Level 2-PE) are currently evaluated on their ability to document clinical findings using a handwritten postencounter note. However, keyboard data entry is increasingly used for medical documentation.

Objective: To determine the use and perception of keyboard data entry among osteopathic medical students and residents in educational and clinical settings.

Methods: A Web-based survey regarding frequency of and preference for keyboard data entry was distributed to 9801 osteopathic medical students, 17,268 osteopathic residents, and 34 clinical deans of colleges of osteopathic medicine (COMs). In addition, 31 COMs' clinical skills center directors were contacted to participate in a telephone survey about the use of keyboard data entry in their centers.

Results: A total of 1711 students, 1198 residents, 14 clinical deans, and 17 clinical skills center directors responded to the surveys. The majority of students (872 [51%]) reported using electronic keyboard data entry at their COM's clinical skills center for postencounter notes. Among respondents, 379 students (23%), 77 residents (9%), and 1 clinical dean reported that electronic keyboard data entry is never or rarely used during clinical rotations. Most trainees (1592 students [93%], 864 residents [94%]) reported that they were either comfortable or very comfortable with typing. Given the option of recording methods for SOAP (subjective, objective, assessment, plan) note findings on the COMLEX-USA Level 2-PE, 7 clinical deans were unsure of their students' preferences, while the remaining favored keyboard data entry (5) over handwriting (2). The majority of student and resident respondents would choose keyboard data entry (1009 [60%] and 511 [55%], respectively).

Conclusion: Osteopathic medical students and residents are comfortable with typing; they are exposed to and would prefer using an electronic form of entry for medical documentation. These results support a conversion from written postencounter notes to keyboard data entry of notes on the COMLEX-USA Level 2-PE.

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With the advent of the electronic medical record (EMR) and its growing use in clinical practice, a new composition medium has been introduced as a means of recording patient health information. The implementation of The American Recovery and Reinvestment Act of 2009 has created a surge in medical literature focusing on health information technology and the promotion of EMRs.^{1,2} A national survey published in the National Center for Health Statistics Data Brief in December 2012 reported that 72% of office-based physicians used EMR systems—up from 48% in 2009.³

The medical community is not naïve to implementation of advancing technology changing practices. Medical educators have expressed concerns regarding the ability of medical students to use an EMR as a medium for documentation within medical education, the effect of EMR on doctor-patient communication, and the possibility of electronic entry affecting standardized testing.^{2,4-9} Researchers from the University of Texas Southwestern Medical Center offered a promising pilot study regarding the implementation of educational programs targeted at doctor-patient communication with the use of a computer.⁴ Morrow et al⁴ showed that as early as the first year of medical school, students are able to integrate EMR-specific communication skills by adding a 45-minute training session to their standard EMR training.⁴ In 2006, Boulet et al⁵ published a study showing composition medium (written vs typed) did not have an effect on the psychometric properties of the patient note scores on the Educational Commission for Foreign Medical Graduates Clinical Skills Assessment.⁵ Although these studies showed that EMR-specific communication skills can be taught and scores using an electronic form of entry are comparable to those using handwritten notes, the use of EMR and electronic keyboard data entry has not been fully explored among the osteopathic medical profession, in particular among osteopathic trainees (ie, students and residents, including interns and fellows).

The Comprehensive Osteopathic Medical Licensing Examination-USA Level 2-Performance Evaluation (COMLEX-USA Level 2-PE) is a high-stakes examination for osteopathic medical students that evaluates candidates' skills in 2 domains: the Biomedical/Biomechanical Domain, which evaluates the skills of history taking and physical examination, performance of osteopathic manipulative treatment, and documentation, and (2) the Humanistic Domain, which assesses doctor-patient communication, interpersonal skills, and professionalism.¹⁰ A candidate's ability to document clinical findings on a postencounter note is evaluated using a SOAP (subjective, objective, assessment, plan) note format. Handwritten SOAP notes, constructed in the 9 minutes after the 14-minute standardized patient encounter, reflect the candidates' written communication skills and ability to synthesize information, develop a differential diagnosis, and formulate a diagnostic and treatment plan.¹⁰ As written patient notes become replaced by keyboard data entry and EMRs in clinical settings, it is important to consider the most appropriate medium for recording clinical information after standardized patient encounters for COMLEX-USA Level 2-PE. Investigating stakeholders' preferences for using keyboard data entry to complete notes helps to inform development for COMLEX-USA Level 2-PE. The purpose of the present study was to investigate current use, preference, and perceived preference for using keyboard data entry in educational and clinical settings among osteopathic medical students, residents, clinical deans, and standardized patient training center directors.

Methods

Institutional review board approval was granted by the Center for the Advancement of Healthcare Education and Delivery to collect, analyze, and report the data for the present study. All participants were informed the results would be reported as aggregate to retain anonymity, and participation was voluntary.

Participants

In fall 2011, a Web-based survey (Survey Monkey) was e-mailed to 9801 osteopathic medical students (anticipated graduation in 2012 or 2013) and 17,268 residents (all former osteopathic medical students who graduated in 2007 through 2011) using e-mail addresses contained in the NBOME's candidate database (e-mail addresses are collected from each student every time they take an NBOME examination). For the postgraduate training population, interns, residents, and fellows in training were eligible for the study. Physicians in clinical practice were excluded. A separate survey was also distributed through e-mail invitations to 34 osteopathic clinical deans. E-mail addresses of responders were not tracked, thus allowing for responders to remain anonymous. Thirty-one osteopathic site directors for clinical skills laboratories were contacted by means of telephone to participate in a telephone survey.

Survey Instruments

Survey questions were developed by 4 staff physicians of the NBOME and were reviewed by COMLEX-USA Level 2-PE physician examiners who score postencounter written notes and serve on the Clinical Skills Testing Advisory Committee (comprised of experts in medical education and clinical assessment). The Web-based surveys were pilot tested by NBOME staff members. Invitations to participate in this research survey were sent twice to each of the osteopathic medical students and residents and 3 times to each of the clinical deans. Three attempts were made via telephone to contact each of the directors of the clinical skills laboratories.

The student and resident surveys contained questions regarding demographic information and the use and preference (or lack thereof) for using “keyboard data entry, word processing and/or electronic medical record[s]” as part of clinical training and testing. The student survey contained 18 items and the resident survey contained 17 items.

The survey for clinical deans consisted of 12 items—the first question asked that they identify their COM, and the remaining questions focused on the current use of keyboard data entry, word processing, or EMRs; perceived student preference of such tools; perceived influence of such tools on COMLEX-USA Level 2-PE performance; and whether adaptation of “electronic entry of post encounter exercises” could be accomplished in 1.5 to 2 years.

The survey of clinical skills training center directors included demographic information and focused on the use of standardized patients for training and the documentation tools used for postencounter findings. The final question of the 13-item survey mimicked the clinical dean question regarding whether EMRs could be incorporated into the postencounter exercises.

Analysis

Survey responses were analyzed using descriptive statistics.

Results

Demographics

Of the 9801 surveys sent to students, 534 e-mails were returned as undeliverable and 88 students declined the survey. Of the remaining students, 1711 responded, resulting in a response rate of 18%. Student survey participants represented 32 (94%) of 34 COMs, branch campuses, and additional locations in existence at the time of study. Students were equally distributed between male and female (49% and 51%, respectively) with ages ranging from 22 to 56 years (mean, 28 years). Students' anticipated year of graduation was equally distributed between the classes of 2012 and 2013, with 12 (1%) selecting “other,” all of whom anticipated 2014 as their year of graduation. Demographic information can be found in *Table 1*.

Responses were obtained from 1198 of the 17,268 graduates of osteopathic colleges. A total of 814 emails

were returned as undeliverable and 150 residents declined the survey, leaving a response rate of 7%. Resident respondents were equally distributed between male and female with ages ranging from 24 to 59 years (mean, 31 years). Of the 960 residents who identified the state in which they were training, 43 (4%) were in the New England Division, 285 (30%) in the Middle Atlantic Division, 235 (24%) in the East North Central Division, 79 (8%) in the West North Central Division, 111 (12%) in the South Atlantic Division, 15 (2%) in the East South Central Division, 51 (5%) in the West South Central Division, 46 (5%) in the Mountain Division, and 95 (10%) in the Pacific Division.

Intern and first-year residents and third-year residents made up the majority of resident survey participants (collective mean, 71%; *Table 1*). Four hundred seven residents (42%) reported that their residency programs were ACGME-accredited, 390 (41%) were AOA-accredited, and 163 (17%) were dually accredited. The majority of resident respondents selected family medicine (226 [24%]), internal medicine (203 [21%]), and “other” (246 [26%]) as their residency program (*Figure*). Other program specialties, as manually identified by residents, included psychiatry, orthopedics, dermatology, pathology, and anesthesiology, among others.

Clinical dean survey participants represented 14 (41%) of 34 existing COMs, branch campuses, and additional locations. Each geographic region mentioned above, with the exception of the Northwest, was represented by at least 1 clinical dean survey participant.

Seventeen clinical skills center directors (55%) participated in the telephone survey. The remaining center directors did not respond to e-mail or telephone requests to participate in the study.

Current Use of Keyboard Data Entry

When asked about the use of keyboard data entry across all clinical rotations, the majority of students, residents, and clinical deans reported that they (or their students, in the case of clinical deans) used keyboard data entry oc-

Table 1. Demographic Information and Typing Comfort Level of Student and Resident Survey Respondents

Characteristic	Response, No. (%) ^a	
	Students (n=1711)	Residents (n=1198)
Sex^b		
Male	846 (49)	473 (49)
Female	865 (51)	487 (51)
Current Age, ° y		
20-24	255 (15)	6 (1)
25-29	1146 (67)	405 (42)
30-34	203 (12)	408 (43)
35-39	62 (4)	82 (9)
40-44	22 (1)	21 (2)
>45	19 (1)	32 (3)
Anticipated Year of Graduation^d		
2012	862 (50)	NA
2013	849 (49)	NA
Other ^e	12 (1)	NA
Current Year of Residency Training^f		
Intern or first-year resident	NA	307 (26)
Second-year resident	NA	31 (3)
Third-year resident	NA	367 (31)
Fourth-year resident	NA	121 (10)
Fifth-year resident	NA	29 (2)
Fellow	NA	90 (8)
Comfort Level With Typing^b		
Not comfortable	19 (1)	6 (<1)
Somewhat comfortable	100 (6)	57 (6)
Comfortable	429 (25)	236 (25)
Very comfortable	1163 (68)	661 (69)

^a Percentages may not total 100 because a small number of survey respondents skipped individual questions.
^b The number of residents who responded was 960.
^c The number of students and residents who responded was 1707 and 954, respectively.
^d The number of students who responded was 1723.
^e All students who selected “other” noted 2014 as their anticipated year of graduation.
^f The number of residents who responded was 945.

Abbreviation: NA, not applicable.

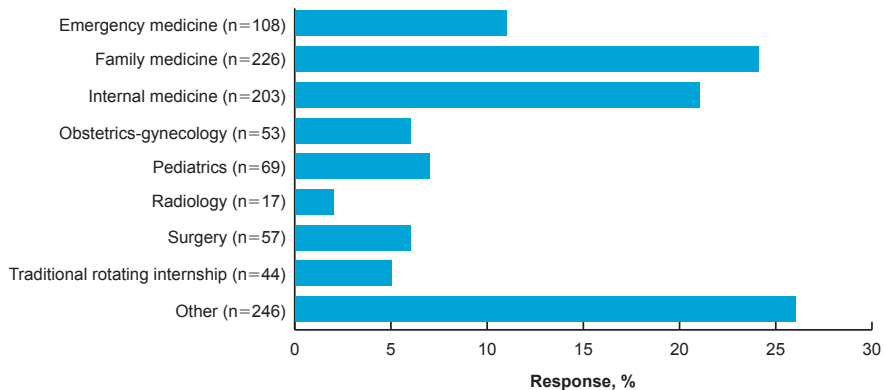


Figure. Program specialty identified by study residents. Family medicine and internal medicine were the largest reported subgroups, and more than 25% of respondents identified “other” (eg, psychiatry, orthopedics, dermatology, pathology, anesthesiology). A total of 960 individuals responded to this item. Respondents were allowed to select more than 1 option; therefore, the number of responses does not total 960 and the percentages do not total 100.

asionally, often, or always. Among respondents, 379 students (23%), 77 residents (9%), and 1 clinical dean reported that they or their students never or rarely use electronic keyboard data entry. The majority of students, residents, and clinical deans reported that they or their students occasionally, often, or always use electronic methods across all rotations. Detailed responses by clinical rotation type are presented in *Table 2*.

Among student respondents, 1028 (62%) reported they “were not permitted to document patient encounters in the chart” at a point in time during their clinical rotations. For those rotations in which students were not permitted to document in the medical record, students reported the notes were electronic (258 [25%]), handwritten (315 [31%]), or both (444 [44%]). In addition, 862 students (51%) reported having used keyboard data entry at their designated clinical skills center to create postcounter notes, and 824 (48%) reported that they had never used keyboard data entry, word processing, or an EMR (*Table 2*) at their COM’s clinical skills center.

All 17 clinical skills center director respondents reported that their sites used SOAP notes as a postcounter exercise, 2 reported history taking and physical examination as postcounter exercises, and 5 reported other postcounter exercises, such as multiple-choice questions. All directors reported that students also used a handwritten format to document or report their post-

counter findings, and 10 also reported use of an alternative method in addition to a handwritten format (5, keyboard entry/word processing; 4, verbal report; 1, EMR). The majority of center directors (10) responded that their clinical skills center currently has the capability to use keyboard data entry or EMRs (eg, their site has the software systems), but they are not using that technology. Five of the center director respondents reported that their site is currently using keyboard data entry or EMRs, and 2 reported that their site does not have the current capability for electronic documentation.

Preferred Use of Keyboard Data Entry

Among respondents, 1592 students (93%) and 897 residents (93%) reported they were either comfortable or very comfortable with typing (*Table 1*). A minority of respondents (19 students [1%] and 6 residents [$<1\%$]) reported that they were “not comfortable” with typing (*Table 1*).

Among resident respondents, 745 (79%) reported they would choose keyboard data entry for recording clinical findings in current practice if given the option (*Table 3*). Given the option of recording methods for SOAP note findings on COMLEX-USA Level 2-PE, the majority of students (1009 [60%]) and residents (524 [56%]) would choose keyboard data entry, while 367 students (22%) and 288 residents (31%) would choose

handwriting. Five clinical deans reported they believed that their students would prefer keyboard data entry on COMLEX-USA Level 2-PE, while 2 clinical deans reported they believed that their students would prefer handwriting. Seven clinical deans reported they were not sure what students' preferences would be on COMLEX-USA Level 2-PE. When asked if they thought keyboard data entry would improve their performance on COMLEX-USA Level 2-PE, 857 students (51%) either agreed or strongly agreed. Among clinical dean respondents, 8 also indicated they agreed or strongly agreed that keyboard data entry would increase their students' performance on COMLEX-USA Level 2-PE.

Discussion

Implementation of electronic entry in medical documentation, both in clinical and educational settings, has posed some concerns.^{2,4-9} Are students and residents comfortable with typing? Will keyboard data entry affect the degree to which students and residents are permitted to record a patient encounter in a clinical setting?^{2,9} Our survey confirmed that the overwhelming majority of osteopathic medical students and residents surveyed were comfortable with typing. We also found that the majority of students and residents reported that they (and clinical deans reported that their students) are already using keyboard data entry in a clinical setting. This finding was true across different population density clinical sites (urban, rural, and suburban), as well as in both hospital and outpatient settings. This result did not come as a surprise to the investigators, considering that electronic documentation has risen substantially in the past 4 years.³

Residents reported higher rates of keyboard data entry than students both in hospital and in outpatient settings. This finding is consistent with other studies that suggest that students are restricted from documenting in clinical charts.² Gliatto et al² posed many reasons why medical students are often not permitted to document in a patient's medical record: insurance regulations, billing

Table 2.
Current Use of Keyboard Data Entry in a Standardized Patient or Clinical Setting

Question	Response, No. (%) ^a		
	Students (n=1711)	Residents (n=1198)	Deans (n=14)
How often have you (your students) used keyboard data entry, word processing, and/or an electronic medical record...?			
...at your school's designated standardized patient site (eg, testing center) to create your (their) post encounter SOAP note? ^b			
Never	824 (48)	NA	4
Rarely	151 (9)	NA	1
Occasionally	202 (12)	NA	2
Often	233 (14)	NA	4
Always	276 (16)	NA	3
NA or unsure	17 (1)	NA	0
...across <i>all</i> clinical rotations? ^c			
Never	125 (7)	25 (3)	0
Rarely	254 (15)	52 (6)	1
Occasionally	506 (30)	143 (15)	9
Often	635 (38)	402 (43)	4
Always	159 (9)	323 (34)	0
NA or unsure	NA	NA	NA
...on your (their) <i>urban</i> rotations? ^c			
Never	139 (8)	31 (3)	0
Rarely	133 (8)	49 (5)	2
Occasionally	286 (17)	88 (9)	4
Often	430 (26)	224 (24)	5
Always	243 (14)	347 (37)	0
NA or unsure	448 (27)	203 (22)	3
...on your (their) <i>rural</i> rotations? ^c			
Never	177 (11)	69 (7)	0
Rarely	181 (11)	63 (7)	2
Occasionally	258 (15)	88 (9)	7
Often	234 (14)	107 (11)	1
Always	125 (7)	82 (9)	0
NA or unsure	704 (42)	536 (57)	4
...on your (their) <i>suburban</i> rotations? ^c			
Never	160 (10)	38 (4)	0
Rarely	151 (9)	53 (6)	1
Occasionally	369 (22)	112 (12)	6
Often	424 (25)	211 (22)	4
Always	170 (10)	238 (25)	0
NA or unsure	405 (24)	293 (31)	3

(continued)

Table 2 (continued).
Current Use of Keyboard Data Entry in a Standardized Patient or Clinical Setting

Question	Response, No. (%) ^a		
	Students (n=1711)	Residents (n=1198)	Deans (n=14)
How often have you (your students) used keyboard data entry, word processing, and/or an electronic medical record...?			
...on your (their) <i>hospital</i> rotations? ^c			
Never	170 (10)	45 (5)	0
Rarely	154 (9)	53 (6)	0
Occasionally	339 (20)	123 (13)	5
Often	511 (30)	254 (27)	7
Always	339 (20)	466 (49)	0
NA or unsure	166 (10)	4 (<1)	2
...on your (their) <i>outpatient-based</i> rotations? ^c			
Never	201 (12)	58 (6)	0
Rarely	234 (14)	69 (7)	0
Occasionally	417 (25)	160 (17)	7
Often	442 (26)	220 (23)	4
Always	179 (11)	321 (34)	0
NA or unsure	206 (12)	117 (12)	3

^a Response percentages may not total 100 because a small number of survey respondents skipped individual questions.

^b Number of student respondents was 1703.

^c Number of student and resident respondents was 1679 and 945, respectively.

Abbreviation: NA, not applicable.

claims, concerns about legal status of student notes, increased scrutiny of medical records from pay-for-performance programs, and the implementation of EMRs that do not allow or restrict students' access.³ Interestingly, in our survey, student and resident respondents reported the limitations placed on their ability to document in a medical record within a clinical setting were similar, regardless of documentation medium. Investigating limiting factors for osteopathic medical students and residents to document in clinical settings may provide useful information to the osteopathic educational community and may be of interest for future studies.

As medical informatics continue to advance, it is

imperative that the osteopathic medical community embraces the responsibility of educating our future physicians with the skills to navigate new technology. Students may be limited in the experience they have in documentation in the clinical setting as described previously, but they need education on the use of computers and technology to be prepared to use such technology on rotations and in osteopathic graduate medical education. Courses focused on medical informatics and EMR-specific communication skills have been developed by some medical schools to prepare students with new strategies they will need to deliver excellent patient care while using this new technology.^{4,6} Inclusion of an electronic format of documentation into the standardized patient laboratory centers at each COM will likely propel the further development of curricula specifically related to technology in the clinical setting. The majority of clinical skills center directors reported that their centers currently have the capability to use keyboard data entry and EMRs, but they are not currently using that technology. The majority of directors surveyed believed their school could provide this capability within their educational setting in the next 1.5 to 2 years.

A limitation of this study results from using a convenience sample and self-reported data. Survey responses were collected from a variety of sources (ie, students, residents, clinical deans, and clinical skills center directors), but improved response rates would provide more information. Many of the e-mail addresses for COM graduates were out of date and contributed to a low response rate. In addition, between-school differences were not analyzed in this report. Invitations to participate were inclusive and administered to potential respondents from all COMs. The purpose of the present study was not to investigate school differences but rather to solicit input from a national sample. Investigating response differences between schools may be of interest for future study. Whereas this study examined attitudes and surveyed current use, future studies regarding electronic keyboard data entry and EMRs and their impact on osteopathic medical education and testing are warranted.

Table 3.
Survey Responses Regarding Opinions on the Use of Keyboard Data Entry
in a Standardized Patient or Clinical Setting

Question	Response, No. (%) ^a			
	Students (n=1673)	Residents (n=944)	Deans (n=14)	Site Directors (n=17)
Given the option, which would you choose for recording clinical findings in current practice?				
Handwriting	NA	105 (11)	NA	NA
Keyboard data entry (eg, word processing, EMR)	NA	745 (79)	NA	NA
No preference	NA	46 (5)	NA	NA
Not sure	NA	48 (5)	NA	NA
Given the option on COMLEX-USA Level 2-PE, which would you (your students) have chosen (choose) for recording SOAP note findings?				
Handwriting	367 (22)	288 (31)	2	NA
Keyboard data entry (eg, word processing, EMR)	1009 (60)	524 (56)	5	NA
No preference	149 (9)	90 (10)	0	NA
Not sure	148 (9)	42 (5)	7	NA
I think keyboard data entry, word processing will increase my (my students') performance on COMLEX-USA Level 2-PE.^b				
Strongly disagree	112 (7)	NA	0	NA
Disagree	220 (13)	NA	2	NA
Agree	443 (26)	NA	7	NA
Strongly agree	414 (25)	NA	1	NA
Not sure	484 (29)	NA	0	NA
If you or your administration required adaptation of your current standardized patient site to provide keyboard data entry or word processing of postencounter exercises, could this task be accomplished in 1.5 to 2 years?^c				
Definitely not	NA	NA	0	0
Probably not	NA	NA	2	0
Probably	NA	NA	7	2
Definitely	NA	NA	5	13
NA ^d	NA	NA	NA	2

^a Response percentages may not total 100 because a small number of survey respondents skipped individual questions.

^b The number of deans who responded to this question was 10.

^c The survey administered to site directors asked, "If your administration required that you adapt your current center to provide for [electronic entry] of post encounter exercises, do you feel that you could accomplish this task in 1.5-2 years?"

^d Site director respondents answering NA noted their standardized patient sites were already using electronic entry of postencounter exercises.

Abbreviations: COMLEX-USA Level 2-PE, Comprehensive Osteopathic Medical Licensing Examination-USA Level 2-Performance Evaluation; EMR, electronic medical record; NA, not applicable; SOAP, subjective, objective, assessment, plan.

Conclusion

The NBOME continues to explore new methods of assessment to more completely evaluate osteopathic clinical competencies in the current clinical context. The assessment of osteopathic medical student clinical skills should follow the trends in clinical practice: the medical community is moving to electronic documentation; therefore, students should be educated and evaluated in this electronic medium, rather than the one they will no longer use (eg, paper medical records and written documentation). Results of the present study provide support for transitioning to a keyboard-entry format (eSOAP) for postencounter documentation during COMLEX-USA Level 2-PE.

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