Impact of Early Educational Intervention on Coding for First-year Emergency Medicine Residents

Sunny Bang, and Amit Bahl, MD

ABSTRACT

Objectives: Coding of a medical visit is based on provider documentation in the medical record; the documentation should reflect the level of care that was provided. To maximize coding and subsequent billing, providers must complete various components of the record to best convey the complexity of the case. Little education is provided to resident physicians regarding appropriate documentation practices, and studies suggest a need for improved education in this area. The primary goal of this study is to determine if implementing an early educational intervention will improve billing and coding.

Methods: This was a randomized, prospective controlled study in an academic Level I emergency department (ED). Interns without prior experience in billing and coding were eligible participants. Participants in the intervention group each received an interactive lecture on coding, evaluation and management (E/M) levels, and documentation macros, prior to their first ED rotation at the base hospital. A pocket card with E/M level requirements was given as a resource. Biweekly feedback was given to the residents to address any patterns of mistakes. The number of charts for each E/M level was collected from both groups, which were converted to relative value units (RVUs). A multivariate analysis using multivariate linear regressions controlling for age, sex of patient, admission rate, and month of encounter was used to statistically evaluate billing outcomes.

Results: The mean RVUs per hour and encounter in the intervention group were, respectively, 3.52 and 3.84 while in the control group they were, respectively, 3.36 and 3.72 ($p = 0.0112$). Intervention group encounters had 27% greater odds (odds ratio = 1.27) of having a level 5 chart compared to the control group ($p = 0.0025$).

Conclusion: The focused longitudinal educational interventions resulted in improved billing performances, reflected by better documentation, in the intervention group versus the control group.

Since its creation in 1992, the relative value unit (RVU) has increasingly been used as a direct measurement of physician productivity and reimbursements. It is associated with the Current Procedure Terminology (CPT) book, which codifies thousands of procedures for reimbursement, and a value is assigned to every code.[1] Within emergency medicine (EM), the CPT codes from 99281 to 99285 are the most common reimbursement codes, making up as much as 89% of revenue. These codes denote the evaluation and management (E/M) level of the health care charts, from level 1 to 5.[2,3] More RVUs are assigned to higher E/M levels of coding. These RVUs are multiplied by a dollar conversion factor, which then determines the total reimbursement amount and revenue for the billed health care chart along with any other documented procedures and associated reimbursements during the visit.

The E/M level of a chart is chiefly determined by established criteria based on documentation of several

From the Oakland University William Beaumont School of Medicine (SB) and the Department of Emergency Medicine, Beaumont Health System (AB), Royal Oak, MI.
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Address for correspondence and reprints: Amit Bahl, MD; e-mail: Amit.Bahl@beaumont.edu.
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key components including: the history of present illness (HPI), review of systems (ROS), physical examination (PE), and medical decision making.[4] As a result, detailed, complete documentation accounting for the complexity of the encounter correlates with level of E/M billed. Improper completion of the medical record may lead to downcoding of the chart, in which a patient visit is billed at a lower level than what it warrants due to missing elements of these components.

Table 1 illustrates the relationship between E/M level and documentation of key elements in the medical record. The coding is partly based on reaching a minimum threshold of elements in each category. For example, a minimum of ten elements are required to be documented in the ROS to be billed at an E/M level of 5 for complex visits; otherwise, it will be billed at an E/M level of less than 5, with a lower reimbursement rate. Interestingly, the revenue loss of a level 5 downcoded to a level 3 roughly equates to providing a level 4 service for free.[2] Table 2 illustrates the total RVUs associated with E/M levels.

Although the Accreditation Council on Graduate Medical Education (ACGME) advises programs to implement billing and documentation into their educational curricula, previous studies have shown a need for enhanced documentation education in EM residencies. In 1999, a survey was given to all EM residents across the nation as part of the annual American Board of Emergency Medicine In-Training Examination; the results largely indicated that billing and documentation practices were lacking in their residency education and something that needed to be significantly improved upon.[6] In 2004, a survey found that many program directors and EM residents agreed documentation and coding to be a vital skill, but reported their program's teaching to be inadequate.[7] In 2006, a retrospective, cross-sectional study was performed in an academic emergency department (ED); all patient charts within a 2-week period were reviewed for incidences of downcoding. It was found that EM residents had higher rates of downcoding compared to the attending physicians and physician assistants, identifying this as an area of needed development.[8] Finally, a survey limited to one academic ED in 2010 was given to 34 resident physicians and 22 attending physicians, which greatly highlighted a need for further billing and documentation education in EM residencies.[9] EM residents are lacking adequate training in billing and documentation, which is an integral skill to their future practice.[10]

With the integration of health care records to an electronic platform, it has become increasingly transparent for coders and insurers to determine E/M levels, highlighting the need for dedicated education during residency.[11] Further research is needed to assess the impact of educational interventions. As the electronic medical record (EMR) continues to evolve, certain efficiencies can be gained by optimizing presets in the medical record to facilitate documentation. Moreover, the impact of the interventions may be stronger if employed early during residency training. The goal of this study was to determine whether a longitudinal focused educational intervention on first-year EM residents would impact billing performance. We hypothesize that focused early educational interventions with longitudinal support would demonstrate greater billing performances (higher E/M chart levels) in the intervention group versus the control group.

Table 1
Association Between E/M Levels and Minimum Number of Required Documented Elements Per Category

E/M level	HPI	ROS	Past/family/social history	Physical examination
99281	1–3	0	0	1
99282	1–3	1	0	2
99283	1–3	1	0	2–4
99284	4	2–9	1	5–7
99285	4	10	2	8

E/M = evaluation and management; HPI = history of present illness; ROS = review of systems.

Table 2
2016 ED E/M RVUs 99281–99285[5]

E/M code	2016 total RVUs
99281	0.60
99282	1.17
99283	1.75
99284	3.32
99285	4.90

E/M = evaluation and management; RVUs = relative value units.

METHODS

Study Design

We used a randomized, prospective controlled design. All protocols were reviewed and approved by the institutional review board.

Study Setting and Population

The study setting is a large academic Level I ED with a 3-year EM residency program consisting of 14

residents per class. The ED has a volume of 130,000 patients annually.

Study Protocol

All EM provider documentation is within the Epic EMR. Once documentation is complete, the ED coding department analyzes the patient record and generates an E/M level code. These codes are then submitted by billing to insurers for reimbursement. All coders had at least 5 years of ED coding experience.

First-year EM resident providers beginning training in July 2016 were approached by the principal investigator for participation in this study. Participation was entirely voluntary and choosing to or not to participate did not impact professional or clinical performance evaluations. All residents received an information sheet outlining the purpose of the study and details about their anticipated participation. Residents with prior experience in medical billing and coding were excluded. Participants could drop out at any point during the intervention. Fourteen residents were recruited into the study; 12 residents agreed to participate. The 12 residents were randomized into the intervention and control groups by assigning a randomly generated number from 1 to 12, with even numbers designated into the control and odd numbers into the intervention. One resident in the intervention group dropped out 1 month into the study, leaving the final number of participants to 11. Based on the 2015 to 2016 schedules for first-year residents, each resident rotated at the main hospital ED for a total of 4 months throughout the year after their initial orientation month. The 4 months consisted of two full ED rotations at 20 shifts, one ED rotation that included a 1-week vacation for 15 shifts, and one ED rotation including ultrasound training with only 10 shifts in the ED. The total time spent is approximately 3 months and 1 week, or 650 hours per resident.

The standard education for coding and documentation at this EM residency for first-year residents is one lecture during orientation without any EMR documentation training or interactive support and follow-up with the ED coding department. All residents received this instruction. Additional focused educational interventions on coding were created and employed for this study, but only performed on the experimental arm of the study. The educational interventions included a 1-hour lecture, biweekly reviews and follow-ups, and a pocketbook. The lecture was given one-on-one in person with direct interaction of the EMR approximately 1 to 2 weeks before the start of their first ED rotation. It consisted of highlighting specific requirements for each E/M level, illustrating the loss of revenue in downcoding, discussing common downcoding errors identified by the ED coding department, and optimizing EMR training on generating and utilizing macros. Figure 1 demonstrates an example of a personalized macro that a resident would utilize in his or her PEs. A pocketbook containing the information from Table 1 on E/M level requirements was also distributed to the intervention group. Each resident in the intervention group then had biweekly phone calls of approximately 10 to 15 minutes to review and prevent common documentation mistakes pointed out by the ED coding department, review E/M levels and their requirements, and answer any coding questions. These phone calls were only made during their ED rotations and by the lead investigator with faculty supervision. The ED coding department did not allow the residents from both groups to revise any of the downcoded charts.

Measurement

The data of interest used for analysis are E/M chart levels and therefore billing, which is reflective of resident documentation performance between the intervention and control group. Professional charges were inputted at the time of coding by the ED coding department as the primary claim for insurance reimbursement. Charts billed for critical care were excluded from the data analysis, as only attending physicians, not residents, can do so in this academic ED. Critical care billing also does not have specific key element requirements (HPI, ROS, PE), which falls outside of our study interventions.

The total number of E/M chart levels were collected as encounters throughout the year only during the main hospital ED rotation months for each resident. Age, sex of patient, admission rate, and the total number of the six most common complaints for EC visits nationally (fever, headache, shortness of breath, chest pain, abdominal pain, and back pain) were also collected to control for patient population differences and acuity between the groups. Based on the E/M chart levels, each E/M chart level (1 to 5) was proportioned out of the entire amount to properly assess the differences due to the uneven number of participants in the intervention versus control groups. The E/M chart levels were further broken down by converting

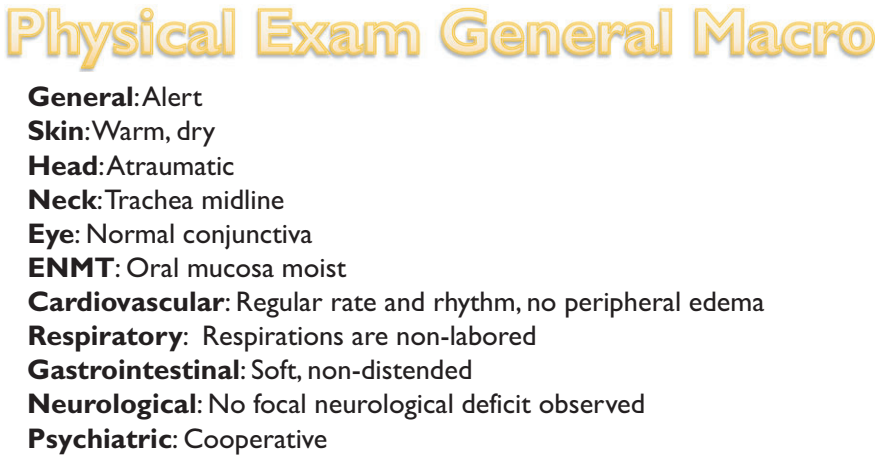

Figure 1. Example of physical examination macro.

them into RVUs to assess for differences in total RVUs generated per group, hour, and encounter. A RVU conversion factor of 1 RVU to $35.8887 was applied to also assess for differences in total USD (revenue) generated per group, hour, and encounter.[7]

Data Analysis

Evaluation and management chart levels were reported as percentages of the total number of encounters to determine if there was a statistically significant association between the level of coding (1 to 5) and whether the resident for the encounter was in the intervention group or the control group. Mean RVU/revenue per encounter and frequency of level 5 coding were also compared between the intervention group and the control group. A multivariate analysis was employed using multivariate logistic regressions controlling for age, sex of patient, admission rate, and month of encounter to evaluate these outcomes. $p < 0.05$ indicated significance.

RESULTS

Study Subjects

A total of 11 first-year EM residents were included in the study: five in the intervention and six in the control group. These residents rotated in the main ED throughout the year for approximately 3 months and 1 week. The mean number of patients for the entire year seen by the residents in the intervention group was 594 versus 587 in the control group ($p = 0.863$).

Patient Population

The difference in patient populations between the groups was not significantly different in acuity, determined by age ($p = 0.3115$), sex ($p = 0.0772$), admission rate ($p = 0.0606$), and proportion of the six most common complaints (chest pain $p = 0.7918$, abdominal pain $p = 0.6128$, fever $p = 0.9076$, headache $p = 0.1256$, back pain $p = 0.0912$, shortness of breath $p = 0.6143$).

E/M Chart Level

For univariate analysis using a chi-square test, there was a statistically significant association between the E/M chart levels and whether the resident for the encounter was in the intervention group or the control group ($p = 0.0059$). Controlling for age, sex of patient, admission rate, and month of encounter, there was a statistically significant association between the E/M chart levels and whether the resident for the encounter was in the intervention group or the control group ($p = 0.0230$; see Table 3)

RVU/Revenue

The mean RVUs per hour and encounter in the intervention group was, respectively, 3.52 and 3.84, while in the control group they were, respectively, 3.36 and 3.72. The mean revenues per hour and encounter in the intervention group were, respectively, $126.33 and $137.77, while in the control group they were, respectively, $120.59 and $133.60. Using multivariate linear

Table 3
E/M Chart Levels for the Intervention and Control Groups

Group	Level 1	Level 2	Level 3	Level 4	Level 5
Intervention	0.17%	4.26%	15.27%	26.14%	54.16%
Control	0.17%	4.52%	17.78%	27.87%	49.66%

E/M = evaluation and management.

regressions controlling for age, sex of patient, admission rate, and month of encounter to statistically evaluate possible associations, the mean RVU/revenue per hour and encounter was significantly higher in the intervention group than in the control group (p = 0.0112; see Tables 4 and 5).

Level 5 Coding

In the intervention group, 54.16% of encounters were level 5 charts while only 49.66% of control group encounters were level 5 charts. Using multivariate linear regressions controlling for age, sex of patient, and admission rate, intervention group encounters had 27% greater odds (odds ratio [OR] = 1.27) of having a level 5 chart, and this difference was statistically significant (p = 0.0025; see Table 6).

Table 6
E/M Level 5 Chart Frequencies

	Level 5 Chart Frequencies		OR Results	
	Intervention Group (%)	Control Group (%)	OR_{ADJ} (95% CI)	p-value
Overall	54.16%	49.66%	1.27 (1.09–1.48)	0.0025

E/M = evaluation and management; OR_{ADJ} = adjusted odds ratio.

DISCUSSION

Despite ACGME recommendations to incorporate billing and documentation education in EM residency training, residency programs have variable approaches to address this directive and most graduating physicians do not feel adequately prepared in this skill.[4,7,9] Further, there is a dearth of existing literature that addresses the solution to this problem. In 2007, Pines et al.[12] demonstrated that educational stipends linked to documentation training improved documentation and E/M chart thresholds, which resulted in significant increases in E/M levels 4 and 5. Carter et al.,[4] similar to our study, investigated the impact of a prospective educational intervention on billing and coding outcomes. Interventions consisted of lectures, case-specific feedback, and regularly using supplemental documentation cards for reference. The authors concluded that targeted interventions have a positive impact on RVUs and revenue per encounter, but not procedures. We aimed to add to this research by similarly assessing the impact of an educational intervention. Some key differences in our approach include study design, length of intervention, and targeted subject group. We conducted a randomized prospective trial with an experimental and control group over a 1-year period. Further, instead of focusing on senior residents, we felt the impact of our interventions would have the highest yield at the intern level. As interns newly enter residency, they are prime candidates for the purposes of our study. This is when they begin to adapt to the system and readily develop their foundations in documentation practices. While interns have a steep learning curve and may naturally make rapid improvements in documentation, the results of our intervention are not impacted as the randomization process accounts for this tendency and controls for the natural progression.[13] By also adding the month of encounter as a variable to our multivariate analysis, we minimize the effect of time as a

Table 4
RVUs per Hour/Encounter in the Intervention and Control Group

	Intervention Group			Control Group			
	Per Resident	Per Hour	Per Encounter	Per Resident	Per Hour	Per Encounter	p-value
Overall	2,288.54	3.52	3.84	2,184.54	3.36	3.72	0.0112

RVUs = relative value units.

Table 5
Revenue in USD Per Hour/Encounter in the Intervention and Control Group

	Intervention Group			Control Group			
	Per Resident	Per Hour	Per Encounter	Per Resident	Per Hour	Per Encounter	p-value
Overall	$82,132.73	$126.33	$137.77	$78,400.30	$120.59	$133.60	0.0112

USD = United States dollars.

confounding factor as well. Further, by implementing these interventions early on, we directly address the issues of EM residents reporting inadequate instruction in documentation and coding.[7] This cementing of proper documentation practices and feedback structure with biweekly reviews may potentially continue through the remaining years of residency. As Nguyen et al.[14] found that longitudinal didactic teaching and small group discussions did not improve coding accuracy in their academic practice; we instead employed interventions at the individual level as our educational modality of choice, such as efficient EMR navigation and creating personalized macros for documentation.

The improved coding and billing performances by the intervention group manifested in the E/M chart levels by showing a significant increase in level 5s coded with a resultant decrease in level 3 and 4s in comparison to the control group. This appears to be consistent and correlates with our educational interventions focused on identifying appropriate E/M codes based on patient acuity, the minimum number of elements to satisfy each component particularly stressing the importance of ROS, and sustained follow-ups with documentation reviews. Based on the ED coding department's reviews, it is likely that the control group accrued more downcoding events by not providing enough ROS and PE elements for these cases. The fact that there was no significant difference in patient population and acuity and hours worked between the two groups suggests that our educational interventions and longitudinal support were responsible for the highlighted improvements in the intervention group. It should be noted that the control group received zero longitudinal support as the baseline, which suggests that the standard one-time lecture on coding and billing is insufficient to maintain proper coding and billing performances.

Although the difference in level 5s between groups of approximately 5% may seem underwhelming, this corresponds to a relatively notable improvement in coding and billing performances in the context of total time spent for interventions and finances. With a 1-hour lecture and 10- to 15-minute follow-up/reviews twice a month, the total time spent for interventions add up to approximately 3 to 5 hours for a 12-month period. If the outcomes from our intervention were extrapolated to all 42 emergency resident physicians at our site for the course of 1 year, the improved coding would yield an additional $279,438.11 in revenue for professional services. Table 7 provides a combined projection over the course of an academic year for all 42 residents as well as a breakdown of individual class contributions to the overall projection. Patients per hour data were available for each resident class to help make an accurate calculation. The outcomes support our hypothesis that educational interventions can definitively contribute to the academic ED's finances while improving medical documentation.

Electronic medical record systems are technologic applications that can improve patient care, but also bring frustrations to physicians with its time-consuming data entry and navigation through its multiple complex functions. Physicians must find ways to leverage EMR systems to create the most complete medical record without significant additional time. The coding and billing performances of the intervention group demonstrate the utility of educational interventions that focus on efficient EMR usage to its advantage and therefore better medical record documentation. But most importantly, these educational interventions prepare EM residents under the growing era of RVU-based practices and salary by instilling early foundations of coding and appropriate documentation in their beginning development.

Finally, our study contributes additional data to the research of residency education in coding and billing, which is believed to become more significant in the future as health care technology advances and

Table 7
USD Differences Between Performances With and Without Interventions for Residents

	Total USD (14 PGY-1s)	Total USD (14 PGY-2s)	Total USD (14 PGY-3s)	Total USD (42 PGY-1–3s)
$\text{Performance}_{W/I}$	$1,149,858.22	$2,541,953.55	$4,727,937.14	$8,419,748.91
$\text{Performance}_{WO/I}$	$1,097,604.20	$2,462,517.50	$4,580,189.10	$8,140,310.80
Difference	$52,254.02	$79,436.05	$147,748.04	$279,438.11

PGY = postgraduate year; USD = United States dollars; W/I = with interventions; WO/I = without interventions.
Total USD calculated from total RVU per PGY class (1 RVU = 35.8887 USD).
PGY-2 = calculated RVU and USDs generated with 1.55 encounters per hour and 850 hours per resident.
PGY-3 = calculated RVU and USDs generated with 1.69 encounters per hour and 1450 hours per resident.

everything becomes electronically recorded. The health care industry is no exception when it comes to the effects of technologic revolutions. It will also serve as a reference for future-held studies that attempt to design and implement their own educational interventions within their academic institutions. Also, while this is focused on EM and its primary form of billing, the results can still be useful for other residencies of medical specialties that also deal with the intricacies of billing, such as psychiatry, general surgery, internal medicine, among others.

LIMITATIONS

The main limitation of this study was its sample size. Introducing a control group effectively halved the sample size for the study. There were also the associated challenges of preventing the members of the control group from collaborating with the treatment group, such as sharing information from the focused 1-hour lecture, distributed pocketbooks, and biweekly reviews. The EM residents in the intervention group may have put more effort in their documentation and charting to produce the desired results of the study as well. The control group may have also realized what was happening throughout the study and attempted to produce better documentation results, although the data analysis seems to point otherwise. We also did not directly monitor and record the hours spent on documentation after an ED shift in both groups, which could have been increased to produce the desired results. Only the intervention group was asked informally to approximate the mean hours spent, which suggested no significant increases.

In addition, there were potential influences based on the nature of the planned scheduling, since some residents had more experience than others with documentation in the other blocks, such as orthopedics or pediatric ED, by the time they begin their first rotation at the main ED. However, this affected both groups equally. Finally, this study was strictly confined to one academic ED and the Epic EMR program. Academic EDs come in all forms and sizes, such as the number of residents per year, capacity for care, annual number of visits, and educational curriculum. As a result, the weaknesses that were targeted for the study at this ED may not be a problem for other EDs. Since this study focused on techniques and interventions related to the Epic EMR program, this may not be applicable to other EMR programs such as Cerner, medical transcription dictations, or institutions with paper documentation instead of electronic.

Future studies relevant to our project include assessing documentation performances between the intervention group and the interns currently entering in the year of 2017 to 2018. Their performance and billing after graduation could also be followed up as well. Both the mentioned studies would potentially demonstrate whether the year-long interventions were enough to sustain long-term changes in their documentation practices. The interventions were only related to E/M chart levels, so there needs to be future studies on other factors of billing, such as RVUs generated by procedure notes, especially to be applicable to other specialties that rely heavily on procedures.

CONCLUSIONS

The focused educational interventions throughout the year resulted in statistically significant greater billing performances, reflected by improved documentation, in the intervention group versus the control group.

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