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RESEARCH ARTICLE

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The power of written word: Reflection reduces errors of omission

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Abstract

Background: Medical trainees are expected to perform complex tasks while experiencing interruptions, which increases susceptibility to errors of omission. In our study, we examine whether documentation of clinical encounters increases reflective thinking and reduces errors of omission among novice learners in a simulated setting.

Methods: In 2021, 56 senior medical students participated in a simulated paging curriculum involving urgent inpatient cross-cover scenarios (sepsis and atrial fibrillation). Students responded to pages from standardized registered nurses (SRNs) via telephone, gathered history, and discussed clinical decision-making. Following the phone encounter, students documented a brief note (documentation encounter). A 'phone' score (number of checklist items completed in the phone encounter) and a 'combined' score (number of checklist items completed in the phone and documentation encounters) were calculated. Data were analyzed for differences between the phone scores (control) and combined scores using T-tests and McNemar test of symmetry.

Findings: Fifty-four students (96%) participated. Combined scores were higher than phone scores for sepsis (72.8 ± 11.3% vs. 67.9 ± 11.9%, $p < 0.001$) and atrial fibrillation (74.0 ± 10.1% vs. 67.6 ± 10.0%, $p < 0.001$) cases. Important items, such as ordering blood cultures for sepsis ($p = 0.023$) and placing the patient on telemetry for atrial fibrillation ($p = 0.013$), were more likely to be present when a note was documented.

Discussion: This study suggests that documentation provides a mechanism for learners to reflect, which could increase important diagnostic and therapeutic interventions.

Conclusion: Documentation by novice medical learners may improve patient care by allowing for reflection and reducing errors of omission.

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1 | BACKGROUND

New residents are expected to perform complex cognitive and procedural tasks while simultaneously experiencing a high degree of interruption and discontinuity in their daily workflow.[1–3] This cognitive shifting may increase susceptibility to making errors.[4–6] Indeed, it has been shown that errors in the hospital setting are common.[7] Diagnostic and management errors are an important source of morbidity and mortality.[8–10] This includes errors of omission, such as not obtaining a sufficient history, excluding relevant diagnostic testing or missing appropriate therapy.[11,12]

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Strategies to mitigate diagnostic and management errors have been offered[13–15]; however, less is known about potential cognitive mechanisms to prevent errors of omission in medical diagnosis and management. The literature supports the importance of reflection in diagnostic performance and medical knowledge acquisition.[16,17] In fact, reflection may allow for countering of biases such as availability bias.[18] Intentional use of slower, reflective thinking[19] may reduce errors of omission by promoting an analytical and effortful approach to evaluating and treating a medical problem. For learners, providing explicit opportunities to engage in reflection or metacognition may improve clinical decision-making and therefore patient outcomes.[20] We hypothesise that documentation of a clinical event may provide this opportunity to reflect.

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Preventing errors of omission is critically important in the practice of medicine, particularly during cross-cover, which is the act of caring for hospitalised patients that are not on the physician's primary team, such as overnight.[21] Cross-coverage is a pervasive responsibility of physicians in training. Documentation during cross-coverage is a vitally important aspect of clinical care given the covering physician does not know the patient. A note in the medical record captures the relevant details of an event and can be used to describe medical decision-making, which is visible to others caring for the patient. Unfortunately, despite the importance, one retrospective study found both the quality and quantity of cross-cover notes to be poor, highlighting a need for education on this type of documentation.[22]

The aim of our study was to determine if documentation of urgent cross-cover clinical scenarios reduced errors of omission among novice learners by adding to their diagnostic workup and management decisions in a simulated setting.

2 | METHODS

2.1 | Setting and participants

Participants were 56 fourth-year medical students who enrolled in a 4-week internal medicine residency preparation course (RPC) at a single academic institution in the spring of 2021, just prior to graduation.

2.2 | Simulated paging curriculum

As part of the RPC, students participated in a robust simulated paging curriculum to model cross-coverage.[23] Students received pages over a 5-day period each week from 8 AM to 10 PM over the 4 weeks of the RPC. Students were asked to respond to specialty-specific pages about hypothetical patients regarding acute medical cross-cover scenarios: atrial fibrillation and sepsis. The only information the students had on these patients was a brief written 'sign out', which contained a one-line summary about the patient, medications, allergies, 24-hour vital signs and recent labs, and they were instructed to not use additional resources.

For each scenario, the student was paged by a standardised registered nurse (SRN) and then asked clarifying questions to the SRN to gather additional relevant clinical information and further testing and/or treatment. Because these were simulated patient scenarios, students were not able to evaluate the patients in person and, as such, were instructed to use the SRN as a surrogate for bedside patient evaluation and develop a diagnostic and management plan that they would have ordinarily done at the bedside. The SRN followed a script and provided the history, subjective symptoms, vitals, physical exam and results of labs and imaging in real time as the students asked for them, to allow for the clinical reasoning process (phone encounter). Immediately following the encounter, the SRN completed the clinical

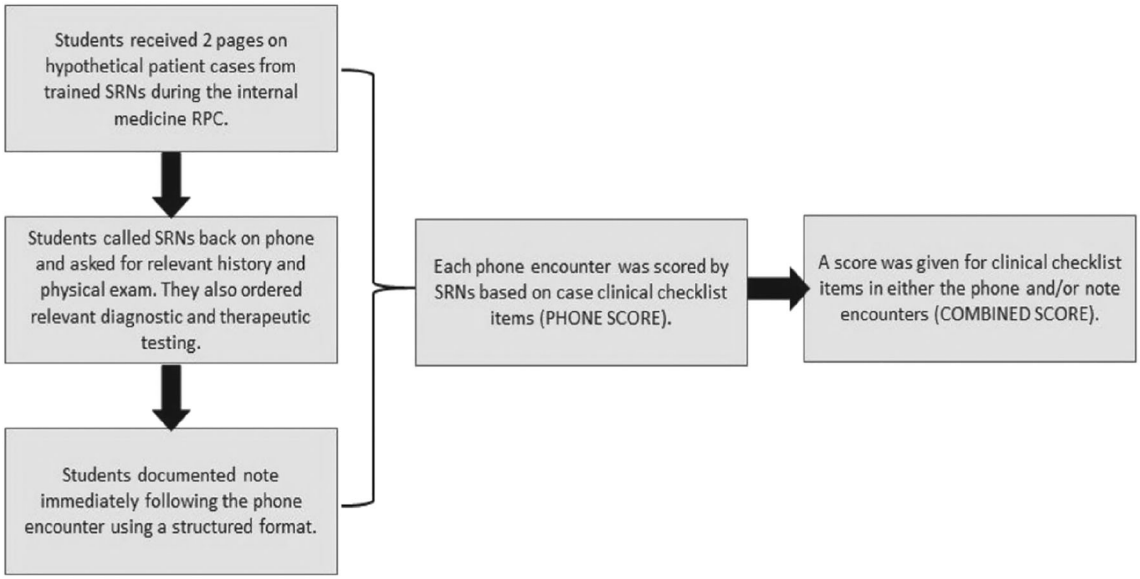


FIGURE 1 Structure of cross-cover paging curriculum and documentation for senior medical students.

checklist described below to generate the phone score and the student was instructed to complete a free form note that documented the clinical encounter (document encounter) using an electronic survey platform (Qualtrics, Provo, UT). Students were instructed that they could document additional diagnostic or management plans even if they did not mention this on the phone call. Students were told to write their notes as soon as possible after the phone call and not to use additional resources. The same clinical checklist was then applied to the documented note to generate the combined score. Students received feedback on their clinical performance within several days of case completion. Figure 1 depicts this curriculum's overall flow. See supporting information for a sample case and checklist items.

2.3 | Simulated paging curriculum structure and assessments

Cases and checklists were developed by one internal medicine hospitalist faculty and reviewed and modified by three others for content validity. Checklists included both diagnostic tests and management interventions and were developed based on current clinical guidelines. The sepsis case contained 17 weighted key clinical items and the atrial fibrillation case contained 14 weighted key clinical items that the students 'must do' (2 points) and 'should do' (1 point), 'could do' (0 points), 'should not do' (−1 point) and 'must not do' (−2 points).

2.4 | Definitions

Phone score (control): the percentage score calculated based on the number of checklist items completed in the phone encounter.

Combined score: the percentage score calculated based on the checklist items completed in the phone encounter and documentation encounter. This score is believed to be the most clinically relevant given that this combined score accounts for additional critical items that had been missed during the phone call and represent what actions are most likely to take place in the authentic clinical setting.

2.5 | Data analysis

We analyzed data using paired T-tests to examine mean differences between phone scores and combined scores for both cases with $p = 0.05$, two-tailed test. We compared the students against themselves. We used the McNemar test for symmetry to examine differences in selection frequency between phone and combined scores for the individual checklist items for both cases. All analyses were completed using R Studio software (Boston, MA). Students who did not complete both a phone and documentation encounter were excluded from the analysis.

3 | FINDINGS

Fifty-four (96%) students completed the curriculum. Combined scores were significantly higher than phone scores (control) for the sepsis case (72.8 ± 11.3% vs. 67.9 ± 11.9%, $p < 0.001$) and the atrial fibrillation case (74.0 ± 10.1% vs. 67.6 ± 10.0%, $p < 0.001$) (Figure 2). Several items were included more often in documented notes after the encounter than were communicated over the phone. For the sepsis case, examples included obtaining blood cultures ($p = 0.023$), assessing mental status ($p = 0.004$) and asking the RN to monitor urine output ($p < 0.001$) (Table 1). For the atrial fibrillation case, items

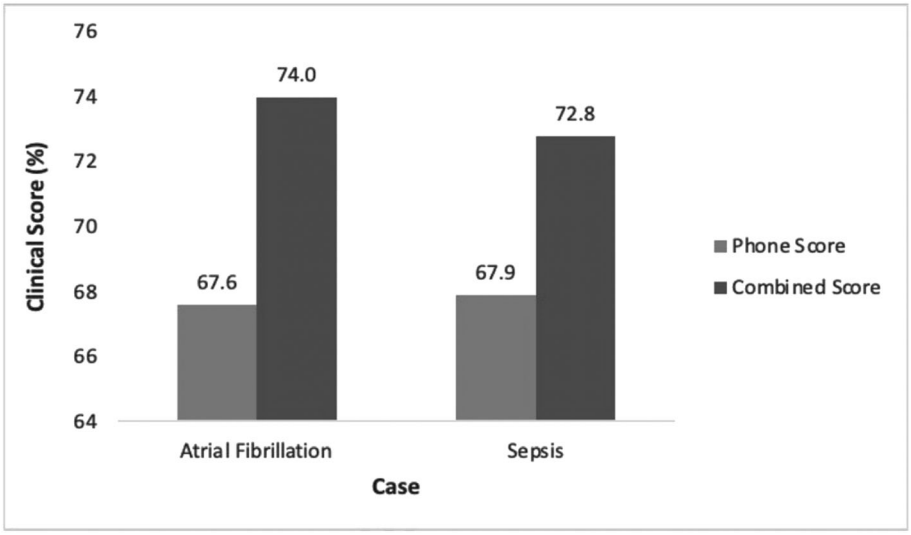


FIGURE 2 Phone and combined scores (%) for atrial fibrillation and sepsis simulated paging cases at a single academic institution, n = 54, 2020–2021.

TABLE 1 Item analysis for sepsis simulated paging case, comparing mean phone scores (%) and combined scores (%) at a single academic institution, n = 54, 2020–2021.

Sepsis checklist item	Mean phone score, %	Mean combined score (phone + note), %	p value
Ask about patient's baseline mental status	74.1%	92.6%	0.004
Ask for a current set of vitals	100%	100%	NA
Ask for physical exam findings	90.7%	94.4%	0.48
Ask about intravenous access	40.7%	40.7%	NA
As-k for chest x-ray	98.1%	98.1%	NA
Order blood cultures	66.7%	79.6%	0.023
Obtain complete blood count (± differential)	100%	100%	NA
Obtain arterial blood gas and/or venous blood gas and/or lactate	44.4%	50.0%	0.248
Obtain basic metabolic panel OR comprehensive metabolic panel	98.1%	98.1%	NA
Start empiric intravenous antibiotics	90.7%	94.4%	0.48
Give at least 1-L normal saline or lactated ringer bolus	75.9%	81.5%	0.248
Ask registered nurse to repeat vital signs after fluids	42.6%	42.6%	NA
Instruct nurse to place second intravenous access (does not have to specify gauge) OR can indicate they will obtain central access	25.9%	25.9%	NA
Ask registered nurse to monitor urine output	7.4%	53.7%	<0.001

Note: If percentages between phone and combined scores were the same, p-value was not calculated.
Abbreviation: NA, not applicable.

included assessing mental status and/or shortness of breath (p = 0.023), obtaining TSH (p = 0.003) obtaining an echocardiogram (p = 0.013) and placing the patient on telemetry (p = 0.013) (Table 2).

4 | DISCUSSION

Our study demonstrates that written documentation following a clinical encounter includes notation of more appropriate diagnostic testing and therapeutic interventions when compared to what is discussed verbally in the telephone encounter. This is reflected in the increased clinical combined score and may lead to increases in the quality of care. Many of the items that were included more often in the combined score were crucial for advancing patient care. Thus, documentation not only allows for capturing more items that should be completed for appropriate evaluation and management but importantly inclusion of critical items.

TABLE 2 Item analysis for atrial fibrillation simulated paging case, comparing mean phone scores (%) and combined scores (%) at a single academic institution, n = 54, 2020–2021.

Atrial fibrillation checklist item	Mean phone Score, %	Mean combined score (phone + note), %	p-value
Ask if the patient has chest pain	70.4%	77.8%	0.134
Ask if patient has shortness of breath and/or altered mental status	69.1%	87.3%	0.023
Ask about current vital signs	100%	100%	NA
Ask for physical exam	94.5%	94.5%	NA
Obtain 12 lead electrocardiogram	100%	100%	NA
Order potassium (e.g., basic metabolic panel OR comprehensive metabolic panel)	67.2%	70.9%	0.48
Order magnesium	14.5%	21.8%	0.134
Order thyroid-stimulating hormone	34.5%	54.5%	0.003
Order chest x-ray	49.1%	54.5%	0.248
Order echocardiogram	14.5%	29.1%	0.013
Move patient to telemetry bed	54.5%	69.1%	0.013
Start intravenous beta-blocker (e.g., esmolol *or* metoprolol) OR calcium channel blocker (e.g., diltiazem)	78.2%	85.5%	0.134

Note: If percentages between phone and combined scores were the same, p-value was not calculated.
Abbreviation: NA, not applicable.

Documentation not only allows for capturing more items that should be completed for appropriate evaluation and management but importantly the inclusion of critical items.

While documentation has been recognised as an important means of communication about patient care and clinical decision-making, there is limited study on the potential effect that documentation may have on patient care. Our results are consistent with the hypothesis that the process of documenting a note allowed students to engage in reflective thinking and reduced errors of omission. The findings from our work further validate the importance of integrating formal medical education regarding documentation of significant clinical events, especially those that come up during times of cross-cover, as documentation may not only help to communicate clinical decision-making but may also even lead to reduced errors of omission, potentially improving the quality of care delivered. We recognise that documentation adds another task to an already busy schedule among novice learners and clinicians, but we believe that the benefits of effective documentation (reduced errors of omission and improved communication) outweigh the risks (increased time).

A novel aspect of our study is that we examined both diagnostic and therapeutic decision-making. Interestingly, we observed that errors of omission were decreased in all elements of the workup of a patient including obtaining a history, performing a physical exam, ordering diagnostic tests and starting therapeutic interventions. It may be hypothesised that more analytical, reflective thinking would be more likely to decrease errors of omission on what is perceived as more complex tasks, such as therapeutic decision-making, rather than more straightforward and practiced behaviours such as the history and physical exam. However, we found a substantial benefit in reflective thinking in all elements of the workup, highlighting the importance of all aspects of diagnostic and therapeutic decision-making in clinical reasoning, regardless of the complexity of the tasks.

Limitations of our study include that it is at a single institution with a small number of participants in the internal medicine field and only two cases that limit generalisability. The setting also does not mimic the true clinical setting in that learners were not at the bedside where they can get more information and visual cues. Furthermore, this study was 'closed book' and did not allow learners to look up resources online or ask others for help. Also, given the simulated nature of the study during a fourth-year residency preparatory course, learners did not experience the usual interruptions faced in direct patient care settings such as additional pages while writing a note. Lastly, it is possible that some learners process information differently (visual vs. auditory) and, hence, some may benefit more from the writing exercise than others.

Next steps include expanding this curriculum to include more cases and additional participants from other specialties for increased generalisability. In the future, it would also be interesting to examine the quality of cross-cover notes of these graduating students as they

transition to the intern role and gauge trainee perceptions about the impact on actual clinical care. It would also be interesting to see if documentation has a similar effect on more advanced trainees or faculty members. Furthermore, while our study was underpowered to detect a true difference between the various tasks involved in diagnostic and therapeutic decision-making, in the future, it may be worthwhile to explore if there is a differential effect of reflecting on these specific elements of the clinical encounter.

5 | CONCLUSION

In conclusion, documentation may serve as a mechanism to reduce errors of omission and potentially improve clinical care by engaging learners in reflective thinking and promoting analytical, critical thinking. It is important that this documentation be formally taught and integrated into the undergraduate medical education curriculum.

Documentation may serve as a mechanism to reduce errors of omission and potentially improve clinical care by engaging learners in reflective thinking and promoting analytical, critical thinking.

AUTHOR CONTRIBUTIONS

Dr. Heidemann, Dr. Hartley, Dr. Morgan, Dr. Gruppen and Dr. Kempner conceptualised and designed the study and also designed the data collection. Dr. Heidemann and Dr. Morgan acquired the data. Dr. Rao and Dr. Gruppen carried out the analyses. Dr. Heidemann, Dr. Hartley, Dr. Kempner and Dr. Rao drafted the initial manuscript. All authors reviewed and revised the manuscript and approved the final manuscript as submitted.

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CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

ETHICAL APPROVAL

This study was determined to be exempt by our hospital's Institutional Review Board. All work was conducted in compliance with international ethical guidelines. Participants provided electronic consent to use data for research purposes at the beginning of the RPC, and all data were collected and analysed anonymously.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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