MAYO CLINIC

MAYO CLINIC PROCEEDINGS:
INNOVATIONS, QUALITY & OUTCOMES

ORIGINAL ARTICLE

Improving Communication in the Medical Intensive Care Unit Through Standardization of Handoff Format: A Quality Improvement Project

Lindsey A. Wallace, DScPAS, PA-C; Kelsey K. Schuder, CNP, MSN, MPH; Vicki Loeslie, DNP; Andrew C. Hanson, MS; Clifford Ongubo, DNP; Elaine Chiarelly, CNP, MSN; Gregory Schalla, PA-C; Kathleen Hinson Meek, PA-C; and Donald Springer, CNP

Abstract

Objective: To decrease interruptions in handoff, increase compliance with a structured verbal handoff format, and increase compliance with handoff template completion in electronic medical records without increasing the length of handoff time.

Patients and Methods: The project timeline was from April 1, 2019, to February 1, 2020. Define phase data were obtained through a survey of stakeholders to identify the gap in needs. The baseline data included components from the illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver (IPASS) handoff tool because this tool best aligned with information identified in the define phase. Observational data were collected in person and reviewed via audio recording for accuracy. Results were analyzed to determine adherence to the chosen intervention, the IPASS handoff tool, on which the stakeholders were educated and assessed prior to implementation. Five plan-do-study-act cycles were completed over 3 months to optimize the intervention. Final data were collected and analyzed using the same method as baseline data.

Results: After implementation of the IPASS handoff tool, there were more care plan components mentioned in the provider handoffs across all unique IPASS components, there were fewer observed distracting events, and there was increased compliance with electronic medical record handoff completion. The time of handover increased by 3 minutes.

Conclusion: A standardized handoff tool improved communication during provider handoffs by increasing the mention of pertinent details and reducing distracting events during handoff.

 ■ Mayo Clin Proc Inn Qual Out 2023;7(4):301-308

Quality communication between providers in a critical care setting is essential for prompt, accurate, and coordinated care in a dynamic environment. The critical care medicine team with advance practice providers (APPs) in the medical intensive care unit (MICU) of an academic tertiary care hospital in the Midwest had grown in patient census and added resident physicians. With the growth of patient census and team members, increased complexity in transfer of patient information at handoff was noted. The patient handoff process has a significant impact on patients because poor communication during handoff has been found to be the leading cause of omissions, errors, and adverse events.[1-4] Although it is difficult to isolate the path of these events and directly attribute them to provider communication, previous research has demonstrated a clear relationship between communication and medical errors.[4]

The definition of "handoff" in the literature is poorly defined because there is not typically a process standard.[5] Although handoff consistency has been found to increase efficiency

From the Critical Care Medicine Independent Multidisciplinary Program (L.A.W., K.K.S., V.L., C.O., E.C., G.S., D.S.), and Quantitative Health Sciences: Division of Clinical Trials and Biostatistics (A.C.H.), Mayo Clinic, Rochester, MN; and Cardiovascular and Thoracic Surgery, Mercy Heart Hospital, St. Louis, MO (K.H.M.).

and decrease error, compliance to a routine can be difficult.[6] It is important to identify team behaviors during patient handoffs when designing a new structure for the handoff process.[1] Provider participation can be a barrier to changes in the implementation of a new format of handoffs.[7] One way to get more participation from providers is to explain the importance of this behavior change.[7]

The objective of the study was to decrease interruptions in handoff, increase compliance with a structured verbal handoff format, and increase compliance with handoff template completion in electronic medical records without increasing the length of handoff time.

PATIENTS AND METHODS

Study Design

A team of APPs conducted a quality improvement (QI) project at Mayo Clinic in Rochester, Minnesota, from April 1, 2019, to February 1, 2020. This study was exempt from Mayo Clinic Institutional Review Board approval. The key stakeholders included APPs (nurse practitioners and physician assistants) in the MICU and postgraduate year-2 resident physicians on the critical care team. The stakeholders were given a survey that covered topics such as previous training to specific handoff formats, environment in which handoff occurs, professionalism, as well as quality and accuracy of handoff given by their colleagues. This survey included some open-ended questions to best identify issues and find potential solutions (Supplemental Material, available online at http://www.mcpiqojournal.org). Several gaps were identified for improvement in the current handoff process. These included information omission, ambiguity, lack of formal presentation, interruptions during handoff, and efficiency. All stakeholders received disclosure information about project details, and they were offered an opportunity to opt out of the study, although none did.

Measure

For preintervention data collection, the members of the QI team observed and audio recorded handoffs between providers during both morning and evening handoffs. Initial data collection included the number and type of interruptions and acknowledgment of each of the 5 components of the illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver (IPASS) handoff tool. During the same shifts, the providers were asked to report compliance with patient handoff in the electronic medical record (EMR). Lastly, the length of time of handoffs was recorded.

After implementation of the new handoff format, 3 months were spent performing plan-do-study-act cycles to optimize the new handoff process. Postintervention data were not collected for several months to allow for normalization of the new process. The postintervention data collection process mirrored the preintervention data collection process. However, all items (interruptions, duration, and IPASS components) were tabulated during observation, and audio recordings were reviewed by a second QI team member for accuracy after live tabulation to account for interoperator differences.

Intervention

Based on initial data, the survey results, and the gap analysis, it was determined that a pre-existing handoff tool, IPASS, best aligned with practice to address the gap.[8] The IPASS mnemonic is defined by I - illness severity, P - patient summary, A - action list, S - situational awareness and contingency planning, and S - synthesis by receiver. This handoff tool has been demonstrated to help providers in other studies prevent adverse patient events.[8,9] Given that IPASS included the identified gaps and was a pre-existing tool that had clinical relevance, it was the chosen intervention tool. The preintervention data handoff recordings were reviewed a second time to identify the mention of IPASS items such as patient summary, plan for patient, ongoing assessment, follow-up needs, contingency plan, and synthesis by the receiver. Each recording was reviewed for counts of items by at least 2 QI team members.

RESULTS

Preintervention Data

Handoff Components. Twenty-five handoffs (11 at the end of the day shift at 1800 and

Mayo Clin Proc Inn Qual Out ■ August 2023;7(4):301-308 ■ https://doi.org/10.1016/j.mayocpiqo.2023.05.006
www.mcpiqojournal.org

14 at the beginning of the day shift at 0600) were observed and audio recorded. The original handoff format yielded consistency with some of the IPASS components, but others were rarely mentioned or addressed at all. Components such as patient summary (mentioned in 73% of the handoffs observed), plan (66%), and ongoing assessment (66%) were frequently mentioned per patient. Less frequently mentioned aspects of the IPASS format included follow-up needs (53%). However, situational awareness/contingency planning (25%) and synthesis by receiver (6.3%) were rarely mentioned/addressed per patient (Figure 1). The mean (SD) length of preintervention handoffs was 22.3 (7.5) minutes, with 2.2 minutes on average per patient. An average was reported to capture the variety of different patients, patient complexity, severity of illness, and number of patients reported in the handoffs.

Interruptions. A Pareto chart (Figure 2) was used to determine where to focus the intervention to reduce interruptions during handoff. Side discussions, pagers beeping, off-topic discussions, and phone calls accounted for 80% of the interruptions. Of these interruptions, side conversations, pages, phone calls, and off-topic conversations were deemed as dependent variables because they could be influenced by the stakeholders. Independent variables included those that were uninfluenced by the stakeholders, such as staff entering the room, emergency or overhead pages, decompensating patients, or a new admission (these accounted for the remaining 20% of interruptions).

EMR Utilization. Electronic medical record handoffs were updated for 54.3% of patients, with comparable percentages between daytime and nighttime shifts (59% vs 54%, respectively).

Intervention. The IPASS tool was chosen because it was already used at the institution for the resident physician learners and training materials were readily available. Additionally, as part of this intervention, there was an added expectation to update electronic handoffs in the EMR at least once during each shift to create an ongoing written handoff as a supplement to verbal handoffs. Education was provided to all APPs in the MICU about the handoff process. To verify the efficacy of education, a 6-question quiz was provided to all APPs before and after their education to ensure knowledge expansion (average score of 74.25% on pretest vs 86.4% on posttest). The residents were reminded of this format but did not receive formal training because they had already received education on this format at the start of their residency.

To cut down on side discussions and off-topic discussions, a memo on professionalism was provided. Providers were encouraged to remind one another about side conversations and interruptions for several weeks after initial implementation of the new handoff format. To reduce pager interruptions and phone calls, a communication was sent to all nursing staff at the unit about the best uses of pagers. Nurses were also reminded to strictly limit paging providers around the time of handoff to urgent communications to only between 0600-0630 and 1800-1830 to avoid further interruptions.

Several plan-do-study-act cycles were conducted during the intervention phase to optimize the process as outlined in Table 1. This

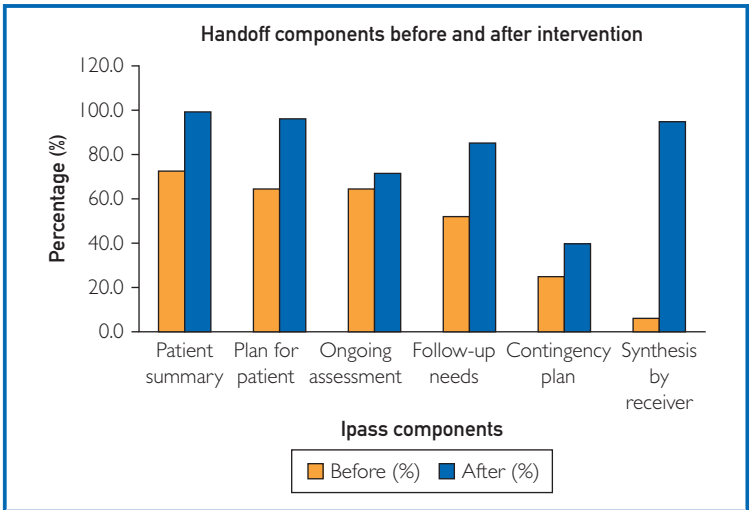

FIGURE 1. Handoff components before and after the implementation of the new handoff format. These components were recorded before and after the education and promotion of the selected handoff tool, illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver.

TABLE 1. Plan-Do-Study-Act Cycles After Intervention[a]

Cycle	Dates	Evaluation methods	Lessons learned	Changes to intervention
1	August 9, 2019-August 11, 2019	Observation by QI team members	Providers were unclear on what to do	- Email to team reminding them of the intervention kick off - QI team members reminded all providers at the beginning of handoff that IPASS was to be used
2	August 12, 2019-August 20, 2019	Two-question survey[b] QI team members	- Handoff format was difficult to adhere to - Lack of synthesis aspect of handoff - Seemed long to providers	- Added visual aids in the room where handoff occurs - Email to team reminding them about the intervention
3	August 21, 2019-September 16, 2019	Two-question survey[b] Observed handoffs to evaluate interruptions and respond to questions raised by providers in previous PDSA cycles	- More comfort with the process - Difficult to bring new residents into the existing process - Providers starting to have buy in to the process - Felt it was still too long	Recorded the length of handoffs and provided data on how well the steps were being adhered to and how different the average handoff length per patient was from before until now
4	September 17, 2019-October 1, 2019	Two-question survey[b] Spot data observations by QI team member	- Synthesis was too long and included too much information - EMR handoff aspect not being filled out consistently - The severity of illness was not consistently reported during handoff	- Provided guidance on the "synthesis" step to attempt to cut down on the length of handoff - Provided statistics to stakeholders on adherence to the IPASS format and highlighted areas that could be improved (eg, illness severity, EMR handoff updates)
5	October 2, 2019-October 16, 2019	Two-question survey[b] Spot data observations by QI team members	Synthesis not clear, too much chatter during handoff	Reminded teams about the expectations for synthesis (Table 3)

[a]IPASS, illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver; EMR, electronic medical record; PDSA, plan-do-study-act; QI, quality improvement.
[b]Two questions asked: "what went well with the new handoff process?" and "what can be improved with the new handoff process?"

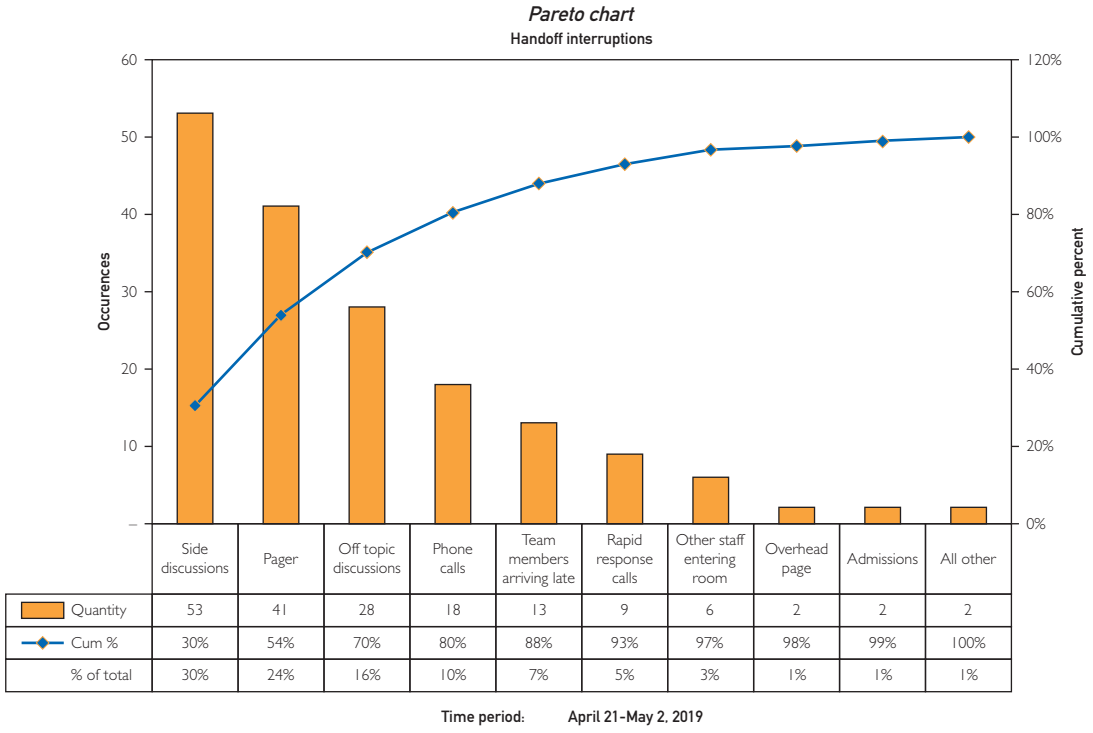

FIGURE 2. Pareto chart for handoff interruptions. This chart identifies the most influential types of interruptions during handoff based on observational data collection.

TABLE 2. Plan-Do-Study-Act Cycles 4 and 5 Spot Data Compared With Preintervention Data

IPASS aspect	Preintervention	Cycle 4 spot check	Cycle 5 spot check
Illness severity/ patient acuity	42.2%	74%	81%
Patient summary	72.3%	99%	100%
Action list/follow-up needs	52%	96%	100%
Situational awareness/ contingency planning	25%	92%	97%
Synthesis by receiver	6.3%	92%	93%
Electronic handoff updated on EMR	54.3%	70%	76%

EMR, electronic medical record; IPASS, illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver.

feedback was derived from a 2-question survey sent electronically to the stakeholders. Spot checks were performed during the intervention phase to track progress for improvement based on plan-do-study -act cycles (Table 2).

Postintervention Data

Handoff Components. Preintervention data on handoff components are compared with postintervention data in Figure 1. The inclusion of every handoff category improved after implementation of the new IPASS format. The mean overall length of handoff was slightly longer in the postintervention timeframe than in the preintervention timeframe (25.5 minutes [5.9] vs 22.3 minutes [7.5], respectively; P=.153).

Interruptions. Preintervention data on interruptions are compared with postintervention data in Figure 3. All categories dependent on the team had reduced with the use of the new

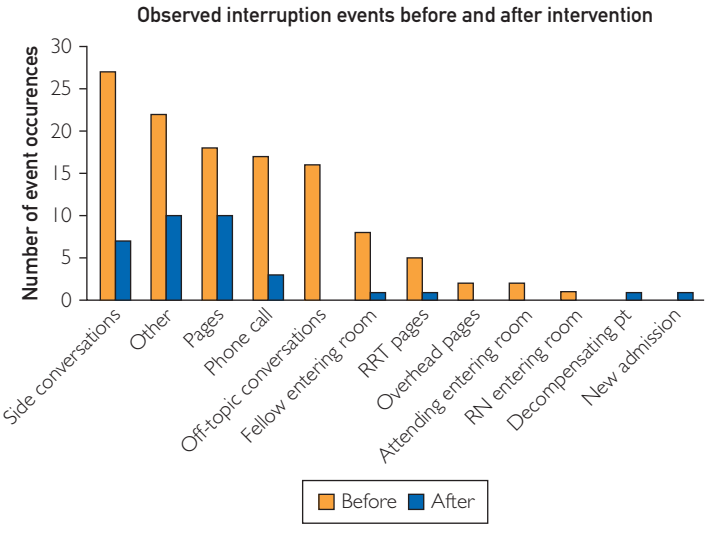

FIGURE 3. Events of interruptions during the preintervention phase compared with those during the postintervention phase. After the implementation of the handoff tool, the number of interruptions during handoff improved. Pt, patient; RN, registered nurse; RRT, rapid response team.

handoff format (side conversations, pages, phone calls, and off-topic conversations) because these were related to the quality of communication and attention from MICU staff. Independent categories, such as staff entering the room, emergency or overhead pages, decompensating patient, or new admissions, were determined to be independent because they were beyond the control of the IPASS process at the time of the handoffs.

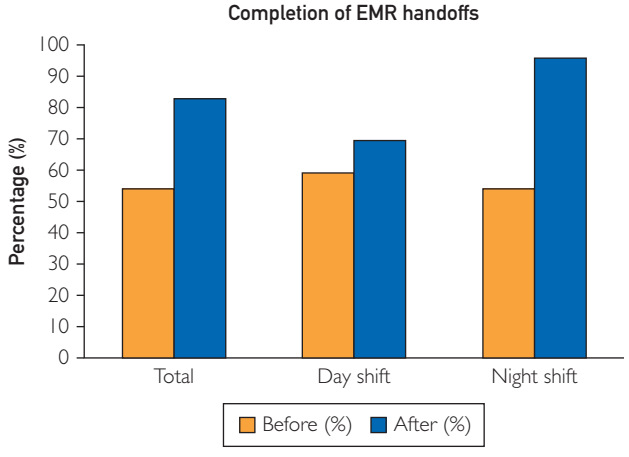

FIGURE 4. Preintervention vs postintervention data for completion of the electronic medical record handoff tool. The electronic medical record handoff tool is formatted in the illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver format and acts as a guide during handoffs between providers. EMR, electronic medical record.

EMR Utilization. Previously, there was inconsistent use of the EMR handoff tool. After the implementation of the new handoff format, the use of the EMR handoff tool increased to 82.9% during the postintervention timeframe (Figure 4). The use of this tool increased by 28.6%, with as large as a 41.5% increase in use by night shift providers specifically.

DISCUSSION

The leading cause of medical errors occurs during patient handoffs.[2,8] These medical errors have been identified as sentinel events that, as defined by the Joint Commission, are patient safety events that result in death, permanent harm, or severe harm.[10] This QI project aimed to decrease interruptions and increase compliance by addressing the critical components of patients' care plans during verbal and written handoffs. Through implementation of a standardized handoff format adopted from the IPASS structure, the aim was achieved.

Mayo Clin Proc Inn Qual Out ■ August 2023;7(4):301-308 ■ https://doi.org/10.1016/j.mayocpiqo.2023.05.006
www.mcpiqojournal.org

All handoff components were mentioned more often after the implementation of the new handoff format. The largest impact was noted in synthesis by receiver, which was related to a reduction in dependent interruptions because the receiver needed to focus more closely on the colleague speaking and was less likely to engage in side conversations or off-topic conversations during handoff. The number of pages and phone calls during handoff was reduced after sharing communication about handoff timeframes with nursing staff. As expected, the independent interruptions did not show a significant change from before to after the intervention.

The mention of other components, such as patient summary, plan for patient, and follow-up needs, showed some of the largest improvements with the new handoff format. Although the postintervention duration of handoff was longer than the preintervention duration, the difference was not large relative to variability and was not meaningful clinically. Overall, compliance with the usage of the EMR handoff tool was improved and believed to have supplemented the quality of verbal handoffs because it provided an outline of information to report in the IPASS format and a reference point for the oncoming shift.

Overall, based on our study, critical care provider teams could benefit from following a structured handoff format to limit medical errors and omission of information. We recommend using a handoff tool, such as IPASS, to help providers include pertinent information during handoffs. However, it is important to review the institution's needs and environment before selecting a handoff tool. For this study, the IPASS tool fit the needs of the patient population and the workflow of the unit best. Additionally, with any update that involves behavior change, strategies, including thorough explanations for the importance of changes and stakeholder buy-in, are pivotal to the success of the new change.

LIMITATIONS

The duration of handoff could be impacted by other factors, including patient acuity and number of new admissions during the prior shift. These factors were not assessed or compared between the preintervention and postintervention groups. Power and sample size analyses were not conducted prior to this QI study. Lastly, the presence of an in-person observer could have affected the behavior of the providers; however, because the observer was present during both preintervention and postintervention data collection, the potential effect is considered negligible.

CONCLUSION

The aims of this QI project, which were to decrease interruptions in handoff, increase compliance with a verbal structured handoff format, and increase compliance with EMR handoff completion, were met through the implementation of a standardized handoff format adopted from the IPASS structure. This standardized handoff tool improved communication during provider handoffs as more pertinent details were mentioned and there were fewer distracting events during handoff. The overall handoff time increased with the IPASS format by 3 minutes; however, the increase was not clinically significant. Based on this study, we recommend that providers follow a standardized handoff format to avoid interruptions in handoff, which could lead to medical errors in patient care.

POTENTIAL COMPETING INTERESTS

The authors report no competing interests.

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mayoclinicproceedings.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **APP,** advance practice provider; **EMR,** electronic medical record; **IPASS,** illness severity, patient summary, action list, situational awareness and contingency plans, and synthesis by receiver; **MICU,** medical intensive care unit; **QI,** quality improvement

Grant Support: No funding was provided for this QI project or publication.

Correspondence: Address to Lindsey A. Wallace, DScPAS, PA-C, Critical Care Medicine Independent Multidisciplinary Program, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (Wallace.lindsey@mayo.edu).

ORCID
Lindsey A. Wallace: https://orcid.org/0000-0001-7264-9704

REFERENCES

1. Manser T, Foster S, Flin R, Patey R. Team communication during patient handover from the operating room: more than facts and figures. *Human Factors*. 2013;55(1):138-156. https://doi.org/10.1177/0018720812451594.
2. von Dossow V, Zwissler B. Recommendations of the German Association of Anesthesiology and Intensive Care Medicine (DGAI) on structured patient handover in the perioperative setting. *Anaesthesist*. 2016;65(suppl 1):S1-S4. https://doi.org/10.1007/s00101-016-0237-5.
3. Nanchal R, Aebly B, Graves G, et al. Controlled trial to improve resident sign-out in a medical intensive care unit. *BMJ Qual Saf*. 2017;26(12):987-992. https://doi.org/10.1136/bmjqs-2017-006657.
4. Müller M, Jürgens J, Redaèlli M, Klingberg K, Hautz WE, Stock S. Impact of the communication and patient hand-off tool SBAR on patient safety: a systematic review. *BMJ Open*. 2018;8(8):e022202. https://doi.org/10.1136/bmjopen-2018-022202.
5. Cohen MD, Hilligoss PB. The published literature on handoffs in hospitals: deficiencies identified in an extensive review. *Qual Saf Health Care*. 2010;19(6):493-497. https://doi.org/10.1136/qshc.2009.033480.
6. Tufts LM, Damron CL, Flesher SL. Addition of CORES to the I-PASS handoff: a resident-led quality improvement study. *Pediatr Qual Saf*. 2020;5(1):e251. https://doi.org/10.1097/pq9.0000000000000251.
7. Horwitz LI, Moin T, Krumholz HM, Wang L, Bradley EH. Consequences of inadequate sign-out for patient care. *Arch Intern Med*. 2008;168(16):1755-1760. https://doi.org/10.1001/archinte.168.16.1755.
8. Starmer AJ, Spector ND, Srivastava R, et al. Changes in medical errors after implementation of a handoff program. *N Engl J Med*. 2014;371(19):1803-1812. https://doi.org/10.1056/NEJMsa1405556.
9. Sonoda K, Nakaishi L, Salter C. Standardizing sign-out with I-PASS handoff in family medicine Residency. *PRiMER*. 2021;5(1):8. https://doi.org/10.22454/PRiMER.2021.678175.
10. Sentinel event data 2022 annual review. The Joint Commission. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/03162023_sentinel-event-_annual-review_final.pdf. Accessed April 15, 2023.