Critical Care Explorations

OPEN

Impact of Fellows-as-Teachers Workshops on Teaching Rounds: An Observational Study in an ICU

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Objective: During training, fellows serve as teachers and role models for junior colleagues. Fellows-as-teachers curricula may support these roles, but little is known about their effectiveness and durability. We sought to measure the long-term effects on ICU rounds after administering fellows-as-teachers workshops.

Design: Prospective pre-/postintervention observational study of ICU rounds.

Setting: Tertiary-care medical ICU with both pulmonary critical care and critical care medicine fellowships.

Subjects: ICU teaching teams.

Interventions: Fellows attended immersive workshops on promoting clinical reasoning, managing the learning environment, teaching bedside skills, and developing situational awareness on ICU rounds. After the workshops, faculty physicians were encouraged to have fellows routinely lead afternoon rounds.

Measurements and Main Results: We gathered data from direct observations of ICU rounding activities, residents' evaluations of rounds from surveys, and faculty physicians' written comments on fellows' performance in the ICU from end-of-rotation evaluations. Data were analyzed using descriptive statistics, nonparametric comparative tests, and chi-square tests for categorical data. A total of 61 ICU rounding sessions were observed with 501 discrete provider-patient interactions. Survey responses were collected from a total of 53 residents preintervention and 34 residents postintervention. We reviewed 72 open-ended faculty comments on fellows' end-of-rotation evaluations, with 22 occurring postintervention. During the postintervention period, fellows were significantly more likely to make clinical decisions, explain their reasoning, provide teaching points, and ask questions on rounds. Additionally, we observed significantly higher quality written feedback on end-of-rotation evaluations by faculty physicians. However, residents generally harbored neutral or negative perceptions about the educational value of fellow-led rounds postintervention.

Conclusions: Fellows' contributions to patient care and teaching on ICU rounds increased for several months after our fellows-as-teachers workshops. Despite limitations and contamination in our design, our data suggest that similarly designed curricula may promote fellow engagement, possibly at the expense of residents' education.

Key Words: critical care; education, medical, graduate; intensive care units; teacher training; teaching methods; teaching rounds

Fundamentally, clinical fellowships should develop fellows into effective clinicians, leaders, and communicators (1). Although accrediting bodies do not require fellowship programs to train fellows as teachers (2), fellows often assume formal and informal educational roles during their training. Furthermore, fellows performing at aspirational levels of clinical competence should teach and role model clinical skills (1).

Fellows-as-teachers curricula may have extensive benefits despite barriers to their implementation, such as time and competing educational priorities (3). First, irrespective of post-fellowship career plans, fellows will likely be required to educate peers, patients, families, and other healthcare professionals (4). Additionally, teaching regularly may foster fellows' professional growth by deepening their understanding of disease, improving bedside skills, and promoting mindfulness in practice (5). Finally, because of the near-peer effect, fellows might more effectively relate to residents due to cognitive and social congruence (6–8).

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Crit Care Expl 2020; 2:e0235

DOI: 10.1097/CCE.0000000000000235

Despite these potential benefits of "postgraduate-as-teacher" curricula, data on their effectiveness have significant limitations. Though these curricula have positive effects on both learners and teachers (9–13), few demonstrate the impact at the highest level of Kirkpatrick pyramid of programmatic assessment (4, 11). In the Kirkpatrick model, high-impact curricula not only influence participants' attitudes but also result in observable changes in the broader learning environment and/or long-term effects on organizational practice (8, 11). Contrarily, most postgraduates-as-teachers programs have evaluated intermediary endpoints based on learners' feedback or observations in nonclinical settings (9–12). Furthermore, program directors and experts in postgraduate education may worry about the feasibility, scalability, and reproducibility of such curricula (3, 11).

Given these considerations, we sought to develop a series of immersive, simulation-based fellows-as-teachers workshops targeted toward teaching on ICU rounds due to the dual purposes of rounds: providing clinical care and promoting trainee education. We hypothesized that our workshops would improve fellows' engagement, teaching activities, and general clinical leadership skills on ICU rounds. To assess the impact of the workshops on the broader learning environment, we also explored residents' perceptions of rounding activities. Finally, as an exploratory aim, we sought to measure whether the quality of written feedback provided by faculty physicians on fellows' end-of-rotation evaluations would improve on the presumption that faculty physicians would have more opportunities to observe fellows in the clinical learning environment.

MATERIALS AND METHODS

Study Design, Population, and Setting

We conducted a prospective pre-/postintervention observational study of a fellows-as-teachers curriculum from May 2018 to February 2020. We gathered data from the observations of rounds at our program's major tertiary-care center, a 536-bed hospital in a Midwest suburban setting. This study was reviewed by the Institutional Review Board (IRB) and was deemed minimal risk, thereby qualifying as a registered study that did not require full IRB oversight.

In our medical ICU, two teams round separately and include a faculty physician, a pulmonary-critical care or critical care fellow, residents from various disciplines, advanced practice providers, and medical students. Fellows alternate call days with the on-call fellow triaging ICU admissions and performing emergency procedures.

During the study period, approximately 10 faculty physicians routinely supervised ICU teams, and we had approximately 14–15 fellows between our pulmonary-critical care and critical care fellowships.

Preintervention Rounding Structure

Prior to the intervention, ICU teams routinely rounded twice daily with rounding practices left to the faculty physician's discretion. However, morning rounds typically were led by faculty intensivists. Afternoon rounds were generally used to staff daytime patient admissions, communicate with families, develop contingency plans for overnight care, and supplement teaching topics from morning rounds.

Curricular Intervention

Fellows participated in a series of three interactive workshops intended to enhance their bedside teaching skills, assessment of learners' reasoning, and situational awareness on rounds. Each workshop spanned approximately 2 hours and consisted of didactics, case studies, and role playing in simulations, some of which included standardized patients and other actors. Full details of the workshops, including their setting, objectives, and instructional methods, are shown in **Supplementary Appendix 1** (http://links.lww.com/CCX/A372). As the educational intervention spanned 2 academic years but funding was only dedicated for 1 year, newly on-boarded fellows received an intensive 2-hour workshop that combined the elements of all three original workshops (Supplementary Appendix 1, http://links.lww.com/CCX/A372). We did not formally assess fellows' knowledge, skills, or attitudes in clinical teaching prior to or after the workshops.

Postintervention Rounding Structure

After all fellows had completed the core workshops, faculty physicians were provided baseline data from preintervention observations of rounds (as described in the "Data Collection and Sources section") to highlight the state of fellow engagement on rounds. They were encouraged in faculty meetings and by two brief email reminders to continue to use their own rounding preferences and practices on morning rounds but to allow fellows to lead afternoon rounds routinely. Although we did not enforce adherence to fellow-led afternoon rounds, faculty physicians uniformly agreed to support the intervention. Furthermore, we did not require any specific practices for fellow-led afternoon rounds.

Data Collection and Sources

Observations of Rounds. Research personnel responsible for the data collection were trained by the primary investigator (PI) on three separate occasions when the PI was not serving as the ICU attending on service. During these pilot observations of rounds, the PI and research personnel (henceforth "trained observers") refined the data collection tools in real time, and the observers were trained in defining rounding activities and entering data. To ensure the fidelity and validity of data entry, we performed a preliminary analysis of interobserver reliability, which the PI reviewed and deemed satisfactory.

These trained observers then shadowed ICU teams on both morning and afternoon rounds and recorded observations directly into REDCap (Vanderbilt University, Nashville, TN) using digital checklists on tablets. Observers captured both explicit teaching behaviors on rounds and more general markers of engagement and role modeling (**Supplementary Appendix 2**, http://links.lww.com/CCX/A373) and they recorded other information about rounds (e.g., time spent per patient and number of learners on round).

Preintervention observations occurred between June 2018 and August 2018. Postintervention data were collected between November 2019 and February 2020, which allowed for at least 6 months to lapse between the most recent faculty reminder and at least 3 months from the most recent workshop for fellows. We scheduled observations to obtain a relatively equal number of observation periods stratified by pre-/postintervention

and morning versus afternoon rounds and to ensure the maximal number of faculty-fellow pairings. Due to the anonymous nature of observations, we did not track these pairings and could not reliably reidentify these pairings at the study's conclusion.

Residents' Attitudes Toward Rounds. We also captured residents' perceptions of rounds on 5-point Likert scales using online surveys hosted on Qualtrics XM (SAP, Walldorf, Germany). We sent e-mail reminders to complete surveys within 1 week of residents' completion of the ICU rotation. Pre- and postintervention surveys contained many identical items, but additional questions were added to the postintervention survey to delineate how residents perceived fellow-led afternoon rounds. A full copy of both surveys is included in **Supplementary Appendix 3** (http://links.lww.com/CCX/A374). Surveys were collected from May 2018 to March 2019 in the preintervention group and from August 2019 to February 2020 in the postintervention group. The 5-point scales were subsequently dichotomized to reflect favorable (1–2) versus unfavorable (3–5) attitudes toward rounds.

Attending Physicians' Evaluations of Fellows. Finally, we gathered faculty physicians' assessments of fellows from the open-ended comments section from our standard end-of-rotation evaluations of fellows. Faculties were not provided with any additional training on writing feedback in the postintervention period, and we did not institute any change in our feedback collection processes. All open-ended comments from end-of-rotation evaluations were deidentified and decontextualized. Two reviewers independently and blindly rated the quality of written comments in three domains with each domain scored on a 5-point Likert scale (**Supplementary Appendix 4**, http://links.lww.com/CCX/A375). Domains were identified from the literature on workplace-based formative assessments (14). After data collection, Likert scales were dichotomized to reflect low (1–2) versus high (3–5) quality feedback.

Reliability of Observations

A total of five trained observers were involved in the study, with three observers partaking in the preintervention phase and two different observers capturing the data postintervention due to research staff turnover. To establish interobserver reliability, observers were paired for the first eight rounding sessions and independently recorded their observations of fellows' activities during 63 total patient-provider interactions. As new research staff joined the project, they were trained by the original three observers. For the paired observations of fellows' activities, Cohen kappa ranged from 0.245 to 1 for 12 variables and could not be computed on four variables due to perfect or near-perfect agreement. The average Cohen kappa was 0.52. Due to limitations in the research staff availability and budget, interobserver reliability analyses were only performed during the preintervention period with the original observers and PI.

Outcomes of Interest

The primary outcome of interest was the frequency of fellows' teaching activities pre- and postintervention. Secondary outcomes included fellows' other activities on rounds, residents' perceptions of the educational value of rounds, and the quality of faculty physician written feedback on fellows' end-of-rotation evaluations, duration of rounds per patient, and level of involvement of nurses, patients, and families during rounding activities.

Statistical Analysis

We performed all statistical analyses using XLSTAT (Addinsoft, New York, NY) in Microsoft Excel (Microsoft, Redmond, WA). In analyzing rounding demographics, we compared pre- and postintervention characteristics using Fisher exact test for categorical comparisons and Mann-Whitney *U* test for ordinal variables.

For fellows' activities on rounds, we first compared pre- versus postintervention data using chi-square tests for categorical variables and Mann-Whitney *U* test for ordinal variables. To determine if fellow-led rounds (which occurred in the afternoon) explained an increase in fellows' activities on rounds, we then compared morning against afternoon rounds in the postintervention phase and morning rounds preintervention versus postintervention. We ran analyses using all patient-provider interactions (akin to an intention-to-treat model) and subsequently only for patient-provider interactions in which the fellow was physically present.

In analyzing the residents' perceptions of rounds, we performed chi-square tests comparing dichotomized survey responses before and after the intervention. Furthermore, postintervention, we evaluated differences in the residents' perceptions of morning rounds against afternoon fellow-led rounds using paired Wilcoxon signed rank test. We evaluated correlations of residents' perceptions and attitudes with Spearman rho. Finally, we used chi-square tests to compare the quality of written feedback pre- versus postintervention across the three domains.

RESULTS

During the study period, 501 distinct patient-provider interactions were observed over 61 rounding sessions: 29 rounding sessions occurred preintervention and 32 postintervention. **Table 1** provides general characteristics for rounding sessions. On rounds during the postintervention period, fellows were present at the start of patient-provider interactions more often (84.5% vs 76.5% preintervention, chi-square test, $p < 0.05$). Thus, to compare more fairly the differences in variables that estimated fellows' engagement on rounds, we excluded the 97 patient-provider interactions in which the fellow was absent and only analyzed the remaining 404 interactions.

Comparisons of Fellow Engagement on Rounds

In the postintervention period, fellows were significantly more engaged on rounds in all domains of clinical care and teaching, as shown in **Table 2** and **Supplementary Table 1** (http://links.lww.com/CCX/A376). Most notably, the proportion of patient-provider interactions in which the fellow made teaching points was higher in the postintervention period (62.3% postintervention vs 15.1% preintervention, chi-square test, $p < 0.0001$). Similarly, they explained their reasoning for decisions in a larger proportion of patient-provider encounters (56.4% postintervention vs 26.3% preintervention, chi-square test, $p < 0.01$). Across most variables, we also observed an increase in the absolute number of fellows'

TABLE 1. General Characteristics of Rounding Sessions

	Number of Sessions Observed (*n*)	Attending Physician Present (*n* [%])	Fellow Present at Start of Rounds (*n* [%])	Additional Team Members on Rounds (Mean, SD)	Preround Huddle Performed (*n* [%])	Time Spent per Patient (Median [IQR])
Morning rounds						
Preintervention	13	13 (100)	11 (85)	5.9, 1.8	7 (54)	12 (6–17)
Postintervention	16	16 (100)	15 (94)	6.0, 1.1	5 (31)	9 (6–14)
Afternoon rounds						
Preintervention	18	17 (94)	12 (67)	4.8, 2.0	7 (38)	4 (3–13)
Postintervention	14	13 (93)	14 (100)[a]	6.6, 1.9	3 (21)	5 (2–12)[b]
Total	61	59 (97)	52 (85)	5.7, 1.8	22 (36)	

[a]$p < 0.05$ in Fisher exact test, two-tailed, pre- vs postintervention.
[b]$p < 0.05$ in Mann-Whitney *U* test, pre- vs postintervention.

TABLE 2. Changes in Fellows' Activities, Pre- Versus Postintervention

Variable	Frequency, Preintervention (%)	Frequency, Postintervention (%)	*p*, Chi-Square Test
All 503 patient-provider interactions observed			
Fellow present at start of patient-provider interaction	76.5	84.5	< 0.05
Four hundred and four patient-provider interactions observed in which fellow was present			
Fellow was positioned to allow entire team to see him/her	89.2	96.3	< 0.01
Bedside nurse invited to participate[a]	9.7	80.2	< 0.0001
Fellow made decision	18.8	33.4	< 0.01
Fellow explained reasoning	26.3	56.4	< 0.01
Fellows asked provocative question of attending	12.9	34.9	< 0.0001
Fellow gave a teaching point	15.1	62.3	< 0.0001
Fellow delegated a decision	1.6	17.9	< 0.0001
Fellow asked team member a question	8.6	19.3	< 0.01
Fellow asked team member for his/her reasoning	2.2	11.0	< 0.0001
Fellow exchanged key information with the nurse	11.3	23.9	< 0.01
Fellow exchanged key information with patient, family, or surrogate	6.4	24.8	< 0.0001
Fellow made teaching point at the bedside (as opposed to hall)	4.3	17.0	< 0.0001
Fellow demonstrated a bedside skill	15.1	13.3	NS

NS = not significant.
[a]$p < 0.05$.

activities (Mann-Whitney *U* tests; Supplementary Table 1, http://links.lww.com/CCX/A376).

Although afternoon rounds were designated as fellow-led, most markers of fellow engagement and teaching were not significantly different between the morning and afternoon rounds in the postintervention period (**Supplementary Table 2**, http://links.lww.com/CCX/A377). Most importantly, fellows were significantly more likely to exhibit behaviors of engagement and teaching in the postintervention phase even on attending-led morning rounds (**Table 3**). These behaviors included more frequently providing general teaching points (60.0% postintervention vs 10.5% preintervention, $p < 0.0001$, chi-square test).

Residents' Perceptions of Rounds

We collected surveys from 53 residents preintervention and 34 residents postintervention with the response rates of 48.6% and 47.0%, respectively. Between the groups, there were no differences in the percentage of residents in their first year of postgraduate training or the percentage of residents who had previously rotated in our ICU (data not shown, chi-square tests). As shown in **Table 4**, residents' satisfaction with rounds significantly declined postintervention. Similarly, residents felt that their education was less prioritized and that rounds were less likely to enhance their professional development postintervention (Table 4). In the postintervention period, residents favored attending-led morning rounds for their

TABLE 3. Changes in Fellows' Activities on AM Rounds, Pre- Versus Postintervention

Variable	Frequency, Preintervention (%)	Frequency, Postintervention (%)	*p*, Chi-Square Test
Two hundred sixty-four patient-provider interactions observed on AM rounds in which fellow was present			
Fellow was positioned to allow entire team to see them	70.1	80.7	NS
Bedside nurse invited to participate[a]	10.5	83.3	< 0.0001
Fellow made decision	8.8	21.3	< 0.05
Fellow explained reasoning	17.5	52.0	< 0.0001
Fellows asked provocative question of attending	8.8	26.0	< 0.01
Fellow gave a teaching point	10.5	60.0	< 0.0001
Fellow delegated a decision	0.9	13.3	< 0.0001
Fellow asked team member a question	1.8	20.7	< 0.0001
Fellow asked team member for their reasoning	0.9	8.0	< 0.0001
Fellow exchanged key information with the nurse	3.5	25.3	< 0.001
Fellow exchanged key information with patient, family, or surrogate	4.4	17.3	< 0.01
Fellow made teaching point at the bedside (as opposed to hall)	3.5	6.0	NS
Fellow demonstrated a bedside skill	14.9	9.3	NS

NS = not significant.
[a]$p < 0.05$.

TABLE 4. Residents' Perceptions of Rounds, Pre- Versus Postintervention

Variable	Preintervention (% Residents Agreeing)	Postintervention (% Residents Agreeing)	*p*, Chi-Square Test
Overall satisfied with rounds	90.7	60.9	< 0.001
Resident education was a priority	61.1	36.2	< 0.01
Teaching was at an appropriate level for residents	83.3	76.8	NS
Rounds enhanced professional development	83.3	56.5	< 0.01

NS = not significant.

own professional development and the appropriateness of teaching on rounds (data not shown, $p < 0.05$ in Wilcoxon signed rank sum and chi-square tests), and residents did not perceive any increase in the fellows' level of investment in their education (data not shown, chi-square test). However, fellows' level of investment was modestly correlated with fellows' effectiveness as teachers on rounds relative to their attending physician counterparts (Spearman rho = 0.571; $p < 0.0001$) in the postintervention period.

Quality of Faculty's Written Evaluations of Fellows

Finally, we reviewed 72 open-ended comments written by faculty on fellows' end-of-rotations evaluations of which 50 were written preintervention and 22 written postintervention. We observed higher quality written feedback on end-of-rotation evaluations by faculty physicians with feedback more frequently based on fellows' behaviors rather than general traits (79.5% high-quality postintervention vs 48.0% preintervention, chi-square test, $p < 0.001$), more often targeted toward fellows' decisions and actions (77.2% high-quality postintervention vs 44.9% preintervention, chi-square test, $p < 0.001$), and more often containing a specific plan for action (41.0% postintervention vs 21.4% preintervention, chi-square test, $p < 0.05$). The interobserver reliability between the two reviewers' ratings was modest when using the 5-point Likert scale (Cohen's kappa = 0.449) but exceptional with dichotomized ratings (kappa = 0.802).

DISCUSSION

In this observational study, the combination of a fellows-as-teachers workshop series and encouragement of fellow-led rounds enhanced fellow engagement on ICU rounds. After fellows completed workshops totaling 2–6 hours of instructional time, we observed a significant increase in fellows' clinical- and education-oriented behaviors on rounds for several months beyond the curricular intervention. This increased engagement carried over into faculty-led morning ICU rounds, and it may have also allowed faculty to observe directly fellows more often, as evidenced by the improved quality of faculty physicians' written formative feedback on fellows' end-of-rotation evaluations. On the other hand,

residents harbored generally unfavorable perceptions about the educational value of fellow-led rounds.

To our knowledge, we present the first empirical evidence that fellows-as-teachers workshops can affect the clinical training environment on ICU rounds by cataloging clinical teaching activities. Furthermore, unlike most trainees-as-teachers curricula that have used intermediary markers of effectiveness, such as learners' satisfaction, or objective structured teaching examinations (9, 11, 12), we have observed change in fellows' behaviors and the organizational practice of our ICU, thereby reaching higher levels of the Kirkpatrick model of programmatic evaluation (8, 11). Our findings suggest a positive return on investment for fellows-as-teachers curricula and provide supportive evidence for these curricula in critical care training programs (4). Empowering fellows with teaching and leadership skills and a leadership role on ICU rounds also may generate more opportunities for clinical faculty to observe fellows' performance and accordingly to provide meaningful feedback.

Our findings need to be interpreted with some caution, as our fellows-as-teachers workshops narrowly focused on teaching and leadership skills specific to the ICU, such as managing team dynamics and teaching bedside skills and procedures. An ideal fellows-as-teachers program might include a broader range of topics like adult learning theory, small group facilitation, and effective feedback (4, 10). Given the investment of time and resources required by our program to achieve a narrow set of outcomes in the ICU, such as through workshop development and training of standardized patients, our findings do raise concerns about broadly scoped trainees-as-teachers curricula. In addition, enhancing fellow participation on rounds may have unintentionally detracted from other inherently educational activities, such as assessing an unstable patient or performing a procedure. Finally, we did not collect data on fellows' perceptions, attitudes, skills, and knowledge around workshop content; these data would have substantiated the value of the intervention from the fellows' perspective.

Although our intervention sought to reshape ICU rounds for the benefit of fellows and residents, we also witnessed an increase in the fellow-nurse and fellow-patient interactions. We did not measure whether these interactions with stakeholders affected their perceptions of rounds, but an immense body of literature supports nurses', patients', and families' receptiveness to rounding models that incorporate bedside teaching and patient-centered care (15, 16), including in ICUs (17, 18). Thus, increasing bedside interactions between fellows and these stakeholders likely has positive effects on communication among stakeholders (15–17) without sacrificing the educational value of rounds (18).

Surprisingly, residents reported a decrement in the educational value of rounds postintervention, a finding that may have myriad explanations. First, although we posited that near-peer teaching from fellows would resonate better with residents, the slightly longer time spent on rounds or changes in team dynamics may have negatively influenced residents' perceptions. Second, although well-intentioned and carefully considered, our fellows-as-teachers workshop content may have focused on teaching and rounding practices that were less likely to be perceived as educationally beneficial to residents or less likely to be influenced by the fellow, such as the tenor of the clinical learning environment. Next, although educators often cite social congruence between the learner and the teacher as a major advantage of near-peer teaching (8, 19), having fellows lead rounds may also degrade this relationship. Residents might even view fellows as intentionally distancing themselves from the trainee role, and this "otherness" could counteract the cognitive and social congruences of the fellow-resident relationship. Furthermore, previous work has shown that medical students particularly value informal teaching by their resident supervisors (20); by analogy, residents may prefer to learn from fellows outside of formal rounding structures. Residents and fellows may have come to rounds with preconceptions or certain expectations about their roles and responsibilities (21). Thus, the culture shock of having fellows lead rounds could have negatively impacted residents' receptiveness to the intervention. Furthermore, fellows have additional responsibilities not shared by their faculty physician counterparts, such as triaging new admissions, and these may have curtailed teaching opportunities, which in turn may have resulted in residents' more negative attitudes. Finally, most studies of trainees-as-teachers and near-peer teaching in clinical medicine targeted medical students as the learner audience (9, 11); the fellows-as-teachers approach may have less applicability or impact on the fellow-resident dyad.

The primary limitation of this study is that merely encouraging faculty to support afternoon-led rounds may explain our findings. Furthermore, without a control group, we cannot separate direct effects of the curriculum. Similarly, by presenting baseline data on fellow engagement to faculty, we may have incited cultural change that also partially explains the increased fellow engagement. In addition, despite waiting several months from the final workshop to collect the postintervention data, we may have witnessed the Hawthorne effect in action whereby attending physicians and fellows improved behavior in the presence of an observer whom we could not conceal. Social desirability bias also may explain why fellows exhibited increased engagement; the presence of the faculty or the presence of the observer could have amplified this bias.

Our study has additional limitations that may temper our conclusions and limit its generalizability. First, we cannot disentangle the effects of the fellows-as-teachers curriculum from contamination by other initiatives in the ICU. For example, during the postintervention phase, our ICU initiated a nurse-led checklist project around the ICU liberation bundle (22). This project may have empowered nurses to participate in rounds more actively. Additionally, as the project was conducted over 18 months, the cadre of fellows in the training program experienced some turnover, and faculty clinical assignments changed. Thus, differences in individual fellows' willingness to teach, faculty members' willingness to give fellows autonomy, or overall programmatic culture change could have influenced the results. Obviously, trainees naturally mature during an academic year; how observation periods intersected with the academic calendar also could have influenced fellows' activities and residents' perceptions of rounds. Unfortunately, we did not measure or control for changes in attending physicians, did not attempt to reidentify specific attendings or fellows after the observation period, and did not account for attending physician engagement, all of which could have biased the results. Finally, although the PI trained the initial

observers, additional observers joined the study later due to staff turnover. Thus, the reliability of comparing preintervention and postintervention observations may be compromised by the lack of direct training from the PI and the inability to repeat interobserver reliability analyses in the postintervention period.

Despite these limitations, our postintervention data provide hypothesis-generating evidence that cultural change in the ICU endured beyond the fellows-as-teachers curriculum and period of active encouragement of fellow-red rounds. Future work in this space could examine whether parallel faculty development or an embedded, longitudinal fellows-as-teachers thread in the fellowship's overall curriculum would potentiate these benefits. Our results should also encourage other fellowship programs to measure the long-term effects of trainees-as-teachers curricula on the broader learning environment.

CONCLUSIONS

We observed a significant increase in fellows' engagement with the clinical and educational activities on ICU rounds after a series of fellows-as-teachers workshops. Future studies would add clarity on the impact of fellows-as-teachers curricula.

This study was reviewed by the Institutional Review Board at the Medical College of Wisconsin and was deemed minimal risk. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website (http://journals.lww.com/ccejournal).

Supported, in part, by the Scholarship in Medical Education Research Award, which is an educational grant from the Association of Pulmonary and Critical Care Medicine Program Directors.

The authors have disclosed that they do not have any potential conflicts of interest.

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