Getting on the Same Page: A Quality Improvement Project to Enhance Nurse-to-Resident Communications and Reduce Overnight Sleep Interruptions

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ABSTRACT

Background Many residency programs utilize "home call" residents who answer hospital communications and place orders from home. Often, residents are required to live nearby and arrive in-person if needed. Residents work normal daytime work hours while on home call, which can last several nights. This disrupts sleep and creates the potential for increased resident fatigue and patient safety issues.

Objective To implement and evaluate a novel program to reduce non-urgent overnight pages from nurses to home call physical medicine and rehabilitation (PM&R) residents between 11 PM and 6 AM.

Methods At an inpatient acute rehabilitation unit in a tertiary care university teaching hospital, we implemented a 2-step prospective quality improvement study with interventions derived from nurse-physician meetings implemented 9 months apart in 2018 and 2019. The first intervention was a centralized nightly handoff sheet. The second intervention was to display suggested PRN medication lists in resident workrooms. The primary outcome measure was the percentage of nights with non-urgent pages between 11 PM and 6 AM. Tracking urgent pages and 7-10 AM emergent pages were used as balancing measures.

Results A total of 1835 text-based nursing pages (366 pre- and 1469 post-intervention) were received and categorized by content, urgency, and timing over a 17-month period. Post-intervention, there was a stable 25% decrease in nighttime non-urgent pages. The most common hour to be paged shifted from 11 PM to 8 PM. Pain, constipation, insomnia, and nausea were the most common complaints overnight.

Conclusions By characterizing and studying nighttime pages, residents collaborated with nighttime nursing staff through structured meetings to reduce non-urgent nighttime pages for more than 1 year.

Introduction

For resident physicians, sleep loss has been associated with decreased trainee motivation, academic retention, patient empathy, and mood.[1,2] To combat this, there has been increasing oversight of residents' work hours to balance patient care and resident well-being. In particular, the Accreditation Council for Graduate Medical Education (ACGME) has been fine-tuning rules regarding work hours, particularly for in-house call residents.[3,4]

The "home call" system, which lacks specific regulations, often requires residents to reside within a certain radius of the hospital (in case a resident is needed in-person). The resident serves as the primary physician contact overnight from home, then works the following day shift as usual. Home call often has durations of 1 to 7 consecutive nights. Literature specific to home call sleep disturbance is sparse, although one study suggested home call residents slept an average of 3.1 hours on fatiguing call nights.[5] Another study suggested that in-house residents working longer than 24 hours with minimal sleep have higher rates of motor vehicle accidents.[6] While on call, some forced awakenings are necessary; however, it is well-established that non-urgent pages are sent day and night.[7,8]

Previously studied interventions on non-urgent pages include charge nurses screening or batching pages and physicians adding PRN (pro re nata) medications at admission. These studies involved in-house residents, and the effects were studied for 1 to 5 months.[9-11] Communication overnight also involves night shift nursing challenges; these nurses are often early career with less supervision, staffing support, and resources.[12] In one study, overnight nurses reported psychological stress from contacting certain physicians and stressed well-timed pages for good

DOI: http://dx.doi.org/10.4300/JGME-D-21-00846.1

team relationships.[13] Currently, there is a lack of home call resident–based initiatives to improve nighttime communications and studies that track effects for over a year.

In this prospective quality improvement (QI) study, we studied and categorized overnight text-based pages to guide interventions targeting non-urgent communications to improve handoffs and patient care timeliness, while decreasing resident fatigue.

Objectives
Our objective was to implement and evaluate a novel program to reduce non-urgent overnight pages from nurses to home call physical medicine and rehabilitation residents.

Findings
Our 2 interventions were associated with a 25% decrease of non-urgent pages for over a year.

Limitations
The setting of our study was a rehabilitation medicine unit connected to an acute care hospital with an in-house internal medicine team for emergencies, which may limit the generalizability of our exact methods to other hospital-based less centralized units.

Bottom Line
Two sets of nurse-physician meetings lasting less than 10 minutes each provided insight into mutually agreed upon interventions that improved communication timing for over a year.

Methods

Design

This study was conducted in a 756-bed tertiary care teaching hospital in a city with a 1.1-million-person metropolitan area. Our inpatient rehabilitation unit was attached to the main hospital and housed 3 physical medicine and rehabilitation (PM&R) teaching services: brain injury, general rehabilitation, and spinal cord injury, with an average census of 30.1 patients (range 25.2-34.8) over 17 months (August 1, 2018, to December 31, 2019). Six postgraduate year 2 PM&R residents took home call (sometimes after being the day team resident) 1 to 2 nights per week from July 1 to June 30. The on-call resident received in-person sign-out around 5 PM from 2- to 3-day team residents and stayed in-house until around 7 PM. Every sixth weekend, the resident was "on call" Friday night to Monday morning. No PM&R physician was in-house from 8 PM to 7 AM. An internal medicine–based team was in-house and available 24/7 for emergencies only. The PM&R resident was required to stay within a 20-minute drive of the hospital while on home call, if needed urgently in-person, which occurred rarely (1-4 times per year). We applied the Plan-Do-Study-Act (PDSA) model for QI, which emphasizes interdisciplinary collaboration to develop and test health care system improvements.[14]

Plan

A resident and nursing team reviewed 437 pages sent through an electronic text-based paging system for a 3-month period in 2018. Pages were excluded if (1) not from nursing (from other clinicians or pharmacists); (2) regarding outpatient services; or (3) call back numbers only without context. This yielded 366 pages (84% of all pages). We presented trends regarding timing and content to nursing management and made clarifications of existing protocols.

Do

A resident leader held nurse-physician "Getting on the Same Page" (GOTSP) meetings with 2 groups of nightshift nurses during nursing's regularly scheduled 7 PM safety huddles (BOX).

Team Analysis: The meetings facilitated information sharing for all. Of note, only 2 of 8 nurses at the first meetings knew the home call resident was not physically in the hospital overnight and none knew that residents worked day shifts as usual after being on-call overnight. Nurses stated their cultural norms:

BOX "Getting on the Same Page" Meeting Template and Collaboratively Determined Definitions of Urgent and Non-Urgent Pages

Meeting Template:

1. Express appreciation for night nursing. (Difficult hours/responsibilities; "eyes and ears" of the home call physicians. They catch missing day time items and guard patient sleep, which helps healing.)
2. Clarify work hours. (Our unit: Night nurse shift: 7 PM-7 AM; Resident shift: in-house 7 AM-8 PM, home call 8 PM-7 AM, then regular dayshift after home call at night. Residents work 3 consecutive days and nights on weekends. Home call frequency: approximately 1 in 6 weeknights and weekends).
3. Engage stakeholders on how to improve communication.
4. Decide definitions of urgent versus non-urgent pages and ideal timing.
5. Emphasize that nursing judgment always determines best timing.

Urgent Page Definition:

1. Time-sensitive concerns regarding patient safety, care, or comfort.
2. Protocol pages: notifications of falls, critical labs, or unstable vital signs.

Non-Urgent Page Definition:

1. Any concern that would not negatively impact patient safety, care, or comfort if timed before 11 PM or after 6 AM.

pages were sent 24/7 regardless of urgency to prevent forgetting non-urgencies. Most non-urgencies were caught during initial night nursing rounds and handoffs (around 7-8 PM) but were not paged earlier because there was no suggested deadline for non-urgent matters. Nurses voiced frustrations that residents rarely placed non-urgent orders overnight or relayed non-urgent concerns to the day team, hence, they needed to page multiple nights with the same concern. Together, the group decided to start a night-nurse-to-day-resident handoff sheet stored in the day team resident-nurse huddle room to improve handoffs.

Establish Definitions and Interventions: The group collaborated on definitions for urgent and non-urgent pages (BOX) and decided on ideal timing. Before 11 PM or after 6 AM, nurses would page non-urgent concerns. Between 11 PM and 6 AM, nurses would only communicate urgent concerns and write non-urgent concerns on a nightly printed patient list with the words "FYI—Non-urgent issues not requiring page between 11 PM and 6 AM."

Study

Initial interventions were implemented. Post-intervention pages were studied for content and timing to identify areas for further improvement.

Act

Intervention 2 occurred after an increase in non-urgent pages from May to June 2019 attributed to a high turnover of night nurses. We held GOTSP meetings and taught new nurses our paging guidelines. The nurses and residents concluded that having more PRN medications available could decrease care delays; therefore, an attending-approved PRN medication list was established. The residents were asked to consider adding PRN medications for each patient on admission for pain, insomnia, constipation, cough, heartburn, and systolic blood pressure >180 if not contraindicated.

Measurements: Text-based paging data from 7 PM to 7 AM were collected and grouped as such: pre-intervention (pre-int): August 1 to October 31, 2018; post-intervention 1 (post-1): December 5, 2018 to August 31, 2019; and post-intervention 2 (post-2): September 1 to December 31, 2019. November 1 to December 4, 2018 was excluded as a "washout" period during which physician-nurse planning meetings occurred. To reduce potential for bias, all pages were randomly sorted. Date, timing, and resident names were removed before pages were categorized by content and urgency.

Main Outcome Measures: The primary outcome measure was the percentage of nights with non-urgent pages between 11 PM and 6 AM. Secondary outcome measures included categorizing each page by content, urgency, and timing.

Balancing Measures: We analyzed overnight urgent and morning emergent pages for timing and frequency changes. Emergent pages from 7 to 10 AM were studied with the rationale that delayed urgent pages overnight could cause increased morning emergencies at change-of-shift (7 AM) and/or at the end of physician rounds (10 AM). Day shift communications were not studied because most were verbal.

Statistical Analyses: R version 3.6.2 (The R Foundation for Statistical Computing, Vienna, Austria) was used for analysis and charts. A table was formed to display normalized totals per intervention period. The effect of each intervention on urgent and non-urgent pages was assessed using linear modeling of total pages between 11 PM and 6 AM per month as a function of the mean census per month and intervention period. A significance level of $P<.05$ was used. Based on preliminary study, we estimated a small to medium effect size of 0.2. For linear regression modeling with 2 predictors, achieving 80% power at a 5% significance level required a sample size of 244. The study was conducted over 481 days to achieve sufficient power.

Balancing Measures: We analyzed urgent pages using linear modeling as above. Additionally, emergent page types between 7 and 10 AM and at all times (24 hrs/day) were calculated pre- and post-intervention, then normalized.

This study was approved by our university teaching hospital's Institutional Review Board.

Results

We analyzed 1835 text-based pages: 366 (pre-int), 1018 (post-1), and 451 (post-2). FIGURE 1 shows the monthly percentage of nights with pages by intervention period. Analysis revealed the nightly percentage of any page type between 11 PM and 6 AM decreased from 77% pre-int to 63% post-1 and post-2. The nightly percentage of non-urgent pages between 11 PM and 6 AM also decreased from 62% pre-int to 37% post-1 and post-2. The nightly percentage of urgent pages between 11 PM and 6 AM

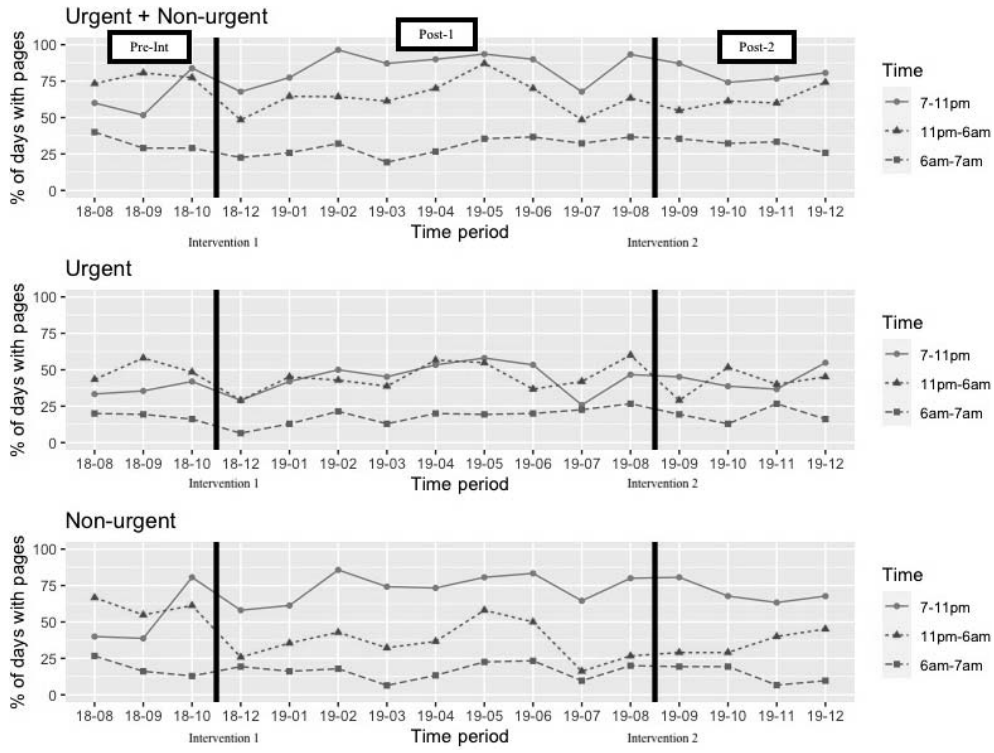

FIGURE 1

Pre- and Post-Intervention Urgent and Non-Urgent Page Timing

Abbreviations: pre-int, pre-intervention; post-1, post-intervention 1; post-2, post-intervention 2.

Note: Run chart displaying percentage of days with pages between 7-11 PM, 11 PM-6AM, and 6-7 AM per intervention period. Urgent and non-urgent pages are described. Non-urgent pages were targeted by our interventions. Tracking urgent pages served as a balancing measure.

decreased: pre-int (50%), post-1 (45%), and post-2 (43%).

The average pages/patient/night decreased from pre-int (1.97) to post-1 (1.28) and remained lower post-2 (1.25). The average non-urgent pages/patient/night from 11 PM to 6 AM decreased from 1.05 pre-int to 0.47 post-1 and remained lower post-2 (0.51). Pre-int, the most commonly paged hour was 11 PM, and 8 PM for post-1 and post-2.

The linear models showed interventions 1 and 2 had significant effects on non-urgent pages. The effects sizes were -0.64 (P=.0008; 95% CI -0.926 to -0.036) and -0.60 (P=.003; 95% CI -0.911 to -0.288), respectively. The linear model did not show significant effects of either intervention on urgent pages, -0.185 (P=.25; 95% CI -0.484-0.14) and -0.248 (P=.17; CI -0.576-0.081) for interventions 1 and 2, respectively.

TABLE 1 displays the paging characterization. Pain, constipation, insomnia, and nausea were the most frequent complaints. Other PRN requests, such as heartburn, dry eye, diarrhea, or cough, were combined due to low frequency. Constipation, pain, and insomnia requests decreased post-1. Pain PRN requests further decreased post-2. Non-urgent pages regarding patient updates and fixing non-urgent orders also decreased.

Lastly, 329 emergent pages were measured 24 hours/day and between 7 and 10 AM pre- and post-interventions (TABLE 2). FIGURE 2 shows no change in emergent page timing characteristics.

Discussion

This study demonstrates the feasibility of investigating text-based page logs to change the overnight paging culture of an inpatient unit. Surprisingly, 2 sets of GOTSP meetings (less than 10 minutes each) guided interventions, improved communication timing, and had lasting effects for 13 months. Despite both interventions, 63% of nights still had 11 PM to 6 AM pages largely due to urgent pages that should not be timed differently, which suggests that some degree of home call sleep loss is unavoidable.

One challenge was consistent FYI sheet use. Compliance improved when new residents (July 2019) were instructed at orientation to print the nightly FYI sheet, and a large colorful binder with "FYI" was incorporated. Another challenge was that we could not include our PRN list in our admission order sets due to electronic medical record

TABLE 1
Characteristics of Overnight Pages, Per Time Period

Characteristics	Pre-Intervention Per Patient Per Day (Raw No. of Pages)		Post-Intervention 1 Per Patient Per Day (Raw No. of Pages)		Post-Intervention 2 Per Patient Per Day (Raw No. of Pages)	
	11 PM-6 AM	<11 PM, >6 AM	11 PM-6 AM	<11 PM, >6 AM	11 PM-6 AM	<11 PM, >6 AM
Total number days	91		269		121	
Mean census per day	28		31		31	
Type						
Urgent	0.033 (83)	0.029 (73)	0.026 (218)	0.028 (232)	0.024 (89)	0.029 (109)
Non-urgent	***0.038 (96)***	0.045 (114)	***0.015 (126)***	0.053 (442)	***0.017 (62)***	0.051 (191)
Total	0.070 (179)	0.073 (187)	0.041 (344)	0.081 (674)	0.040 (151)	0.080 (300)
Urgent, divided						
Vital sign issue	0.009 (22)	0.010 (26)	0.005 (41)	0.009 (75)	0.004 (14)	0.009 (34)
Urine output	0.001 (2)	0.001 (3)	0.000 (4)	0.001 (11)	0.001 (2)	0.001 (3)
Agitation	0.004 (10)	0.001 (3)	0.003 (23)	0.003 (23)	0.002 (9)	0.002 (8)
AMS	0.000 (1)	0.000 (1)	0.000 (4)	0.000 (4)	0.000 (0)	0.001 (4)
Urgent order	0.007 (19)	0.003 (8)	0.005 (45)	0.005 (45)	0.006 (24)	0.002 (9)
Dangerous physical exam or EKG finding	0.002 (6)	0.005 (12)	0.003 (25)	0.001 (12)	0.003 (11)	0.003 (10)
RRT called	0.002 (4)	0.001 (3)	0.002 (13)	0.002 (16)	0.000 (3)	0.000 (1)
Critical lab	0.005 (13)	0.005 (13)	0.006 (50)	0.004 (37)	0.006 (22)	0.009 (34)
Fall	0.002 (6)	0.002 (4)	0.002 (13)	0.001 (9)	0.001 (4)	0.002 (6)
Non-urgent, divided						
PRN requests						
Constipation	***0.002 (4)***	0.004 (11)	***0.000 (4)***	0.003 (24)	***0.000 (1)***	0.002 (8)
Pain	***0.008 (21)***	0.005 (14)	***0.003 (22)***	0.006 (46)	***0.001 (5)***	0.004 (14)
Insomnia	***0.004 (9)***	0.001 (3)	***0.001 (11)***	0.003 (24)	***0.002 (6)***	0.001 (4)
Nausea	0.002 (5)	0.001 (2)	0.001 (11)	0.002 (19)	0.001 (4)	0.001 (4)
Other PRN request	0.004 (10)	0.004 (10)	0.002 (20)	0.007 (57)	0.004 (14)	0.006 (21)
Non-PRN requests						
Non-urgent patient update	***0.008 (20)***	0.009 (22)	***0.003 (22)***	0.010 (82)	***0.005 (19)***	0.012 (45)
Low urgency order request	***0.007 (19)***	0.015 (37)	***0.003 (29)***	0.017 (140)	***0.003 (12)***	0.022 (81)
Non-urgent fixing of order	***0.003 (8)***	0.006 (15)	***0.001 (7)***	0.006 (50)	***0.000 (1)***	0.004 (14)

Abbreviations: AMS, altered mental status; EKG, electrocardiogram; RRT, registered respiratory therapist; PRN, pro re nata.
Note: Bold and italicized values indicate specific types of pages that were intervened on. For each category, we display the normalized number of pages/night/bed in each time period, with total raw number of specific pages in parentheses.

TABLE 2
Description of Emergent Pages Between 7 and 10 AM and 24 Hrs/Day (February 2015 to June 2020)

Type	Pre-Intervention 24 Hrs/Day	Pre-Intervention 7-10 AM	Post-Intervention 24 Hrs/Day	Post-Intervention 7-10 AM
Total days	1402		573	
Mean census	29		31	
Rapid response	0.0046 (186)	0.0006 (26)	0.0044 (78)	0.0005 (9)
Stroke alert	0.0008 (31)	0.0002 (9)	0.0008 (15)	0.0002 (3)
Code blue	0.0003 (15)	0.0000 (4)	0.0002 (4)	0.0000 (1)
Totals	0.0057 (232)	0.0010 (39)	0.0055 (97)	0.0007 (13)

Note: Pre-intervention is from February 1, 2015 to December 4, 2018 (1402 days). Post-intervention is from December 5, 2018 until June 30, 2020 (573 days). Values indicate number of pages per patient per day (raw number of pages).

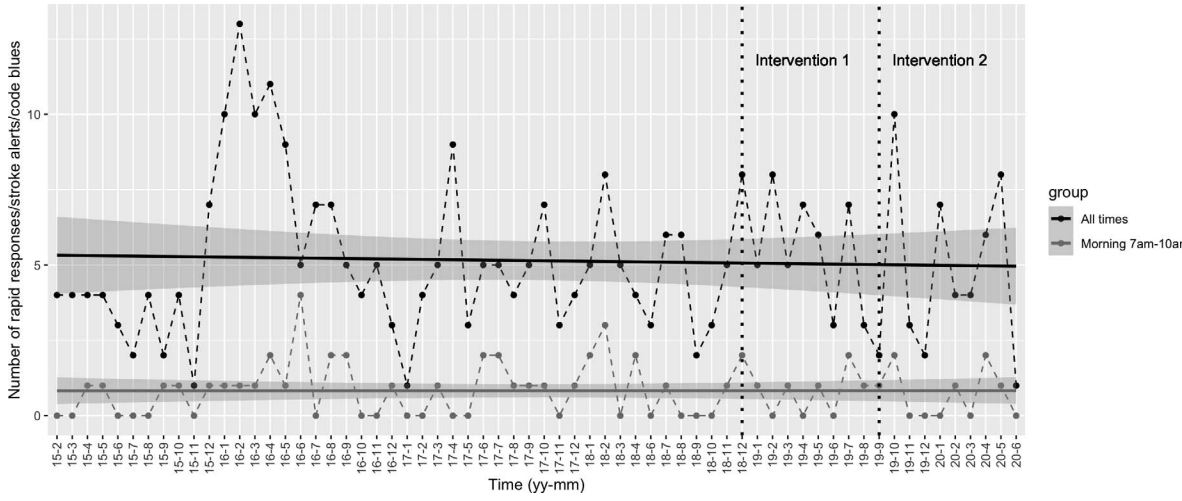

FIGURE 2
Emergent Page Timing

Note: For the purpose of balancing measures, this run chart displays the number of rapid responses, stroke alerts, and code blues between the hours of 7-10 AM (gray, bottom) and 24 hrs/day (black, top) from February 2015 to June 2020 (when the unit closed). Intervention 1 (December 2018) and Intervention 2 (September 2019) are marked with a dotted line. The solid gray lines are linear regression lines.

limitations. Instead, relying on reminder sheets with PRN medications displayed in resident workrooms likely decreased compliance. An impending facility move also resulted in a nearly complete turnover of night nursing staff before intervention 2 and a high percentage of "float" nurses from other units who were unfamiliar with our project. Teaching float nursing staff was a significant barrier throughout the study.

With staffing turnover, potentiating such projects' longer-term effects would necessitate residency programs' commitment, such as having the program director or a resident be responsible for coordinating at least yearly GOTSP meetings. Findings could drive QI initiatives. Though our GOTSP meetings continue and are well-received, our project's longer-term effects were not studied because our unit closed, and we adopted in-house call at our new facility in July 2020.

For balancing measures, we monitored overnight urgent and morning emergent pages, and the statistical analysis showed no change. Theoretically, nurses could have delayed paging due to fear of misidentifying a "non-urgency." There were also no informal reports so there is no way to be 100% sure that no page was delayed.

There might be limited generalizability of some aspects of this study. For example, our unit had an internal medicine team in-house for emergencies, which may not be the case elsewhere. Furthermore, PRN advocacy and FYI sheets may not work for less centralized units, and collaborative meetings may involve different planning for less centralized services.

Finally, studying paging volume alone does not account for the minutes to hours that each page takes to resolve, including time spent on the electronic medical record and phone overnight. Extra sleep loss undoubtedly also occurs from prolonged nocturnal screen time and anxiety from monitoring potentially sick patients from miles away. More research is needed to better quantify home call resident sleep disruption. While the ACGME recently started counting patient care work from home toward work hours,[15] more specific guidelines are needed regarding allowable sleep disruption, before a post-call day is necessary, for resident and patient safety. Moreover, future projects may apply our GOTSP meeting framework to less centralized overnight units in different specialties. Our findings of the most common sleep-interruptive complaints (insomnia, pain, constipation, and nausea) may guide day or night team physicians in research or practice.

Conclusions

This study shows the importance of interdisciplinary communication to improve paging culture overnight, while showing the feasibility of implementing QI processes with text-based paging systems.

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Funding: The authors report no external funding source for this study.

Conflict of interest: The authors declare they have no competing interests.

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Received August 30, 2021; revisions received December 6, 2021, and February 27, 2022; accepted February 28, 2022.