ORIGINAL RESEARCH

Are Text Pages an Effective Nudge to Increase Attendance at Internal Medicine Morning Report Conferences? A Cluster Randomized Controlled Trial

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Background: Despite the importance of medical educational conferences, low attendance remains an issue. The utility of reminder text pages as a behavioral nudge to increase attendance is unknown. Our objective was to determine whether reminder text pages increase daily morning report attendance.

Methods: We conducted a multiple-crossover cluster randomized controlled trial among medical students and internal medicine interns and residents (learners) at the Veteran Affairs Boston Healthcare System during the 2019 to 2020 academic year. During intervention periods, all residents and interns received a text page reminder 5 minutes before the upcoming 8:00 AM morning report conference; no page was sent during control periods. The primary outcome was conference attendance 10 minutes after the start of the conference.

Results: The study period included 85 morning report conferences, which 211 unique learners were eligible to attend; outcome data were available for 100% of eligible learners. On days when no page was sent, 44.4% of eligible learners attended the conference by 8:10 AM; on days when a reminder page was sent, 49.5% of eligible learners attended (P = .007). Accounting for clustering within individuals and controlling for date and team, the adjusted risk difference in morning report attendance associated with a reminder page was 4.0% (95% CI, 0.5%-7.6%) compared with no reminder page. No effect modification by overnight admissions was detected.

Conclusions: Our results suggest that daily reminder pages may result in a small increase in conference attendance. Whether this small increase is educationally significant will vary across training programs that apply this strategy.

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Regularly scheduled educational conferences, such as case-based morning reports, have been a standard part of internal medicine residencies for decades.[1-4] In addition to better patient care from the knowledge gained at educational conferences, attendance by interns and residents (collectively called house staff) may be associated with higher in-service examination scores.[5] Unfortunately, competing priorities, including patient care and trainee supervision, may contribute to an action-intention gap among house staff that reduces attendance.[6-8] Low attendance at morning reports represents wasted effort and lost educational opportunities; therefore, strategies to increase attendance are needed. Of several methods studied, more resource-intensive interventions (eg, providing food) were the most successful.[6,9-12]

Using the behavioral economics framework of nudge strategies, we hypothesized that a less intensive intervention of a daily reminder text page would encourage medical students, interns, and residents (collectively called learners) to attend the morning report conference.[8,13] However, given the high cognitive load created by frequent task switching, a reminder text page could disrupt workflow and patient care without promoting the intended behavior change.[14-17] Because of this uncertainty, our objective was to determine whether a preconference text page increased learner attendance at morning report conferences.

METHODS

This study was a single-center, multiple-crossover cluster randomized controlled trial conducted at the Veteran Affairs Boston Healthcare System (VABHS) in Massachusetts. Study participants included house staff rotating on daytime inpatient rotations from 4 residency programs and students from 2 medical schools. The setting was the morning report, an in-person, interactive, case-based conference held Monday through Thursday, from 8:00 AM to 8:45 AM. On Friday mornings, the morning report was replaced with a medical Jeopardy game-style conference. Historically, attendance has not been recorded for these conferences.

TABLE 1 Characteristics of Veterans Affairs Boston Healthcare System Study Participants

Variables	Control group (n = 192)	Intervention group (n = 172)	Total (N = 211)
Total morning report conferences, No. (%)	38 (45)	47 (55)	85
No. of daily eligible learners, median (IQR)	29 (24-29)	29 (29-33)	29 (29-29)
Person-days, No. (%) Residents Interns Medical students	1051 (43) 342 (33) 570 (54) 139 (13)	1406 (57) 423 (30) 705 (50) 278 (20)	2457 765 (31) 1275 (52) 417 (17)
Weekdays learners, median (range)[a]	5 (1-16)	8 (1-19)	11 (1-25)
Overnight admissions per admitting team, median (range)	2 (0-6)	2 (0-5)	2 (0-6)

[a]The total No. of weekdays each learner was present at VABHS during the study period was obtained by tallying up the total No. of weekdays each learner appeared on the daily facesheets (weekdays were counted rather than total days because conferences only occurred on weekdays); the total No. of weekdays need not have been consecutive; data for 11 learners missing unique identification were excluded.

Learners assigned to rotate on the inpatient medicine, cardiology, medicine consultation, and patient safety rotations were eligible to attend these conferences and for inclusion in the study. Learners rotating in the medical intensive care unit, on night float, or on day float (an admitting shift for which residents are not on-site until late afternoon) were excluded. Additional details of the study population are available in the supplement (eAppendix, available online at doi:10.12788/fp.0423). The study period was originally planned for September 30, 2019, to March 31, 2020, but data collection was stopped on March 12, 2020, due to the COVID-19 pandemic and suspension of in-person conferences. We chose the study period, which determined our sample size, to exclude the first 3 months of the academic year (July-September) because during that time learners acclimate to the inpatient workflow. We also chose not to include the last 3 months of the academic year to provide time for data analysis and preparation of the manuscript within the academic year.

Intervention and Outcome Assessment

Each intervention and control period was 3 weeks long; the first period was randomly determined by coin flip and alternated thereafter. Additional details of randomization are available in the supplement (Appendix 1). During intervention periods, all house staff received a page at 7:55 AM that listed the time and location of the upcoming morning report or Jeopardy conference. Medical students do not carry pagers and did not receive reminder pages; however, we included these learners because changes in their conference attendance behavior would indicate an extension of the effect of reminder pages beyond the individual learner who received the page.

A daily facesheet (a roster of house staff names and photos) was used to identify learners for conference attendance. This facesheet was already used for other purposes at VABHS. At 8:00 AM and 8:10 AM, a chief medical resident who was not blinded to the intervention or control period recorded the attendance of each eligible learner as present or absent; learners were unaware that their attendance was being recorded. This approach to data collection was selected to minimize the likelihood that the behavior of the study participants would be influenced.

During control periods, no text page reminder of upcoming conferences was sent, but the attendance of total learners at 8:00 AM and 8:10 AM was recorded by a chief medical resident who used the same method as during the intervention periods. Attendance at 8:10 AM was chosen as the primary outcome to account for the possibility that learners may arrive after a conference begins. Attendance at 8:00 AM also was recorded to assess the effect of reminder pages on attendance at the start of morning reports.

Statistical Analysis

The primary outcome was the proportion of eligible learners present at 8:10 AM

TABLE 2 Conference Attendance

Attendance	Adjusted risk difference (95% CI), %[a]	*P* value
8:10 AM conference		
Total	3.8 (0.6-7.0)	.02
Morning report[b]	4.0 (0.5-7.6)	.03
Residents and interns	3.5 (-0.3 to 7.3)	.07
Medical students	6.1 (-4.0 to 16.2)	.23
Jeopardy	2.0 (-4.6 to 8.6)	.56
8:00 AM conference		
Total	3.9 (1.0-6.8)	.007
Morning report	2.1 (-1.1 to 5.3)	.20
Jeopardy	9.7 (4.2-15.3)	.001

[a]A positive risk difference denotes an increase in attendance when a reminder page was sent compared with no reminder page sent.
[b]Primary outcome, accounting for clustering of conference attendance behavior within individuals. All other rows show results for prespecified secondary outcomes.

at the morning report, expressed as the risk difference for attendance between intervention and control periods. Secondary outcomes included the proportion of learners present at 8:00 AM (on-time attendance), the proportion of learners present by type (student vs house staff), and the proportion of learners present at the Friday Jeopardy conference. Two preplanned subgroup analyses were performed: one assessing the impact of rotating on clinical services with lighter workloads, and the other assessing the impact of the number of overnight admissions received on the relationship between receipt of a reminder page and conference attendance.

To estimate the primary outcome, we modeled the risk difference adjusted for covariates using a generalized estimating equation accounting for the clustering of attendance behavior within individuals and controlling for date and team. Secondary outcomes were estimated similarly. To evaluate the robustness of the primary outcome, we performed a sensitivity analysis using a multilevel generalized linear model with clustering by individual learner and team. Additional details on our statistical analysis plan, including accessing our raw data and analysis code, are available in Appendices 2 and 3. Categorical variables were compared using the χ^2 or Fisher exact test. Continuous variables were compared using the *t* test or Wilcoxon rank-sum tests. All *P* values were 2-sided, and a significance level of ≤ .05 was considered statistically significant. Analysis was performed in Stata v16.1. Our study was deemed exempt by the VABHS Institutional Review Board, and this article was prepared following the CONSORT reporting guidelines. The trial protocol has been registered with the International Standard Randomized Controlled Trial Number registry (ISRCTN14675095).

RESULTS

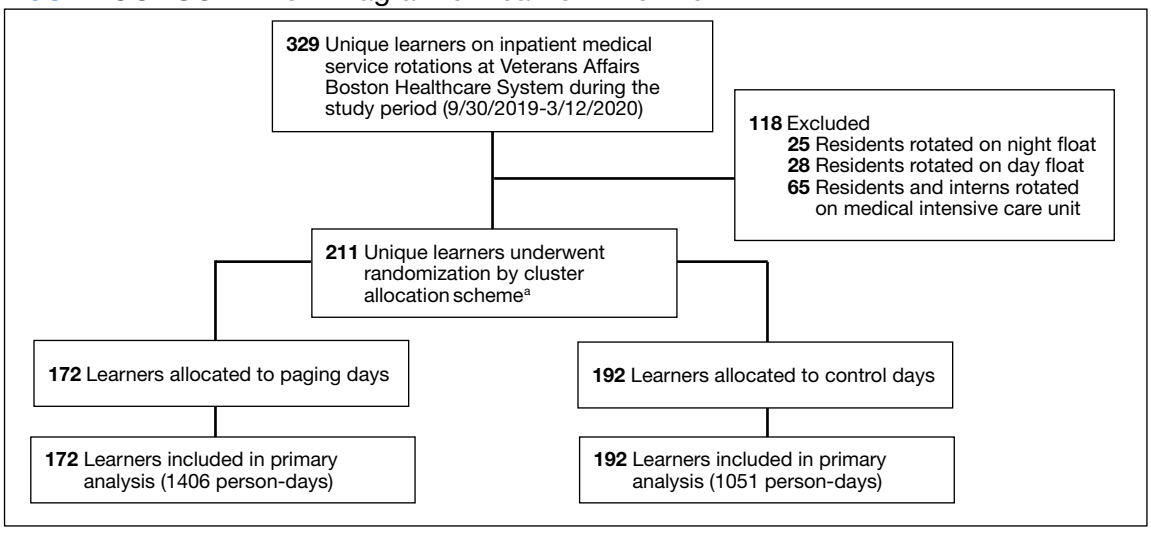
Over the study period, 329 unique learners rotated on inpatient medical services at the VABHS and 211 were eligible to attend 85 morning report conferences and 22 Jeopardy conferences (Figure). Outcomes data were available for 100% of eligible participants. Forty-seven (55%) of the morning report conferences occurred during the intervention period (Table 1).

Morning report attendance observed at 8:10 AM was 5.5% higher during the intervention period compared with the control period (49.9% vs 44.4%, *P* = .007). Accounting for clustering within individuals, the unadjusted risk difference in morning report attendance associated with sending a reminder page was 3.6% (95% CI, 0.09%-7.2%; *P* = .04) compared with no reminder page. When adding date and team to our model, the adjusted risk difference in conference attendance increased to 4.0% (95% CI, 0.5%-7.6%; *P* = .03) (Table 2). Results were similar in a sensitivity analysis using a multilevel generalized linear model accounting for clustering by both individual and team (adjusted risk difference, 4.0% [95% CI, 0.4%-7.6%; *P* = .03]).

On-time attendance was lower than at 8:10 AM in both groups, with no difference in the observed attendance at 8:00 AM between the control and intervention groups (22.4% vs 25.0%, *P* = .14). Regarding Jeopardy-like conferences, on-time attendance differed between the control and intervention groups at 8:00 AM (15.3% vs 23.6%, *P* = .01), but not at 8:10 AM (42.9% vs 42.8%, *P* > .99). We found no evidence of an interaction between receipt of a reminder page and learner type (student vs house staff, *P* = .33).

To estimate the impact of rotating on teams with lighter clinical workloads on the association between receipt of a reminder page and conference attendance, we repeated our primary analysis with a test of interaction between team assignment and the intervention, which was not significant

FIGURE CONSORT Flow Diagram of Learner Enrollment



[a]72% of learners were exposed to at least 1 day of both the intervention and control periods.

(P = .90). To estimate the impact of morning workload on the association between receipt of a reminder page and conference attendance, we performed a subgroup analysis limited to learners rotating on teams eligible to receive overnight admissions and included the number of overnight admissions as a covariate in our regression model. A test of interaction between the intervention and the number of overnight admissions on conference attendance was not significant (P = .73).

In a subgroup analysis limited to learners on teams eligible to receive overnight admissions and controlling for the number of overnight admissions (a proxy for morning workload), no significant interaction between the intervention and admissions was observed. We also assessed for interaction between learner type and receipt of a reminder page on conference attendance and found no evidence of such an effect.

DISCUSSION

Among a diverse population of learners from multiple academic institutions rotating at a single, large, urban VA medical center, a nudge strategy of sending a reminder text page before morning report conferences was associated with a 4.0% absolute increase in attendance measured 10 minutes after the conference started compared with not sending a reminder page. Overall, only one-quarter of learners attended the morning report at the start at 8:00 AM, with no difference in on-time attendance between the intervention and control periods.

We designed our analysis to overcome several limitations of prior studies on the effect of reminder text pages on conference attendance. First, to account for differences in conference attendance behavior of individual learners, we used a generalized estimating equation model that allowed clustering of outcomes by individual. Second, we controlled for the date to account for secular trends in conference attendance over the academic year. Finally, we controlled for the team to account for the possibility that the conference attendance behavior of one learner on a team influences the behavior of other learners on the same team.

We also evaluated the effect of a reminder page on attendance at a weekly Jeopardy conference. Interestingly, reminder pages seemed to increase on-time Jeopardy attendance, although this effect was no longer statistically significant at 8:10 AM. A possible explanation for this is that the fun and collegial nature of Jeopardy conferences entices learners to attend independent of a reminder page.

We also assessed the interaction between sending a reminder page and learner type and its effect on conference attendance and found no evidence to support such an effect. Because medical students do not receive reminder pages,

their conference attendance behavior can be thought of as indicative of clustering within teams. Though there was no evidence of a significant interaction, given the small number of students, our study may be underpowered to find a benefit for this group.

The results of this study differ from Smith and colleagues, who found that reminder pages had no overall effect on conference attendance for fellows; however, no sample size justification was provided in that study, making it difficult to evaluate the likelihood of a false-negative finding.[7] Our study differs in several ways: the timing of the reminder page (5 minutes vs 30 minutes prior to the conference), the method by which attendance was recorded (by an independent observer vs learner sign-in), and the time that attendance was recorded (2 prespecified times vs continuously). As far as we know, our study is the first to evaluate the nudge effect of reminder text pages on internal medicine resident attendance at conferences, with attendance taken by an observer.

Limitations

This study has some limitations. First, it was conducted at a single VA medical center. An additional limitation was our decision to classify learners who arrived after 8:10 AM as absent, which likely underestimated total conference attendance. Further, we did not record whether learners stayed until the end of the conference. Additionally, many hospitals are transitioning away from pagers in favor of mobile phones; however, we have no reason to expect that the device on which a reminder is received (pager or phone) should affect the generalizability of these results.

Unfortunately, due to the COVID-19 pandemic and the suspension of in-person conferences, our study ended earlier than anticipated. This resulted in an imbalance of morning report conferences that occurred during each period: 55% during the intervention period, and 45% during the control period. However, because we accounted for the clustering of conference attendance behavior within individuals in our model, this imbalance is unlikely to introduce bias in our estimation of the effect of the intervention.

Another limitation relates to the evolving landscape of educational conferences in the postpandemic era.[18] Whether our results can be generalized to increase virtual conference attendance is unknown. Finally, it is not clear whether a 4% absolute increase in conference attendance is educationally meaningful or justifies the effort of sending a reminder page.

CONCLUSIONS

In this cluster randomized controlled trial conducted at a single VA medical center, reminder pages sent 5 minutes before the start of morning report conferences resulted in a 4% increase in conference attendance. Our results suggest that reminder pages are one strategy that may result in a small increase in conference attendance, but whether this small increase is educationally significant will vary across training programs applying this strategy.

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Author contributions

Determining the study concept and design, the acquisition, analysis, and interpretation of data, and the critical revision of the manuscript for important intellectual content: Ganatra, Reese, Breu. *Drafted original manuscript*: Reese. *Planned and conducted the statistical analysis and revised the original manuscript*: Ganatra. *Provided supervision*: Breu, Ganatra.

Author disclosures

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Disclaimer

The opinions expressed herein are those of the authors and do not necessarily reflect those of *Federal Practitioner,* Frontline Medical Communications Inc., the US Government, or any of its agencies.

Ethics and consent

Our study was deemed exempt by the Veterans Affairs Boston Healthcare System Institutional Review Board, and this manuscript was prepared in accordance with the CONSORT reporting guidelines.

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APPENDIX 1 Details of Randomization

Because the conference attendance behavior of one resident may influence others, particularly on the same team, as well as the impracticality of randomizing individuals to receive a reminder page for a conference intended for all learners, it was not practical or desirable to randomize study group assignment at the level of the individual learner. Instead, an alternating cluster-controlled trial design was chosen, with the cluster being the 3-week period during which pages were sent or not sent to all learners eligible to attend morning report conferences. Three weeks was chosen as the cluster length to coincide with the general medical ward rotation length for the academic affiliate with the largest clinical footprint at Veterans Affairs Boston Healthcare System (VABHS).

Apart from receipt of a reminder text page, we had no reason to suspect that any other relationship would exist between the timing or length of the intervention and control periods and the primary outcome of conference attendance. Learners can therefore be considered to have been randomly allocated to the intervention or control group based on the timing of their clinical rotation at VABHS. Furthermore, it was common for individual learners to contribute person-days of follow-up to both the intervention and control periods (for example, if a learner's rotation overlapped with both an intervention and control period). However, because we accounted for correlation of conference attendance behavior at the level of the individual learner in our generalized estimating equations model, this should not introduce bias in our estimate of the effect of receipt of a reminder page on conference attendance.

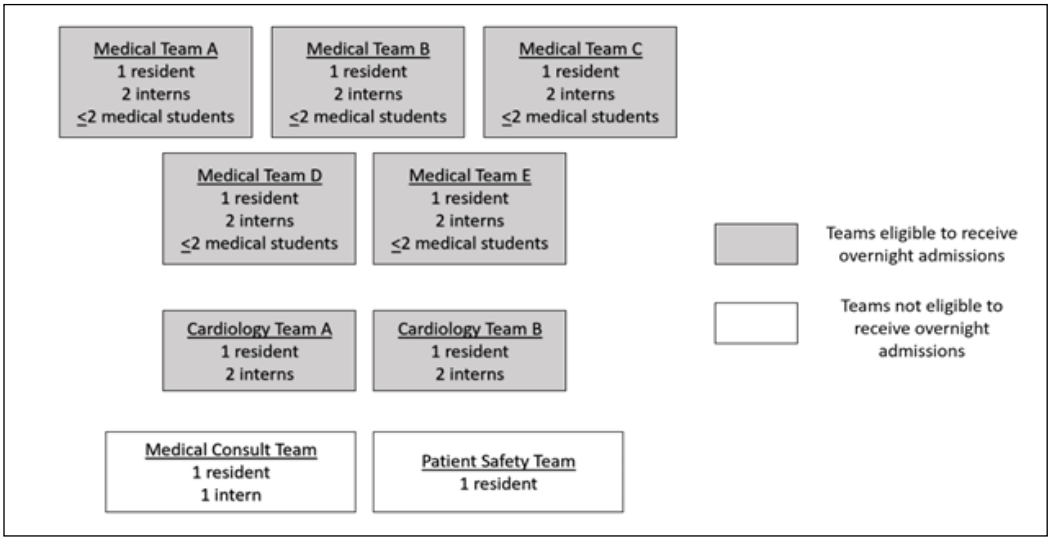
APPENDIX 2 Details of Generalized Estimating Equations Model for the Primary Analysis

To account for differences in conference attendance behavior of individual learners, we used a generalized estimating equation (GEE) model that allowed clustering of outcomes by individual. The GEE model allowed us to account for the fact that conference attendance behavior is correlated within individuals (some learners may habitually attend conferences often, whereas others may habitually attend conferences infrequently). Further, we controlled for date and team by adding these variables as covariates in our model.

APPENDIX 3 Data Sharing Statement and Analysis Code

The authors have made de-identified raw data and statistical analysis code available at synapse.org, project ID: syn25986377. Additionally, the full trial protocol and statistical analysis plan are available on request.

eAPPENDIX Team Distribution



Learners were distributed over 5 general medicine teams, 2 cardiology teams, a medicine consult team, and a patient safety team.