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The Practice of Emergency Medicine

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A GLOBAL JOURNAL OF EMERGENCY MEDICINE

WILEY

Internet-based self-scheduling is associated with a high degree of physician satisfaction in an academic emergency medicine group

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Abstract

There are various methods for scheduling emergency physicians ranging from a schedule created by hand by a physician scheduler, fixed templates, to computer-assisted scheduling. The authors describe a novel method adopted by an academic emergency department using remote asynchronous physician self-scheduling. The physician group follows a pre-determined order in which each physician chooses where to place his or her assigned proportion of day/evening/weekend/night shifts on the shared calendar that is hosted in a cloud-based spreadsheet. This process gives physicians a high degree of control over their schedules, and the participants related a high degree of satisfaction regarding this process. This method of physician scheduling is a low-cost successful alternative to conventional emergency physician scheduling practices.

KEYWORDS
ED management, ED Scheduling, physician management, scheduling

1 | INTRODUCTION

One of the great challenges of emergency medicine is finding a delicate balance between the staffing requirements of the emergency department (ED) and the personal commitments of the physicians involved. A range of scheduling methods has traditionally been used in EDs, ranging from a dedicated scheduler to fixed templates.[1] In recent years, several computer-based scheduling applications and formal mathematical approaches[2–6] have been developed as well. Each of these methods has significant downsides such as the perception of bias or poor sched-

ule arrangement at the hands of an "expert" individual who creates the schedule or excessive rigidity related to a templated schedule. Some asynchronous self-scheduling approaches amongst ED nurses have been reported,[7] but this required participants to access a physical schedule "whiteboard," which did not have an "audit trail" and required significant direction from a nursing director. The role of physician "expert" scheduler is highly time-consuming, with some authors describing that the process of scheduling a 24-physician group's 3-month schedule requires as much as 40 hours of effort.[5] Assuming that the scheduling physician is compensated either by way of a shift reduction or a monetary stipend, this cost can be significant, assuming a conservative assumption of physician compensation of $150/h. The

Supervising Editor: Elizabeth Donnelly, PhD, MPH

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direct costs of scheduling software can be significant, with costs being reported as $5 per provider per month for some commercial scheduling solutions.[8,9]

There are a variety of research papers that address the difficulty of ED physician scheduling from the descriptive and mathematical standpoint,[11] as well as various proprietary computer programs or app-based solutions. The issue with most of this literature is that it describes "pure science" that is not readily applicable by clinicians and open-sourced solutions that will require computer science engineers to implement and will thus be more complex and costly to implement while being less user-friendly than the commercially available resources they intended to replace. Other non-emergency medicine authors[10,12,13] describe a spreadsheet-based solution involving "detailed and complex mixed-integer programming formulation" that is neither intuitive nor readily reproducible by other sites.

Furthermore, a lack of physician satisfaction with the ED schedule can negatively impact physician job satisfaction. There are numerous personal factors that affect physician satisfaction that is innumerable and particular to each physician. Some of the factors noted by faculty that limit satisfaction with the clinical schedule, such as the ability to spend time with family, fulfill elder or childcare requirements, participate in leisure activities, fulfill non-clinical teaching or administrative duties, and subjective preferences for non-traditional scheduling patterns such as preferring longer stretches of shifts or conversely wanting to avoid them. Ultimately there are more subtleties to the scheduling process than can be addressed by most human schedulers. There are scheduling preferences that can also be seen as too trivial to prompt a schedule request but which are still important to the individual physician. In the healthcare workplace, dissatisfaction with scheduling has been associated with decreased productivity and absenteeism.[2,7] A lack of flexibility in schedule creation and transparency in how schedule requests are fulfilled and considered is noted as a factor in emergency physician burnout as well.[13,14]

Various methods of self-scheduling relying on individual choice for the selection of shift assignments in the ED have been described in the medical literature both in regard to physician and nursing scheduling.[6] Typically, authors created a calendar corresponding to the blank ED schedule using a computer-based spreadsheet application such as Excel (Microsoft Inc, Redmond, WA) and allowed participants to sign up for shifts of their choosing based on a pre-set allotment. In each reviewed article, self-scheduling was felt to be a success, but there have been considerable downsides in each case that limit the general appeal of the system. In one system, an intermediary with access to the schedule was required[6] to edit the schedule, or central access on a single computer terminal was needed to allow participants to take their turns entering their names on the calendar.

2 | NOVEL SCHEDULING SYSTEM

We have developed a self-scheduling system using Google Sheets (Google Inc, Mountain View, CA), a free service that allows collaborative creation and editing of a spreadsheet using any common web browser regardless of the user's location or choice of computing platform. The process we developed does not require any specialized programming skills, non-standard computing interfaces, or higher order spreadsheet manipulation talents and is readily reproducible by other emergency physician groups without the upfront cost. Although the challenge of producing a completely "perfect" may represent a problem without a solution, the fact that our system's collaboratively constructed schedule lends itself to a sense of control and ownership over the process that is lacking in other systems.

3 | METHODOLOGY

The Department of Emergency Medicine at the University of Connecticut Health Center, a 224-bed hospital in Farmington, Connecticut is staffed by 15 faculty members. The schedule is produced in 3 month-long quarterly blocks running July to July based on the standard academic year. Before the beginning of each quarter, the ED director calculates the number of total shifts each faculty member must work taking into account protected time and administrative responsibilities. In this system, each faculty member receives a listing of the number of each specific shift (weekday and evening days, evenings, nights) he or she must place on the schedule. Our group does not have vacation blocks per se, but physicians note their desired dates away from the department on the spreadsheet for that month and place their shifts around those dates. A rotating holiday schedule provides a guide for which physicians are expected to place schedules on a holiday weekend or specific holiday. Many holidays traditionally celebrated as a weekend, such as Memorial Day or Labor Day in the United States, are scheduled as a 3 day block starting at midnight on Friday while "standalone" holidays, such as Christmas, start at midnight the night before and end at midnight on the night of the holiday. The holiday schedule ensures that there is an equitable distribution of holiday work and that a sufficient number of physicians are seeking to place shifts on any given holiday. The ED director also defines the order in which the physicians will take their turns. In the interest of equity, the scheduling order is progressive so that each physician rotates one spot down the list each time the schedule is generated. Therefore, each physician has equal exposure to each slot in the scheduling lineup over time. The scheduling administrator prepares a spreadsheet corresponding to the calendar of that quarter, and the members of the faculty are given access to this document using the collaboration feature.

At the start of each scheduling period, our group allows our dedicated night physicians to place their shifts first to help them avoid split blocks of nights and the "every other night" situation which might occur if large numbers of night shifts cannot all be placed on the schedule at once.

At the completion of the night physician phase, the faculty members begin taking their turns at placing shifts on schedule. Each individual is given 4 "turns" at the schedule during which time they are the sole individual who may make additions to the schedule. This is regularly checked by the schedule administrator or director. In addition, any deviation from the number of assigned shifts and turns is discouraged

by the freely viewable and open nature of the schedule. In the first 2 turns, each physician places 1/3 of his or her shifts, and 1/6 in the last 2 turns. When each physician's turn is completed, he or she contacts the person who is next in the order. Physician behavior tends to vary in terms of how shifts are placed in each turn—one of the strengths of the system is that varying physician preferences (clustered shifts versus a more spread-out shift apportionment) can be accommodated. The 3-month time frame that is used is arbitrary, but this tends to work well as it is far enough in advance (most of the time the active scheduled block is 4–6 months in the future because we try to have the schedule complete at least 4 weeks before the end of the last block) that school and family considerations can be taken into account without excessive lead time. We have chosen to have a flexible time frame for each physician's turn at the schedule but have agreed that if a turn has not been taken within 7 days, it will be considered forfeit and the turn will move on to the next physician. Our standard practice is for each physician to send a text message whose turn it is to place shifts, which allows a 3-month block of the schedule to be completed in approximately 4–6 weeks, as multiple physicians can take a "turn" in a single day.

As an example, if the scheduling roster is as follows:

Doctor A: 46 shifts per quarter (15 shifts may be placed each turn in rounds 1 and 2, 8 shifts each turn in round turns 3 and 4), and

Doctor B: 30 shifts per quarter (10 shifts per turn in rounds 1 and 2, 5 shifts per turn in rounds 3 and 4).

Although each individual has access to the schedule at all times, we have collectively agreed not to make edits during another physician's turn. The Google Documents system provides logging of the time and date each edit to the schedule occurred and saves a copy of how the schedule appeared at the time each new individual begins editing the schedule. Therefore, if an individual inadvertently makes a deletion or otherwise damages the spreadsheet, the administrator is able to restore the spreadsheet to how it appeared when this person began his turn. Once the schedule is complete, the administrator makes the schedule "read only" to prevent further changes. When physicians make agreed-on shift swaps, they notify the schedule administrator who makes the corresponding change on the spreadsheet. The transparency this service provides also fosters a sense of trust in the scheduling system we have adopted. A de-identified example of the spreadsheet is attached as Supporting Information Appendix S1. Certain basic logic features of the spreadsheet have been used including the COUNTIF function, which provides a running tally of the number of times a physician's name appears on the spreadsheet. This provides an easy way for faculty to assess how many shifts they have placed on the schedule and reinforces the notion of the open and public nature of the schedule as a means of encouraging "best behavior" in the scheduling process.

Before our current online scheduling format, our group used other methods of scheduling, including having a designated physician who created the group schedule, taking into account specific requests for time off. In the initial attempts at self-scheduling, the group tried to hold an annual self-scheduling meeting which would typically last over 4 hours and made staffing the ED difficult during this time period.

A medical student (C.D.) not involved in devising the scheduling process surveyed the physician staff individually to determine responses to the questions as noted in Table 1. All of the attending staff involved completed the survey (100% response rate) in written form, and the data were compiled by the medical student. No incentives were offered for this first attempt at gathering impressions and satisfaction data from the faculty involved in this scheduling system.

4 | RESULTS

The survey results can be seen in Table 2 that reflected a very high level of satisfaction with the remote self-scheduling system. All faculty members rated the system a "4" or greater in regard to overall satisfaction, effectiveness, ease of use, sense of fairness, convenience, and transparency. The survey indicates that there are some issues that self-scheduling does not address, such as the need for secondary shift switches after the schedule is completed, perhaps due to the fact that the schedule is often completed 1–2 months in advance of the beginning of each quarter, which can mean that the schedule is determined up to 6 months in advance. There was significant disagreement between the physicians surveyed regarding the impression of the time commitment needed for the time to take scheduling turns, which may have been influenced by the fact that 4 of the physicians surveyed were not members of the group when the self-scheduling process was done in person over a 3- to 4-hour period.

5 | LIMITATIONS AND FUTURE RESEARCH

Limitations of this study include the small number of participants and the fact that physicians in the group have different perspectives on scheduling, owing to the number of years each physician has been in the group. We would anticipate that a larger physician group might take longer to complete each block of scheduling because more physician "turns" would be required to complete the schedule, which could be addressed by scheduling further in advance. To shorten the overall time required to complete a scheduling block (particularly if a larger group was scheduled), a shorter "turn duration" than one day could be explored. Although a shorter scheduling period than 3 months could be chosen, such as 1 month, this would be inefficient since a shorter segment of the schedule would be completed with the same number of turns. For example, only four physician scheduling "turns" per calendar quarter are needed when the schedule is completed three months at a time compared to 12 turns per calendar quarter are needed when one month is scheduled at a time. Another limitation is that a "referee" is needed to ensure that each physician takes his or her turn correctly. Although this could be automated using computer logic, this would likely exceed the capabilities of a spreadsheet, and in a sense, defeat the open-source and low-complexity nature of this solution that allows for its reproducibility in other EDs. There is also the opportunity

TABLE 1 Questions to physician staff regarding self-scheduling

	In comparison to the prior method of scheduling, please consider the following statements relating to your satisfaction with the new format of scheduling	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
1	I have an overall satisfaction with the scheduling that occurs.	1	2	3	4	5
2	The method for scheduling is very efficient.	1	2	3	4	5
3	The method for scheduling is very effective.	1	2	3	4	5
4	I have a lot of flexibility in the scheduling method.	1	2	3	4	5
5	The method is easy to use.	1	2	3	4	5
6	The numbers of shift changes that occur are less.	1	2	3	4	5
7	The ability to change shifts is easier.	1	2	3	4	5
8	I have more time for personal commitments.	1	2	3	4	5
9	Picking my shifts has increased my productivity while working.	1	2	3	4	5
10	There is equal sharing/fairness in shift responsibility.	1	2	3	4	5
11	The time commitment for making the schedule is less.	1	2	3	4	5
12	I have more control over my own scheduled shifts.	1	2	3	4	5
13	The time it takes to schedule is convenient.	1	2	3	4	5
14	The schedule eliminates favoritism in making of the schedule.	1	2	3	4	5
15	There is more team collaboration in making the schedule.	1	2	3	4	5
16	The schedule-making format provides transparency.	1	2	3	4	5

TABLE 2 Mean response and SD by survey question

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mean	4.1	3.95	4.2	4	4.7	3	3.1	3.95	3.5	4.45	3.2	4.85	3.95	3.8	3.6	3.8
Standard deviation	0.4	0.9	0.75	0.8	0.4	1	1.35	1.1	0.75	0.5	1.75	0.4	1.2	0.45	1	0.5

to include additional spreadsheet logic functions that could provide detailed tallies of the number of night and weekend shifts placed to further demonstrate compliance with the assigned number of shifts and to make the process of placing shifts easier for physicians. We have trialed some of these features but also noted that the more complex the logic functions are in each calendar month spreadsheet, the more time-consuming it is for the schedule administrator to create the next scheduling block's schedules because each counting formula must be reset and tested for proper function.

6 | DISCUSSION

Overall, our group of emergency physicians indicated a high level of satisfaction with this system of remote self-scheduling. This method circumvents some of the pitfalls with other systems regarding perceived bias or the necessity of a central individual as the administrating hub. The result from the survey show that the group believes the scheduling method is easy to use, eliminates favoritism, and allows transparency in the scheduling process.

Although our survey confirms the obvious fact that there is no perfect system of scheduling that addresses all the varied and conflicting personal and professional issues of the busy emergency physician, the results of the survey show that physicians have a high level of satisfaction regarding the convenience, fairness, and transparency in this process. In a group with appropriate physician buy-in and patience, we show that this can be a highly successful method of creating an ED schedule. The convenience of being able to add one's shifts to the master schedule from anywhere internet access is available has allowed members to travel while still being able to participate in the scheduling process. This system has no direct costs or cash outlay. The indirect cost of time for spreadsheet and account setup is minimal and although technical, does not require significant training or expertise beyond the capability for basic spreadsheet creation. The password and access

protection features allow for collaborative work on this spreadsheet while at the same time ensuring the security and confidentiality of the scheduling process.

Ultimately, this process demonstrates a workable alternative to the more common system of having a designated scheduler. Areas for further study include evaluating how this novel scheduling method will perform in larger, physician groups, departments that staff multiple sites, and in the residency environment.

AUTHOR CONTRIBUTIONS

Robert Fuller conceived of the initial self-scheduling process described in the manuscript and Shawn London created the remote, asynchronous protocol. Shawn London, Robert Fuller, and Cassidy Dahn conceived the project, created the questionnaire, and managed the data including IRB approval. Cassidy Dahn distributed the questionnaire and performed data collection. Shawn London, Robert Fuller, and Cassidy Dahn contributed to the manuscript and its revisions. Shawn London takes responsibility for the manuscript as a whole.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

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